CBSE New Pattern

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Mathematics

Class 10 (Term I)

- Multiple Choice Questions
- Assertion-Reasoning MCQs
- Case Based MCQs

3 Practice Papers
On Latest Term I Syllabus

Including Chapterwise Quick Revision Notes

As per CBSE Circular Acad - 51/2021, 05 July 2021 & Acad - 53/2021, 22 July 2021

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Mathematics

Class 10 (*Term I*)

- Multiple Choice Questions
- Assertion-Reasoning MCQs
- Case Based MCQs

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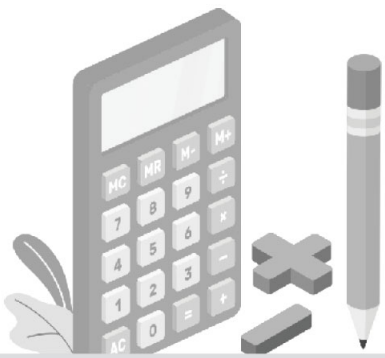

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ARIHANT PRAKASHAN (School Division Series)

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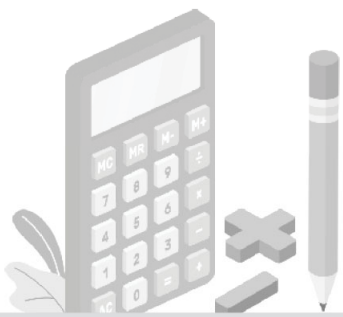

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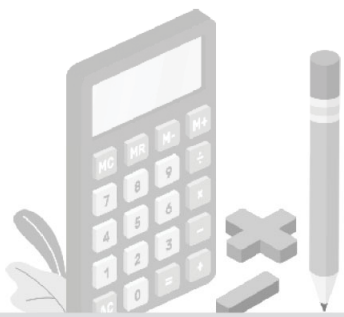


Syllabus (Rationalised)

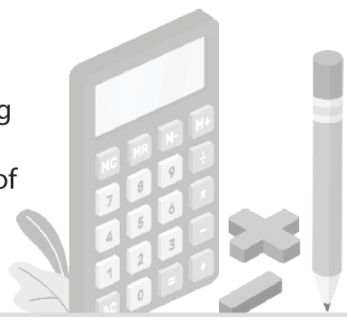
No.	Unit Name	Marks
I	Number Systems	6
II	Algebra	10
III	Coordinate Geometry	6
IV	Geometry	6
V	Trigonometry	5
VI	Mensuration	4
VII	Statistics & Probability	3
	Total	**40**
	Internal Assessment	**10**
	Total	**50**

Internal Assessment	Marks	Total Marks
Periodic Tests	3	10 marks for the term
Multiple Assessments	2	
Portfolio	2	
Student Enrichment Activities-practical work	3	

TERM I NUMBER SYSTEMS

1. Real Number

Fundamental Theorem of Arithmetic - statements after reviewing work done earlier and after illustrating and motivating through examples. Decimal representation of rational numbers in terms of terminating/non-terminating recurring decimals.



TERM II ALGEBRA

2. Polynomials

Zeroes of a polynomial. Relationship between zeroes and coefficients of quadratic polynomials only.

3. Pair of Linear Equations in Two Variables

Pair of linear equations in two variables and graphical method of their solution, consistency/inconsistency. Algebraic conditions for number of solutions. Solution of a pair of linear equations in two variables algebraically - by substitution and by elimination. Simple situational problems. Simple problems on equations reducible to linear equations.

TERM III COORDINATE GEOMETRY

4. Coordinate Geometry

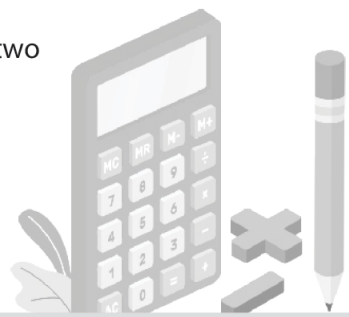
LINES (In two-dimensions)
Review: Concepts of coordinate geometry, graphs of linear equations. Distance formula. Section formula (internal division)

TERM IV GEOMETRY

5. Triangles

Definitions, examples, counter examples of similar triangles.

1. (Prove) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
2. (Motivate) If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.
3. (Motivate) If in two triangles, the corresponding angles are equal, their corresponding sides are proportional and the triangles are similar.
4. (Motivate) If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
5. (Motivate) If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the two triangles are similar.



6. (Motivate) If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.
7. (Motivate) The ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides.
8. (Prove) In a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.
9. (Motivate) In a triangle, if the square on one side is equal to sum of the squares on the other two sides, the angle opposite to the first side is a right angle.

TERM V TRIGONOMETRY

6. Introduction to Trigonometry

Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence (well defined). Values of the trigonometric ratios of 300, 450 and 600. Relationships between the ratios.

Trigonometric Identities

Proof and applications of the identity sin2A + cos2A = 1. Only simple identities to be given

TERM VI MENSURATION

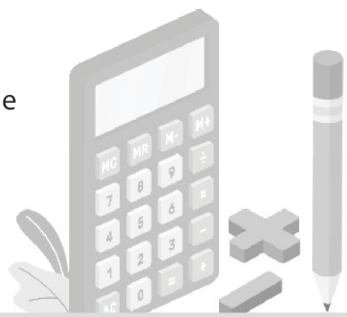
7. Areas Related to Circles

Motivate the area of a circle; area of sectors and segments of a circle. Problems based on areas and perimeter / circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of 60° and 90° only. Plane figures involving triangles, simple quadrilaterals and circle should be taken.)

TERM VII STATISTICS & PROBABILITY

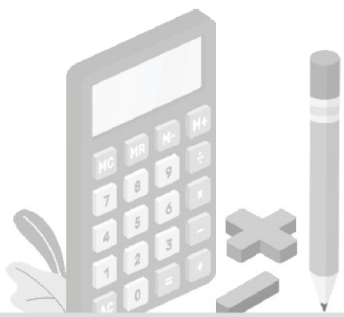
7. Probability

Classical definition of probability. Simple problems on finding the probability of an event.



Deleted Topics

Unit/Chapter	Syllabus Reduced
UNIT I NUMBER SYSTEMS	
Real Numbers	• Euclid's division lemma
UNIT II ALGEBRA	
Polynomials	• Statement and simple problems on division algorithm for polynomials with real coefficients.
Pair of Linear Equations in Two Variables	• Cross multiplication method
UNIT III COORDINATE GEOMETRY	
Coordinate Geometry	• Area of a triangle.
UNIT IV GEOMETRY	
Triangles	Proof of the following theorems are deleted • The ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides. • In a triangle, if the square on one side is equal to sum of the squares on the other two sides, the angle opposite to the first side is a right angle.
UNIT V TRIGONOMETRY	
Introduction to Trigonometry	• motivate the ratios whichever are defined at 0° and 90°
Trigonometric Identities	• Trigonometric ratios of complementary angles.
UNIT VI MENSURATION	
Areas Related to Circles	• Problems on central angle of 120°
UNIT VII STATISTICS & PROBABILITY	
Probability	• No deletion



CBSE Circular

Acad - 51/2021, 05 July 2021

About Latest Exam Scheme Term I & II

केन्द्रीय माध्यमिक शिक्षा बोर्ड

(शिक्षा मंत्रालय, भारत सरकार के अधीन एक स्वायत संगठन)

CENTRAL BOARD OF SECONDARY EDUCATION

(An Autonomous Organisation under the Ministryof Education, Govt. of India)

CBSE/DIR (ACAD)/2021 **Date: July 05, 2021**

Circular No: Acad-51/2021

All the Heads of Schools affiliated to CBSE

Subject: Special Scheme of Assessment for Board Examination Classes X and XII for the Session 2021-22

COVID 19 pandemic caused almost all CBSE schools to function in a virtual mode for most part of the academic session of 2020-21. Due to the extreme risk associated with the conduct of Board examinations during the second wave in April 2021, CBSE had to cancel both its class X and XII Board examinations of the year 2021 and results are to be declared on the basis of a credible, reliable, flexible and valid alternative assessment policy. This, in turn, also necessitated deliberations over alternative ways to look at the learning objectives as well as the conduct of the Board Examinations for the academic session 2021-22 in case the situation remains unfeasible.

CBSE has also held stake holder consultations with Government schools as well as private independent schools from across the country especially schools from the remote rural areas and a majority of them have requested for the rationalization of the syllabus, similar to last year in view of reduced time permitted for organizing online classes. The Board has also considered the concerns regarding differential availability of electronic gadgets, connectivity and effectiveness of online teaching and other socio-economic issues specially with respect to students from economically weaker section and those residing in far flung areas of the country. In a survey conducted by CBSE, it was revealed that the rationalized syllabus notified for the session 2020-21 was effective for schools in covering the syllabus and helped learners in achieving learning objectives in a less stressful manner.

In the above backdrop and in line with the Board's continued focus on assessing stipulated learning outcomes by making the examinations competencies and core concepts based, student-centric, transparent, technology-driven, and having advance provision of alternatives for different future scenarios, the following schemes are introduced for the Academic Session for Class X and Class XII 2021-22.

2. **Special Scheme for 2021-22**

   A. **Academic session to be divided into 2 Terms with approximately 50% syllabus in each term:**

   The syllabus for the Academic session 2021-22 will be divided into 2 terms by following a systematic approach by looking into the interconnectivity of concepts and topics by the Subject Experts and the Board will conduct examinations at the end of each term on the basis of the bifurcated syllabus. This is done to increase the probability of having a Board conducted classes X and XII examinations at the end of the academic session.

   B. **The syllabus for the Board examination 2021-22 will be rationalized** similar to that of the last academic session to be notified in July 2021. For academic transactions, however, schools will follow the curriculum and syllabus released by the Board vide Circular no. F.1001/CBSE-Acad/Curriculum/2021 dated 31 March 2021. Schools will also use alternative academic calendar and inputs from the NCERT on transacting the curriculum.

   C. **Efforts will be made to make Internal Assessment/ Practical/ Project work more credible and valid** as per the guidelines and Moderation Policy to be announced by the Board to ensure fair distribution of marks.

3. **Details of Curriculum Transaction**

   - Schools will continue teaching in distance mode till the authorities permit in-person mode of teaching in schools.
   - **Classes IX-X: Internal Assessment** (throughout the year-irrespective of Term I and II) would include the *3 periodic tests, student enrichment, portfolio and practical work/ speaking listening activities/ project*.
   - **Classes XI-XII: Internal Assessment** (throughout the year-irrespective of Term I and II) would include end of topic or unit tests/ exploratory activities/ practicals/ projects.
   - Schools would create a student profile for all assessment undertaken over the year and retain the evidences in digital format.
   - CBSE will facilitate schools to upload marks of Internal Assessment on the CBSE IT platform.
   - Guidelines for Internal Assessment for all subjects will also be released along with the rationalized term wise divided syllabus for the session 2021-22.The Board would also provide additional resources like sample assessments, question banks, teacher training etc. for more reliable and valid internal assessments.

4. **Term I Examinations:**

- At the end of the first term, the Board will organize **Term I Examination** in a flexible schedule to be conducted between November-December 2021 with a window period of 4-8 weeks for schools situated in different parts of country and abroad. Dates for conduct of examinations will be notified subsequently.
- The Question Paper will have Multiple Choice Questions (MCQ) including case-based MCQs and MCQs on assertion-reasoning type. Duration of test will be **90 minutes** and it will cover only the rationalized syllabus of **Term I only** (i.e. approx. 50% of the entire syllabus).
- Question Papers will be sent by the CBSE to schools along with marking scheme.
- The exams will be conducted under the supervision of the External Center Superintendents and Observers appointed by CBSE.
- The responses of students will be captured on OMR sheets which, after scanning may be directly uploaded at CBSE portal or alternatively may be evaluated and marks obtained will be uploaded by the school on the very same day. The final direction in this regard will be conveyed to schools by the Examination Unit of the Board.
- Marks of the **Term I** Examination will contribute to the final overall score of students.

5. **Term II Examination/ Year-end Examination:**

- At the end of the second term, the Board would organize **Term II or Year-end Examination** based on the rationalized syllabus of Term II only (i.e. approximately 50% of the entire syllabus).
- This examination would be held around **March-April 2022** at the examination centres fixed by the Board.
- The paper will be of **2 hours duration** and have questions of different formats (case-based/ situation based, open ended- short answer/ long answer type).
- In case the situation is not conducive for normal descriptive examination **a 90 minute MCQ** based exam will be conducted at the end of the Term II also.
- Marks of the Term II Examination would contribute to the final overall score.

केन्द्रीय माध्यमिक शिक्षा बोर्ड
(शिक्षा मंत्रालय, भारत सरकार के अधीन एक स्वायत संगठन)
CENTRAL BOARD OF SECONDARY EDUCATION
(An Autonomous Organisation under the Ministryof Education, Govt. of India)

6. **Assessment / Examination as per different situations**

A. **In case the situation of the pandemic improves and students are able to come to schools or centres for taking the exams.**

Board would conduct Term I and Term II examinations at schools/centres and the theory marks will be distributed equally between the two exams.

B. **In case the situation of the pandemic forces complete closure of schools during November-December 2021, but Term II exams are held at schools or centres.**

Term I MCQ based examination would be done by students online/offline from home - in this case, the weightage of this exam for the final score would be reduced, and weightage of Term II exams will be increased for declaration of final result.

C. **In case the situation of the pandemic forces complete closure of schools during March-April 2022, but Term I exams are held at schools or centres.**

Results would be based on the performance of students on Term I MCQ based examination and internal assessments. The weightage of marks of Term I examination conducted by the Board will be increased to provide year end results of candidates.

D. **In case the situation of the pandemic forces complete closure of schools and Board conducted Term I and II exams are taken by the candidates from home in the session 2021-22.**

Results would be computed on the basis of the Internal Assessment/Practical/Project Work and Theory marks of Term-I and II exams taken by the candidate from home in Class X / XII subject to the moderation or other measures to ensure validity and reliability of the assessment.

In all the above cases, data analysis of marks of students will be undertaken to ensure the integrity of internal assessments and home based exams.

Dr. Joseph Emmanuel
Director (Academics)

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01

Real Number

Quick Revision

Prime, Coprime and Composite numbers

Prime numbers are those numbers, which have no factors other than 1 and the number itself.

e.g. 2, 3, 5, 7, 11, …

Coprime numbers are those numbers, which do not have any common factor other than 1.

e.g. 2 and 9 are coprime numbers.

Composite numbers are those numbers, which have atleast 1 factor other 1 and the number itself.

e.g. 4, 6, 24, …

(i) 1 is neither prime nor composite.

(ii) 2 is the smallest prime number.

Factor Tree

A chain of factors which is represented in the form of a tree, is called factor tree.

Fundamental Theorem of Arithmetic

Fundamental theorem of arithmetic states that every composite number can be written (factorised) as the product of primes and this factorisation is unique, apart from the order in which the prime factors occur. It is also called unique factorisation theorem.

∴ Composite number = Product of prime numbers

Relation between Numbers and their HCF and LCM

(i) For any two positive integers a and b, the relation between these numbers and their HCF and LCM is

$$\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b$$

$$\Rightarrow \quad \text{HCF}(a, b) = \frac{a \times b}{\text{LCM}(a, b)}$$

$$\text{or} \quad \text{LCM}(a, b) = \frac{a \times b}{\text{HCF}(a, b)}$$

(ii) For any three positive integers a, b and c, the relation between these numbers and their HCF and LCM is

$$\text{HCF}(a, b, c) = \frac{a \times b \times c \times \text{LCM}(a, b, c)}{\text{LCM}(a, b) \times \text{LCM}(b, c) \times \text{LCM}(c, a)}$$

$$\text{or} \quad \text{LCM}(a, b, c) = \frac{a \times b \times c \times \text{HCF}(a, b, c)}{\text{HCF}(a, b) \times \text{HCF}(b, c) \times \text{HCF}(c, a)}$$

Real Numbers

A number, which is either rational or irrational, is called a real number.

Rational Numbers

A number that can be expressed as $\frac{p}{q}$, where p, q are integers and $q \neq 0$, is called a rational number.

e.g. $\frac{3}{5}, \frac{7}{9}, \frac{13}{15}, \frac{-7}{3}$, etc.

Irrational Numbers

A number that cannot be expressed in the form $\frac{p}{q}$, where p, q are integers and $q \neq 0$, is called an irrational number.

e.g. $\sqrt{2}, \sqrt{3}, \sqrt{15}, \pi, -\frac{\sqrt{2}}{\sqrt{3}}$, 0.1011011101111, …, etc.

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Useful Theorems

Theorem 1 Let p be a prime number and a be a positive integer. If p divides a^2, then p divides a.

Theorem 2 $\sqrt{2}$ is irrational number, then $2\sqrt{2}$ is irrational number.

Decimal Expansions of Rational Numbers

The decimal expansion of every rational number is either terminating or non-terminating repeating.

Terminating Decimal Expansion

The number which terminates (i.e. ends completely) after a finite number of steps in the process of division, is said to be terminating decimal expansion. e.g. 1.25, 3.14, etc.

Non-terminating Decimal Expansion

The number which does not terminate in the process of division, is said to be non-terminating decimal expansion.

There are following two types of non-terminating decimal expansions

(i) **Non-terminating Repeating Expansion** The number, which does not terminate but repeats the particular number again and again in the process of division, is said to be non-terminating repeating decimal or recurring decimal expansion. The repeated digit is denoted by bar '–'

e.g. $\frac{1}{3} = 0.333\ldots = 0.\overline{3}$

(ii) **Non-terminating Non-repeating Decimal Expansion** The number, which neither terminates nor repeats the particular number in the process of division, is said to be a non-terminating non-repeating decimal expansion. These numbers are called irrational numbers.

e.g. $1.030030003\ldots, \sqrt{3}$, etc.

Important Theorems on Decimal Expansion of Rational Numbers

Theorem 3 Let x be a rational number whose decimal expansion terminates. Then, x can be expressed in the form p/q, where p, q are coprimes and the prime factorisation of q is of the form $2^n 5^m$, where n and m are non-negative integers.

Theorem 4 (Converse of Theorem 3) Let $x = p/q$ be a rational number, such that the prime factorisation of q is of the form $2^n 5^m$, where n and m are non-negative integers. Then, x has a decimal expansion, which terminates.

Theorem 5 Let $x = p/q$ be a rational number, such that the prime factorisation of q is not of the form $2^n 5^m$, where n and m are non-negative integers. Then, x has a decimal expansion, which is non-terminating repeating (recurring).

Objective Questions

Multiple Choice Questions

1. For some integer m, every even integer is of the form

(a) m (b) $m+1$
(c) $2m$ (d) $2m+1$

2. If n is an even natural number, then the largest natural number by which $n(n+1)(n+2)$ is divisible, is

(a) 6 (b) 8
(c) 12 (d) 24

3. The product of two consecutive positive integers is divisible by 2'.

(a) True (b) False
(c) Can't say (d) Partially True/False

4. The number, 4^n, where n is a natural number, ends with the digit 0 for any natural number n.

(a) True
(b) False
(c) Can't say
(d) Partially True/False

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5. 12^n ends with the digit 0 or 5 for natural number n

(a) 2 (b) 3
(c) No value (d) 5

6. $(3 \times 5 \times 7) + 7$ is a

(a) Prime number (b) Composite number
(c) Can't say (d) None of these

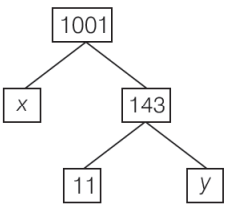
7. The number $(7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1) + 5$ is ..... number.

(a) Prime (b) Composite
(c) Can't say (d) None of these

8. The total number of factors of a prime number is ***[CBSE 2020]***

(a) 1 (b) 2 (c) 0 (d) 3

9. The values of x and y is the given figure are



(a) 7, 13 (b) 13, 7
(c) 9, 12 (d) 12, 9

10. HCF of 96 and 404 is equal to ..... .

(a) 2 (b) 3 (c) 4 (d) 5

11. Total number of distinct primes in the prime factorization of number 27300.

(a) 5 (b) 7
(c) 13 (d) 21

12. The unit place digit of HCF of $2^2 \times 3^2 \times 5^3 \times 7$, $2^3 \times 3^3 \times 5^2 \times 7^2$ and $3 \times 5 \times 7 \times 11$ is

(a) 70 (b) 105 (c) 175 (d) 225

13. If two positive integers a and b are written as $a = x^3 y^2$ and $b = xy^3$, where x, y are prime numbers, then HCF (a, b) is ***[NCERT Exemplar]***

(a) xy (b) xy^2
(c) x^3y^3 (d) x^2y^2

14. Write the HCF of the smallest composite number and the smallest prime number.

(a) 1 (b) 2
(c) 3 (d) 4

15. Two numbers are in the ratio of 15 : 11. If their HCF is 13, then numbers will be

(a) 195 and 143
(b) 190 and 140
(c) 185 and 163
(d) 185 and 143

16. Product of two coprime numbers is 117 their LCM should be ..... .

(a) 1
(b) 117
(c) equal to their HCF
(d) lies between 100 – 110

17. The least number that is divisible by all the numbers from 1 to 10 (both inclusive) ***[NCERT Exemplar]***

(a) 10
(b) 100
(c) 504
(d) 2520

18. If the HCF of 65 and 117 is expressible in the form $65m - 117$, then find the value of m. ***[NCERT Exemplar]***

(a) 1 (b) 2
(c) 3 (d) 4

19. If LCM of 12 and 42 is $10m + 4$, the value of m is equal to

(a) 7 (b) 8
(c) 6 (d) 9

20. There are 24 peaches, 36 apricots and 60 bananas and they have to arranged in several rows in such a way that every rows contains the same member of fruits of only one type. What is the minimum number of rows required for this to happen?

(a) 12 (b) 9
(c) 10 (d) 14

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21. Four bells toll at intervals of 10 s, 15 s, 20 s and 30 s respectively. If they toll together at 10 : 00 am at what time will they toll together for the first time after 10 am?
(a) 10 : 01 am
(b) 10 : 02 am
(c) 10 : 00 : 30 am
(d) 10 : 00 : 45 am

22. P is the LCM of 2, 4, 6, 8, 10; Q is the LCM of 1, 3, 5, 7, 9 and L is the LCM of P and Q. Then, which of the following is true?
(a) $L = 21P$ (b) $L = 4Q$
(c) $L = 63P$ (d) $L = 16P$

23. The LCM and HCF of 120 and 144 by fundamental theorem of arithmetic is
(a) 720, 22 (b) 720, 24
(c) 640, 24 (d) 640, 22

24. If HCF of two numbers is 2 and their product is 120, find their LCM.
(a) 120 (b) 60
(c) 240 (d) 80

25. If the HCF of 65 and 117 is 13, LCM of 65 and 117 is $45 \times a$, then the value of a is
(a) 9 (b) 11
(c) 13 (d) 17

26. If HCF $(a, b) = 12$ and $a \times b = 1800$, then LCM $(a, b) =$
(a) 3600 (b) 900
(c) 150 (d) 90

27. If HCF of 306 and 657 is 9, then their LCM is …… .
(a) 22338 (b) 23328
(c) 22833 (d) 33228

28. The LCM and the HCF of two numbers are 1001 and 7 respectively. How many such pairs are possible?
(a) 0 (b) 1
(c) 2 (d) 7

29. If p is prime, then HCF and LCM of p and $p+1$ would be
(a) HCF $= p$, LCM $= p+1$
(b) HCF $= p(p+1)$, LCM $= 1$
(c) HCF $= 1$, LCM $= p(p+1)$
(d) None of the above

30. The HCF and LCM of 12, 21 and 15 respectively, are *[CBSE 2020]*
(a) 3, 140 (b) 12, 420
(c) 3, 420 (d) 420, 3

31. In which of the following is a irrational number?
(a) $\frac{22}{7}$ (b) 3.1416
(c) $3.\overline{1416}$ (d) 3.141441444...

32. The number of irrational numbers between 15 and 18 is infinite.
(a) True
(b) False
(c) Can't say
(d) Partially True/False

33. The product of a non-zero rational and an irrational number is
(a) always irrational
(b) always rational
(c) rational or irrational
(d) one

34. $3.\overline{27}$ is
(a) an integer number (b) a rational number
(c) an irrational number (d) None of these

35. A rational number p/q has a terminating decimal expansion of prime factorization of q have
(a) 3 (b) 2
(c) 5 (d) Both (b) and (c)

36. If $\frac{13}{125}$ is a rational number, then decimal expansion of it, which terminates
(a) 0.104 (b) 1.04
(c) 0.0104 (d) 0.140

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37. On the basis of form $2^m \times 5^n$ of denominator that $\frac{1458}{1250}$ will be expanded in decimal upto places will be

(a) one (b) two (c) three (d) four

38. After how many places, the decimal form of $\frac{125}{2^4 \cdot 5^3}$ will terminate?

(a) Three places (b) Four places
(c) Two places (d) None of these

39. Without actually performing the long division, the terminating decimal expansion of $\frac{51}{1500}$ is in the form of $\frac{17}{2^n \times 5^m}$, then $(m+n)$ is equal to

(a) 2 (b) 3 (c) 5 (d) 8

40. The rational number which can be expressed as a terminating decimal number will be

(a) $\frac{77}{210}$ (b) $\frac{129}{2^2 \times 5^7 \times 7^5}$
(c) $\frac{13}{3125}$ (d) $\frac{8}{17}$

41. Which of the following rational numbers have non-terminating repeating decimal expansion?

(a) $\frac{31}{3125}$ (b) $\frac{71}{512}$
(c) $\frac{23}{200}$ (d) None of these

42. The rational number $\frac{124}{164}$ can be expressed as a ..... decimal number.

(a) non-terminating (b) can't say
(c) terminating (d) None of these

43. The rational form of $0.2\overline{54}$ is in the form of $\frac{p}{q}$, then $(p+q)$ is equal to 69.

(a) True (b) False
(c) Can't say (d) Partially True/False

44. Column-I denotes the number and Column-II denotes the prime factors of the numbers given in Column-I. Match them correctly.

	Column I		Column II
P.	945	1.	$2 \times 5 \times 11^2 \times 17$
Q.	20570	2.	$7^2 \times 13 \times 17 \times 19$
R.	205751	3.	$3^3 \times 5 \times 7$

	P	Q	R		P	Q	R
(a)	3	1	2	(b)	1	3	2
(c)	2	1	3	(d)	1	2	3

45. Match the Column

	Column I		Column II
P.	13/125	1.	Irrational
Q.	$\sqrt{2}$	2.	Terminating decimal expansion
R.	200/25	3.	Non-terminating repeating decimal expansion
S.	61/455	4.	Rational number

	P	Q	R	S		P	Q	R	S
(a)	2	4	1	3	(b)	2	1	4	3
(c)	1	2	3	4	(d)	1	2	4	3

Assertion-Reasoning MCQs

Directions (Q. Nos. 46-54) Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) A is true, R is true; R is a correct explanation for A.
(b) A is true, R is true; R is not a correct explanation for A.
(c) A is true; R is False.
(d) A is false; R is true.

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46. **Assertion (A)** HCF of (11, 17) is 1.
Reason (R) If p and q are prime, then HCF $(p, q) = 1$

47. **Assertion (A)** If LCM = 182, product of integers is 26×91, then HCF = 13.
Reason (R) LCM × Product of integers = HCF

48. **Assertion (A)** We can say that 3|93 and 5|0 is true.
Reason (R) A non-zero integer a is said to divide an integer b if there exists an integer c such that $b = ac$.

49. **Assertion (A)** $n^2 - n$ is divisible by 2 for every positive integer.
Reason (R) $\sqrt{2}$ is not a rational number.

50. **Assertion (A)** $\sqrt{2}$ is an irrational number.
Reason (R) If p be a prime, then $\sqrt{p}$ is an irrational number.

51. **Assertion (A)** 2 is a rational number.
Reason (R) The square roots of all positive integers are irrationals.

52. **Assertion (A)** Denominator of 34.12345. When expressed in the form $\frac{p}{q}$, $q \neq 0$, is of the form $2^m \times 5^n$, where m, n are non-negative integers.
Reason (R) 34.12345 is a terminating decimal fraction.

53. **Assertion (A)** $\frac{13}{3125}$ is a terminating decimal fraction.
Reason (R) If $q = 2^n \cdot 5^m$ where n, m are non-negative integers, then $\frac{p}{q}$ is a terminating decimal fraction.

54. **Assertion (A)** 29/9261 will have a non-terminating repeating decimal expansion.
Reason (R) Let $a = p/q$ be a rational number such that p and q are co-prime and the prime factorization of q is of the form $2^n \times 5^m$, where n and m are non-negative integers (whole numbers). Then, a has a decimal expansion, which is non-terminating repeating.

Case Based MCQs

55. **Divisibility Rules**
HCF and LCM are widely used in number system especially in real numbers in finding relationship between different numbers and their general forms. Also, product of two positive integers is equal to the product of their HCF and LCM.
{Product of numbers = HCF × LCM}
Based on the above information answer the following questions.

(i) If two positive integers a and b are expressible in terms of primes as $a = p^2q^4$ and $b = p^3q^2$, then which of the following is true?
(a) HCF = pq^2 × LCM
(b) LCM = pq^2 × HCF
(c) LCM = p^2q × HCF
(d) HCF = p^2q × LCM

(ii) Vishal has a collection of marbles realizes that if he makes a group of 2 or 3 marbles, there are always one marbles left, then which of the following is correct if the number of marbles is p?
(a) p is odd
(b) p is even
(c) can't say
(d) Both (a) and (b)

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(iii) Given that HCF (306, 657) = 9, find LCM (306, 657).

(a) 33228 (b) 22833
(c) 22338 (d) None of these

(iv) The greatest number of 6-digits exactly divisible by 15, 24 and 36 is

(a) 999998 (b) 999999
(c) 999720 (d) 999724

(v) If N is the sum of first 13986 prime numbers, then N is always divisible by

(a) 6 (b) 4
(c) 8 (d) None of these

56. To enhance the reading skills of grade X students, the school nominates you and two of your friends to set up a class library. There are two sections- Section A and Section B of grade X. There are 32 students in section A and 36 students in section B. ***[CBSE Question Bank]***

Based on the above information answer the following questions.

(i) What is the minimum number of books you will acquire for the class library, so that they can be distributed equally among students of Section A or Section B?

(a) 144 (b) 128 (c) 288 (d) 272

(ii) If the product of two positive integers is equal to the product of their HCF and LCM is true, then the HCF (32, 36) is

(a) 2 (b) 4 c) 6 (d) 8

(iii) 36 can be expressed as a product of its primes as

(a) $2^2 \times 3^2$
(b) $2^1 \times 3^3$
(c) $2^3 \times 3^1$
(d) $2^0 \times 3^0$

(iv) $7 \times 11 \times 13 \times 15 + 15$ is a

(a) Prime number
(b) Composite number
(c) Neither prime nor composite
(d) None of the above

(v) If p and q are positive integers such that $p = ab^2$ and $q = a^2b$, where a and b are prime numbers, then the LCM (p, q) is

(a) ab (b) a^2b^2
(c) a^3b^2 (d) a^3b^3

57. Activity on Real Numbers

In a classroom (class-X) activity on real numbers, the students have to pick a number card from a box and frame question on it is not a rational number for the rest of the class. The number cards picked up by first 5 students and their questions on the numbers for the rest of the class are as shown below.

Based on the above information answer the following questions.

(i) Akshay picked up $\sqrt{12}$ and his question was-Which of the following is true about $\sqrt{12}$

(a) It is a natural number
(b) It is an irrational number
(c) It is a rational number
(d) None of the above

(ii) Shallu picked up 'BONUS' and her question was-Which of the following is not irrational?

(a) $5 - 3\sqrt{2}$
(b) $\sqrt{5} - 2$
(c) $2 + 2\sqrt{9}$
(d) $3\sqrt{5} - 6$

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(iii) Charu picked up $\sqrt{3}-\sqrt{2}$ and her question was $\sqrt{3}-\sqrt{2}$ is _____ number.

(a) a natural (b) an irrational
(c) a whole (d) a rational

(iv) Bhoomika picked up $\frac{1}{\sqrt{8}}$ and her question was $\frac{1}{\sqrt{8}}$ is _____ number.

(a) a whole (b) a rational
(c) an irrational (d) a natural

(v) Malika picked up $\sqrt{5}$ and her question was - Which of the following is not irrational?

(a) $15+3\sqrt{5}$ (b) $\sqrt{20}-9$
(c) $4\sqrt{129}$ (d) $\sqrt{16}$

58. A seminar is being conducted by an Educational Organisation, where the participants will be educators of different subjects. The number of participants in Hindi, English and Mathematics are 60, 84 and 108 respectively. ***[CBSE Question Bank]***

Based on the above information answer the following questions.

(i) In each room the same number of participants are to be seated and all of them being in the same subject, hence maximum number participants that can accommodated in each room are

(a) 14 (b) 12
(c) 16 (d) 18

(ii) What is the minimum number of rooms required during the event?

(a) 11 (b) 31
(c) 41 (d) 21

(iii) The LCM of 60, 84 and 108 is

(a) 3780 (b) 3680
(c) 4780 (d) 4680

(iv) The product of HCF and LCM of 60, 84 and 108 is

(a) 55360 (b) 35360
(c) 45500 (d) 45360

(v) 108 can be expressed as a product of its primes as

(a) $2^3\times3^2$ (b) $2^3\times3^3$
(c) $2^2\times3^2$ (d) $2^2\times3^3$

59. Decimal Expansion

Decimal form of rational numbers can be classified into two types.

- Let a be a rational number whose decimal expansion terminates. Then a can be expressed in the form $\frac{p}{q}$, where p and q are co-prime and the prime factorisation of q is of the form $2^n\cdot5^m$, where n, m are non-negative integers and vice-versa.
- Let $a=\frac{p}{q}$ be a rational number, such that the prime factorisation of q is not of the form 2^n5^m, where n and m are non-negative integers. Then a has a non-terminating repeating decimal expansion.

Based on the above information answer the following questions.

(i) Which of the following rational numbers have a terminating decimal expansion?

(a) 8/15 (b) 51/150
(c) 15/400 (d) $129/(2^2\times5^2\times7^2)$

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(ii) $23/(2^3 \times 5^3) =$

(a) 0.575 (b) 0.023
(c) 0.91 (d) 1.15

(iii) $686/(2^2 \times 5^7 \times 7^3)$ is a _____ decimal.

(a) terminating
(b) recurring
(c) non-terminating and non-recurring
(d) None of the above

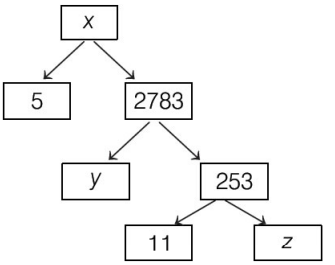
(iv) For which of the following value(s) of p, $251/(2^3 \times p^2)$ is terminating decimal number?

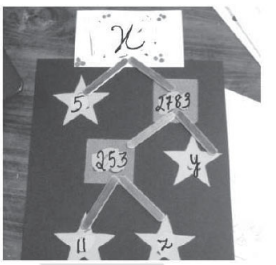
(a) 3 (b) 7
(c) 5 (d) All of these

(v) $61/(2^5 \times 5^3)$ is a _____ decimal

(a) terminating
(b) recurring
(c) non-terminating and non-recurring
(d) None of the above

60. A Mathematics Exhibition is being conducted in your School and one of your friends is making a model of a factor tree. He has some difficulty and ask for your help in completing a quiz for the audience. Observe the following factor tree and answer the following :





[CBSE Quesion Bank]

Based on the above information answer the following questions.

(i) What will be the value of x ?

(a) 15005 (b) 13915
(c) 56920 (d) 17429

(ii) What will be the value of y ?

(a) 23 (b) 22 (c) 11 (d) 19

(iii) What will be the value of z ?

(a) 22 (b) 23 (c) 17 (d) 19

(iv) According to Fundamental Theorem of Arithmetic 13915 is a

(a) Composite number
(b) Prime number
(c) Neither prime nor composite
(d) Even number

(v) The prime factorisation of 13915 is

(a) $5 \times 11^3 \times 13^2$ (b) $5 \times 11^3 \times 23^2$
(c) $5 \times 11^2 \times 23$ (d) $5 \times 11^2 \times 13^2$

ANSWERS

Multiple Choice Questions

1. (c)	2. (d)	3. (a)	4. (b)	5. (c)	6. (b)	7. (b)	8. (b)	9. (a)	10. (c)
11. (a)	12. (b)	13. (b)	14. (b)	15. (a)	16. (b)	17. (d)	18. (b)	19. (b)	20. (c)
21. (a)	22. (a)	23. (b)	24. (b)	25. (c)	26. (c)	27. (a)	28. (c)	29. (c)	30. (c)
31. (d)	32. (a)	33. (a)	34. (b)	35. (d)	36. (a)	37. (d)	38. (b)	39. (c)	40. (c)
41. (d)	42. (a)	43. (a)	44. (a)	45. (b)					

Assertion-Reasoning MCQs

46. (a) 47. (c) 48. (a) 49. (b) 50. (a) 51. (c) 52. (a) 53. (a) 54. (c)

Case Based MCQs

55. (i) (b) (ii) (a) (iii) (c) (iv) (c) (v) (d)
56. (i) (c) (ii) (b) (iii) (a) (iv) (b) (v) (b)
57. (i) (b) (ii) (c) (iii) (b) (iv) (c) (v) (d)
58. (i) (b) (ii) (d) (iii) (a) (iv) (d) (v) (d)
59. (i) (c) (ii) (b) (iii) (a) (iv) (c) (v) (a)
60. (i) (b) (ii) (c) (iii) (b) (iv) (a) (v) (c)

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SOLUTIONS

1. We know that, even integers are 2, 4, 6, ...

   So, it can be written in the form of $2m$, where, m = Integer = z

   [since, integer is represented by z]

   or $m = \ldots, -1, 0, 1, 2, 3, \ldots$

   $\therefore$ $2m = \ldots, -2, 0, 2, 4, 6, \ldots$

2. Since, n is divisible by 2, therefore $(n + 2)$ is divisible by 4, and hence $n(n + 2)$ is divisible by 8.

   Also, n, $n + 1$, $n + 2$ are three consecutive numbers.

   So, one of them is divisible by 3.

   Hence, $n(n + 1)(n + 2)$ must be divisible by 24.

3. Yes, two consecutive integers can be n, $(n + 1)$. So, one number of these two must be divisible by 2. Hence, product of numbers is divisible by 2.

4. Given, n is a natural number. Let us assume that 4^n ends with 0, thus 4^n is divisible by 2 and 5 both.

   But prime factors of 4 are 2×2.

   $\therefore$ $4^n = (2 \times 2)^n = 2^{2n}$

   Thus, prime factorisation of 4^n does not contain 5. So, the fundamental theorem of arithmetic guarantees that there are no other primes in the factorisation of 4^n.

   So, our assumption that 4^n ends with 0 is wrong.

5. If any number ends with the digit 0 or 5, it is always divisible by 5.

   If 12^n ends with the digit zero it must be divisible by 5.

   This is possible only if prime factorisation of 12^n contains the prime number 5.

   Now, $12 = 2 \times 2 \times 3 = 2^2 \times 3$

   $\Rightarrow$ $12^n = (2^2 \times 3)^n = 2^{2n} \times 3^n$

   [since, there is no term contains 5]

   Hence, there is no value of $n \in N$ for which 12^n ends with digit zero or five.

6. We have, $(3 \times 5 \times 7) + 7 = 105 + 7 = 112$

   $\therefore$ Prime factors of $112 = 2 \times 2 \times 2 \times 2 \times 7$

   $= 2^4 \times 7$

   So, it is the product of prime factors 2 and 7. i.e. it has factors other than 1 and itself. Hence, it is a composite number.

7. $(7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1) + 5$

   $= 5040 + 5 = 5045 = 5 \times 1009$

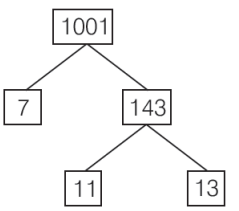
   Thus, it is the product of prime factor of 5 and 1009.

   Hence, it is a composite number.

8. A prime number has exactly two factors, 1 and itself

   So, total number of factors of a prime number is 2.

9. Given number is 10001. Then, the factor tree of 1001 is given as below



   $\therefore$ $1001 = 7 \times 11 \times 13$

   By comparing with given factor tree, we get

   $x = 7, y = 13$

10. We have,

    $96 = 2^5 \times 3$ and $404 = 2^2 \times 101$

    Hence, HCF $(96, 404) = 2^2 = 4$

11.

2	27300
2	13650
3	6825
5	2275
5	455
7	91
	13

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$\therefore\ 27300 = 2 \times 2 \times 3 \times 5 \times 5 \times 7 \times 13$

Total number of distinct primes are 5 which are 2, 3, 5, 7 and 13.

12. HCF = Product of lowest powers of common factors

$= 3 \times 5 \times 7$

$= 105$

13. Given that, $a = x^3 y^2 = x \times x \times x \times y \times y$

and $b = xy^3 = x \times y \times y \times y$

$\therefore$ HCF of a and b = HCF (x^3y^2, xy^3)

$= x \times y \times y = xy^2$

[since, HCF is the product of the smallest power of each common prime facter involved in the numbers]

14. Smallest composite number $= 4 = 2 \times 2 = 2^2$

and smallest prime number $= 2 = 2^1$

$\therefore$ HCF $(4, 2) = 2^1 = 2$

[since, HCF is the product of the smallest power of each common prime factor involved in the numbers]

15. Let the required numbers be $15x$ and $11x$.

Then, their HCF is x.

So, $x = 13$

$\therefore$ The numbers are 15×13 and 11×13

i.e. 195 and 143.

16. Product of two coprime numbers is equal to their LCM.

So, LCM = 117

17. Factors of 1 to 10 numbers

$1 = 1$
$2 = 1 \times 2$
$3 = 1 \times 3$
$4 = 1 \times 2 \times 2$
$5 = 1 \times 5$
$6 = 1 \times 2 \times 3$
$7 = 1 \times 7$
$8 = 1 \times 2 \times 2 \times 2$
$9 = 1 \times 3 \times 3$
$10 = 1 \times 2 \times 5$

$\therefore$ LCM of numbers 1 to 10

= LCM (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

$= 1 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 7 = 2520$

18. By prime factorisation method, factors of 65 and 117 are given as,

$65 = 5 \times 13$

and $117 = 3^2 \times 13$

$\therefore$ HCF $(65, 117) = 13$ ...(i)

According to the question, we have

$65m - 117 =$ HCF $(65, 117)$

$\Rightarrow\ 65m - 117 = 13$

$65m = 13 + 117$

$65m = 130$

$\Rightarrow\ m = 2$

19. Factors of 12 and 42 are

$12 = 2 \times 2 \times 3$

$42 = 2 \times 3 \times 7$

Hence, LCM $(12, 42) = 2 \times 2 \times 3 \times 7 = 84$

And $84 = 10 \times 8 + 4$

Therefore, $m = 8$

20. Let x be number of fruits in one row such that each fruit contains same number of fruits.

i.e. x = HCF of (24, 36, 60)

The factors of 24, 36 and 36 are

$24 = 2 \times 2 \times 2 \times 3$

$36 = 2 \times 2 \times 3 \times 3$

$60 = 2 \times 2 \times 3 \times 5$

$x = 2 \times 2 \times 3 = 12$

So, peaches have $12 \times 2 = 2$ rows, apricots have $12 \times 3 = 3$ rows and bananas have $12 \times 5 = 60$, 5 rows.

Minimum number of rows = 2 + 3 + 5 = 10

21. The time interval between simultaneous tolling of the bells = LCM (10, 15, 20, 30) s

= 60 s = 1 min

Hence, the bells will toll together again for the first time after 10 : 00 am at 10 : 01 am.

22. P is the LCM of 2, 4, 6, 8, 10

$\therefore\ P = 3(8)(5)$

Q is the LCM of 1, 3, 5, 7, 9

$\therefore\ Q = 5(7)(9)$

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L is the LCM of P, Q

$\therefore\ L = 3(8)(5)\,21$ or $5(7)(9)\,8$

i.e. $L = 21P$ or $8Q$

23. The prime factorisation of

$$120 = 2 \times 2 \times 2 \times 3 \times 5$$
$$= 2^3 \times 3 \times 5$$

and prime factorisation of 144

$$= 2 \times 2 \times 2 \times 2 \times 3 \times 3$$
$$= 2^4 \times 3^2$$

Now, LCM $(120, 144) = 2^4 \times 3^2 \times 5 = 720$

and HCF $(120, 144) = 2^3 \times 3 = 24$

24. Let the two number are a and b.

Given, HCF $(a, b) = 2$

and product $(a \times b) = 120$

We know that,

HCF $(a, b) \times$ LCM $(a, b) =$ Product of a and b

$\therefore\quad 2 \times \text{LCM}(a, b) = 120$

$\Rightarrow\quad \text{LCM}(a, b) = \dfrac{120}{2} = 60$

Hence, the required LCM is 60.

25. We know that,

HCF $\times$ LCM = Product of two numbers

$\Rightarrow\ 45 \times a \times 13 = 65 \times 117$

$\Rightarrow\quad a = \dfrac{65 \times 117}{45 \times 13} \Rightarrow a = 13$

26. We know that

HCF $\times$ LCM = Product of two numbers

$\Rightarrow 12 \times \text{LCM}(a, b) = 1800$

$\Rightarrow\quad \text{LCM}(a, b) = \dfrac{1800}{12} = 150$

27. We know that,

LCM $\times$ HCF = Product of two numbers

$$\text{LCM} \times 9 = 306 \times 675$$
$$\text{LCM} = \frac{306 \times 675}{9}$$
$$= 34 \times 657 = 22338$$

$\therefore$ LCM of 306 and 657 = 22338

28. Given, LCM = 1001 and HCF = 7

Let the two numbers be x and y.

$\therefore\ x = 7c$ and $y = 7b$, where c and b are coprimes.

We have, $x \times y =$ LCM $\times$ HCF

$\Rightarrow\quad 7a \times 7b = 1001 \times 7$

$\Rightarrow\quad ab = 143$

$\Rightarrow\quad (a, b) = (1, 143)$ or $(11, 13)$

There are two pairs of numbers.

29. Since, p is prime.

$\therefore\ p$ and $p + 1$ has no common factor other than 1.

$\therefore$ HCF of p and $p + 1 = 1$

and LCM of p and $p + 1 = p \times (p + 1)$

$= p(p + 1)$

30. We have, $12 = 2 \times 2 \times 3 = 2^2 \times 3$

$15 = 3 \times 5$

$21 = 3 \times 7$

$\because$ HCF = product of smallest power of each common prime factor in the number = 3

and LCM = product of greatest power of each prime factor involved in the number

$= 2^2 \times 3 \times 5 \times 7 = 420$

Thus, HCF and LCM are 3 and 420, respectively.

31. (a) $\dfrac{22}{7} = 3.14285714285\ldots = 3.\overline{14285}$

(b) 3.1416 is not irrational number, because it is terminating decimal number.

(c) $3.\overline{1416}$ is not irrational number, because it is non-terminating repeating decimal number.

which is not irrational number.

(d) 3.141441444 ... is an irrational number, because it is non-terminating repeating decimal number.

32. There is infinite numbers between any two numbers.

So, there must be infinite irrational numbers too.

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33. Product of a non-zero rational and an irrational number is always irrational i.e. $\frac{3}{4} \times \sqrt{2} = \frac{3\sqrt{2}}{4}$ (irrational).

34. The number is non-terminating recurring. So, it is a rational number.

35. p/q has a terminating decimal expansion, if prime factorization of q has 2 or 5 or both.

36. Given rational number is $\frac{13}{125}$.

$\therefore$ Prime factorisation of $125 = 5^3$

Now, $\frac{13}{125} = \frac{13}{5^3} = \frac{13 \times 2^3}{5^3 \times 2^3} = \frac{104}{10^3} = 0.104$

[make the denominator in the power of 10]

Thus, $\frac{13}{125}$ has decimal expansion, which terminates.

37. We have, $\frac{1458}{1250} = \frac{1458}{2 \times 5^4}$

$$= \frac{1458 \times 2^3}{2 \times 5^4 \times 2^3} = \frac{11664}{(2 \times 5)^4}$$

$$= \frac{11664}{10^4} = \frac{11664}{10000}$$

$$= 1.1664$$

So, it will terminates after 4 places of decimals.

38. $\frac{125}{2^4 \cdot 5^3} = \frac{125 \times 5}{(2 \cdot 5)^4} = \frac{625}{10000}$

39. We have, $\frac{51}{1500} = \frac{17}{500}$

Prime factorization of 500

2	500
2	250
5	125
5	25
5	5
	1

$$= 2 \times 2 \times 5 \times 5 \times 5 = 2^2 \times 5^3$$

which is in the form $2^n \times 5^m$.

So, it has a terminating decimal expansion.

Now, $\frac{51}{1500} = \frac{17}{2^2 \times 5^3}$

By comparing, we get $n = 2$ and $m = 3$

$\therefore \quad m + n = 2 + 3 = 5$

40. (a) Here, denominator $= 210 = 2 \times 3 \times 5 \times 7$, which is not the form of $2^n 5^m$, so it is not terminating.

(b) Here, denominator $= 2^2 \times 5^7 \times 7^5$, which is not the form of $2^n\ 5^m$, so it is not terminating.

(c) Here, denominator $= 3125 = 5^5$ which is the form of $2^n\ 5^m$, so it is terminating.

Hence, option (c) is correct.

41. 3125, 512 and 200 has factorization of the form $2^m \times 5^n$ (m and n are whole numbers), so all fractions have terminating decimal expansion.

42. Here, denominator $= 164 = 2 \times 2 \times 41$, which is not the form of $2^n \times 5^m$, so it is non-terminating.

43. Let $x = 0.2\overline{54}$, then

$x = 0.2545454\ldots$ ...(i)

On multiplying Eq. (i) by 100, we get

$\therefore \quad 100x = 25.4545\ldots$ ...(ii)

On subtracting Eq. (i) from Eq. (ii), we get

$$99x = 25.2$$

$$\Rightarrow \quad x = \frac{252}{990} = \frac{14}{55}$$

On comparing with $\frac{p}{q}$, we get

$$p = 14 \text{ and } q = 55$$

$\therefore \quad p + q = 14 + 55 = 69$

44.

3	945
3	315
3	105
5	35
7	7
	1

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Prime factors of $945 = 3^3 \times 5 \times 7$

2	20570
5	10285
11	2057
11	187
17	17
	1

Prime factors of $20570 = 2 \times 5 \times 11^2 \times 17$

7	205751
7	29393
13	4199
17	323
19	19
	1

Prime factors of $205751 = 7^2 \times 13 \times 17 \times 19$

45. (P) $\frac{13}{125} = \frac{13}{5^3}$

$125 = 5^3$ is of the form $2^n \times 5^m$

So, it is terminating decimal expansion.

(Q) $\sqrt{2}$ is irrational

(R) $\frac{200}{25} = 8$, it can be represented as p/q form, so it is a rational number.

(S) $\frac{61}{455} = \frac{61}{5 \times 7 \times 13}$

$455 = 5^1 \times 13 \times 7$ is not of the form $2^n \times 5^m$.

So, it is non-terminating repeating decimal expansion.

46. As both the given numbers (11, 17) are prime numbers

$\therefore$ HCF of $(11, 17) = 1$

Assertion is true, Reason is true and Reason is the correct explanation of Assertion.

47. LCM $\times$ HCF = Product of numbers

$\Rightarrow$ $182 \times \text{HCF} = 26 \times 91$

$\Rightarrow$ $\text{HCF} = \frac{26 \times 91}{182} = 13$

$\therefore$ Assertion is true but Reason is false.

48. If 3|93 means 3 divides 93

$\Rightarrow$ $93 = a \times 3$ (a is an integer)

Similarly, if 5|0 means 5 divides 0

$\Rightarrow$ $0 = 5 \times b$ (b is an integer)

$\therefore$ Assertion is true Reason is true and Reason is the correct explanantion of Assertion.

49. **Case I** If $n = 2q$

$n^2 - n = 4q^2 - 2q$

$= 2q(2q - 1)$ {divisible by 2}

Case II If $n = 2q + 1$

$n^2 - n = (2q + 1)^2 - (2q + 1)$

$= 4a^2 + 4q + 1 - 2q - 1$

$= 2q(2q + 1)$ {divisible by 2}

Hence, Assertion and Reason both are true but Reason is not a correct explanation of Assertion.

50. Assertion and Reason both are true and Reason is the correct explanation of Assertion.

51. $\because \sqrt{4} = \pm 2$, which is not an irrational number.

$\therefore$ Assertion is true but Reason is false.

52. Reason is clearly true.

Again $34.12345 = \frac{3412345}{100000} = \frac{682469}{20000}$

$= \frac{682469}{2^5 \times 5^4}$

Its denominator is of the form $2^m \times 5^n$

[$m = 5, n = 4$ are non-negative integers]

Assertion and Reason both are true and Reason is the correct explanation of Assertion.

53. Since, the factors of the denominator 3125 is of the form $2^0 \times 5^5$.

$\therefore \frac{13}{3125}$ is a terminating decimal.

Assertion and Reason both are true and Reason is the correct explanation of Assertion.

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54. Given number $= \frac{29}{9261} = \frac{29}{3^3 \times 7^3}$

$9261 = 3^3 \times 7^3$ is not of the form $2^n \times 5^m$.

Hence, $\frac{29}{9261}$, is non-terminating repeating decimal expansion.

Assertion is true but Reason is false.

55. (i) The factors are

$$a = p^2q^4$$
$$b = p^3q^2$$

HCF of a and $b = p^2q^2$

LCM of a and $b = p^3q^4$

$\therefore$ LCM $= pq^2 \times$ HCF

(ii) Let the number of marbles be $2m + 1$ or $3n + 1$

$\therefore$ Total number of marbles be in the form of (multiple of 2 and 3) + 1

or $p = 6a + 1$ {a is any integer}

p is an odd number.

(iii) Here, HCF of 306 and 657 = 9, we have

LCM × HCF = Product of the numbers

$\therefore$ LCM $\times 9 = 306 \times 657$

$\Rightarrow$ LCM $= \frac{306 \times 657}{9} = 34 \times 657$

$= 22338$

Thus, LCM of 306 and 657 is 22338.

(iv) LCM of 15, 24 and 36 is 360.

Greatest number of 6-digit is 999999.

So, $999999 = 360 \times 2777 + 279$

$\therefore$ Greatest number of 6-digits divisible by 15, 24 and 36 is $999999 - 279 = 999720$.

(v) N will be odd number because N is sum of one even number and 13986 odd numbers.

Hence, N will not be divisible by any even number.

56. (i) Given, number of students in Section A = 32

Number of students in Section B = 36

The minimum number of books acquire for the class library = LCM of (32, 36)

$= 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$= 2^5 \times 3^2 = 32 \times 9 = 288$

(ii) Given, product of the two numbers

= LCM × HCF

$\therefore$ 32×36 = LCM (32, 36) × HCF (32, 36)

$\Rightarrow$ $32 \times 36 = 288 \times$ HCF (32, 36)

$\Rightarrow$ HCF (32, 36) $= \frac{32 \times 36}{288} = 4$

(iii) The prime factors of 36 are

$36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$

(iv) $7 \times 11 \times 13 \times 15 + 15 = 15015 + 15$

$= 15030$

Hence, it is a composite number.

(v) Given, $p = ab^2$ and $q = a^2b$

LCM (p, q) = Product of the greatest power of each prime factor involved in the numbers, with highest power

$= a^2 \times b^2$

57. (i) Given, $\sqrt{12}$ (a number)

$\sqrt{12} = 2\sqrt{3}$

Here, 2 is a rational number and $\sqrt{3}$ is an irrational number.

We know that, product of rational and irrational number is a irrational number.

Hence, $\sqrt{12}$ is an irrational number.

(ii) Here, $\sqrt{9} = 3$ (which is a rational number)

$\therefore 2 + 2\sqrt{9} = 2 + 2(3)$

$= 2 + 6 = 8$

8 is not an irrational number.

(iii) As we know, $\sqrt{2}$ and $\sqrt{3}$ both are irrational number and the difference of two irrational number is always a irrational number.

So, $\sqrt{3} - \sqrt{2}$ is an irrational number.

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(iv) $\because \sqrt{8} = 2\sqrt{2}$

$2\sqrt{2}$ is an irrational number and the reciprocal of irrational number is also a irrational number.

So, $\frac{1}{\sqrt{8}}$ is an irrational number.

(v) Here, $\sqrt{16} = 4$

4 is a rational number or not irrational.

58. (i) Given, number of students in each subject are

Hindi = 60, English = 84,

Mathematics = 108.

The prime factors of each subject students are

$$60 = 2 \times 2 \times 3 \times 5 = 2^2 \times 3 \times 5$$

$$84 = 2 \times 2 \times 3 \times 7 = 2^2 \times 3 \times 7$$

$$108 = 2 \times 2 \times 3 \times 3 \times 3 = 2^2 \times 3^3$$

The maximum number of participants that can accommodated in each room

= HCF (60, 84, 108)

= Product of the smallest power of each common prime factor involved in the numbers

$= 2^2 \times 3 = 12$

(ii) The minimum number of rooms required during the event is

$$\frac{\text{Total number of participants}}{12} = \frac{252}{12} = 21$$

(iii) LCM of (60, 84, 108) = Product of the greatest power of each prime factor involved in the numbers with highest power

$= 2^2 \times 3^3 \times 5 \times 7$

$= 4 \times 27 \times 35$

$= 3780$

(iv) Now, HCF (60, 84, 108) × LCM (60, 84, 108)

$= 12 \times 3780$

$= 45360$

(v) Number 108 can be expressed as a product of its prime as $2^2 \times 3^3$.

59. (i) The simplest form of are the options can be written as

$$\frac{8}{15} = \frac{2^3}{3 \times 5}$$

$$\frac{51}{150} = \frac{51}{2 \times 3 \times 5^2}$$

$$\frac{15}{400} = \frac{3 \times 5}{2^4 \times 5^2}$$

$$= \frac{129}{2^2 \times 5^2 \times 7^2}$$

Only (c) has denominator in the form of $2^n 5^m$.

(ii) $\frac{23}{2^3 \times 5^3} = \frac{23}{10^3} = \frac{23}{1000} = 0.023$

(iii) $\frac{686}{2^2 \times 5^7 \times 7^3} = \frac{2 \times 7^3}{2^2 \times 5^7 \times 7^3} = \frac{2}{2^2 \times 5^7}$

denominator is in the form of $2^n 5^m$ so terminating.

(iv) For the fraction to be terminating the denominator must be in the form of $2^n 5^m$, so the values of P must be 2 or 5.

Hence, (c) will be correct.

(v) $\frac{61}{2^5 \times 5^3}$ here the denominator have only 2 or 5 prime factor (or in the form of $2^n 5^m$), so $\frac{61}{2^5 \times 5^3}$ is a terminating decimal.

60. (i) $x = 5 \times 2783 = 13915$

(ii) We have, $2783 = y \times 253$

$\Rightarrow \quad y = \frac{2783}{253} = 11$

(iii) We have, $253 = 11 \times z$

$\Rightarrow \quad z = \frac{253}{11} = 23$

(iv) According to the fundamental theorem of Arithmetic 13915 is a composite number.

(v) $13915 = 5 \times 11 \times 11 \times 23$

$= 5 \times 11^2 \times 23$

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02

Polynomials

Quick Revision

A **polynomial** in one variable x, is an algebraic expression of the form

$$p(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_2 x^2 + a_1 x + a_0$$

where n is a positive integer and constants $a_0, a_1, a_2, \ldots, a_n$ are known as **coefficients of polynomial**.

Degree of a Polynomial

The highest power (exponent) of x in a polynomial $f(x)$, is called the degree of the polynomial $f(x)$.

e.g. $g(y) = 3y^2 - \frac{5}{2}y + 7$ is a polynomial in variable y of degree 2.

Types of Polynomials

(i) **Linear Polynomial** A polynomial of degree one, is called linear polynomial.

e.g. $f(x) = 3x + 5$

(ii) **Quadratic Polynomial** A polynomial of degree two, is called quadratic polynomial.

e.g. $f(x) = 5x^2 + 3x - \frac{7}{5}$

(iii) **Cubic Polynomial** A polynomial of degree three, is called cubic polynomial.

e.g. $f(x) = 9x^3 + 5x^2$

(iv) **Biquadratic Polynomial** A polynomial of degree four, is called biquadratic polynomial.

e.g. $f(x) = x^4 + 2x^3 - 7x^2 + 5x + 3$

Value of a Polynomial at Given Point

If $p(x)$ is a polynomial and α is a real value, then the value obtained by putting $x = \alpha$ in $p(x)$, is called the value of $p(x)$ at $x = \alpha$ and it is denoted by $p(\alpha)$.

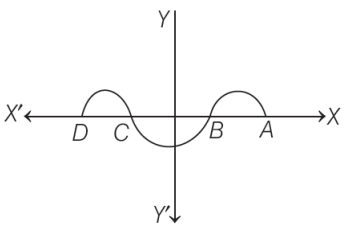
Zeroes of a Polynomial

A real number k is said to be a zero of a polynomial $f(x)$, if $f(k) = 0$.

Geometrical Meaning of the Zeroes of a Polynomial

The geometrical meaning of the zeroes of a polynomial means that the curve intersect the X-axis, the intersection point is said to be zeroes of the curve.

e.g. In the figure we see that graph intersect the X-axis at points A, B, C and D. So, it has four zeroes.



Relationship between Zeroes and Coefficients of a Polynomial

The zeroes of a polynomial are related to its coefficients.

(i) **For a Linear Polynomial** The zero of the linear polynomial $ax + b$ is

$$-\frac{b}{a} = -\frac{\text{Constant term}}{\text{Coefficient of } x}.$$

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(ii) **For a Quadratic Polynomial** Let α and β be the zeroes of quadratic polynomial $p(x) = ax^2 + bx + c$, $a \neq 0$, then

$\therefore$ Sum of zeroes, $\alpha + \beta$

$$= -\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2} = -\frac{b}{a}$$

and product of zeroes, $\alpha\beta$

$$= \frac{\text{Constant term}}{\text{Coefficient of } x^2} = \frac{c}{a}$$

(iii) **For a Cubic Polynomial** Let α, β and γ be the zeroes of the cubic polynomial $ax^3 + bx^2 + cx + d$, $a \neq 0$, then

$$\alpha + \beta + \gamma = -\frac{\text{Coefficient of } x^2}{\text{Coefficient of } x^3}$$

$$= -\frac{b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{\text{Coefficient of } x}{\text{Coefficient of } x^3} = \frac{c}{a}$$

and $$\alpha\beta\gamma = -\frac{\text{Constant term}}{\text{Coefficient of } x^3}$$

$$= -\frac{d}{a}$$

Useful Algebraic Identities

(i) $(a \pm b)^2 = a^2 + b^2 \pm 2ab$

(ii) $(a + b)^2 - (a - b)^2 = 4ab$ and $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$

(iii) $(a^2 - b^2) = (a + b)(a - b)$

(iv) $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ac)$

(v) $(a^3 \pm b^3) = (a \pm b)(a^2 + b^2 \mp ab)$

$= (a \pm b)[(a \pm b)^2 \mp 3ab]$

(vi) $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$

$= a^3 + b^3 + 3a^2b + 3ab^2$

(vii) $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$

$= a^3 - b^3 - 3a^2b + 3ab^2$

(viii) $a^3 + b^3 + c^3 - 3abc$

$= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$

Formation of Quadratic and Cubic Polynomials

(i) If α and β are the zeroes of a quadratic polynomial, then quadratic polynomial will be

$k\,[x^2 - (\text{sum of zeroes})\,x + \text{product of zeroes}]$

i.e. $k\,[x^2 - (\alpha + \beta)x + \alpha\beta]$, where k is some constant.

(ii) If α, β and γ are the zeroes of cubic polynomial, then cubic polynomial will be

$k[x^3 - (\text{sum of zeroes})\,x^2 + (\text{sum of the product of zeroes taking two at a time})x - \text{product of zeroes}]$

i.e. $k[x^3 - (\alpha + \beta + \gamma)\,x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)\,x - \alpha\beta\gamma]$

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Objective Questions

Multiple Choice Questions

1. Which of the following is not a polynomial

(a) $3x+5$ (b) $3y^3-4y^2+2y$
(c) x^3-3 (d) $\frac{1}{x+2}$

2. If 2 is a zero of polynomial $f(x)=ax^2-3(a-1)x-1$, then the value of a is

(a) 0 (b) 2
(c) $\frac{5}{2}$ (d) $\frac{1}{2}$

3. If one of the zeroes of the quadratic polynomial $(k-1)x^2+kx+1$ is -3, then the value of k is ***[NCERT Exemplar]***

(a) $\frac{4}{3}$ (b) $-\frac{4}{3}$
(c) $\frac{2}{3}$ (d) $\frac{-2}{3}$

4. If one of the zeroes of the quadratic polynomial x^2+3x+k is 2, then the value of k is ***[CBSE 2020]***

(a) 10 (b) -10
(c) -7 (d) -2

5. If 2 and 3 are zeroes of polynomial $3x^2-2kx+2m$, then the values of k and m are

(a) $m=\frac{9}{2}$ and $k=15$ (b) $m=\frac{15}{2}$ and $k=9$
(c) $m=9$ and $k=\frac{15}{2}$ (d) $m=15$ and $k=9$

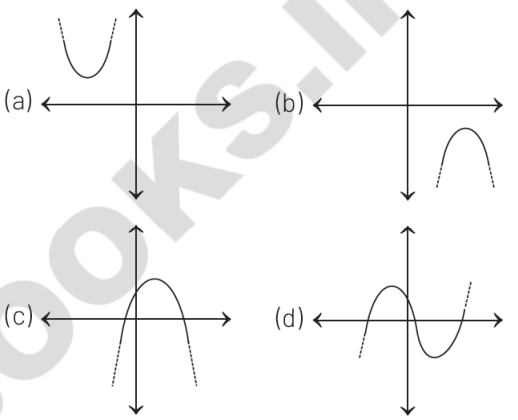
6. The value of p, for which (-4) is a zero of the polynomial $x^2-2x-(7p+3)$ is ..... .

(a) 3 (b) 2
(c) 4 (d) -2

7. If the graph of a polynomial intersects the X-axis at only one point, it can be a

(a) linear (b) quadratic
(c) cubic (d) None of these

8. Which of the following is not the graph of a quadratic polynomial?



9. The graph of a quadratic polynomial is ..... . ***[NCERT Exemplar]***

(a) straight line (b) parabola
(c) hyperbola (d) None of these

10. If one zero of polynomial x^2-4x+1 is $2+\sqrt{3}$, then other zero will be .....

(a) $-2+\sqrt{3}$ (b) $-\sqrt{3}-2$
(c) $2-\sqrt{3}$ (d) $\sqrt{3}+1$

11. The zeroes of the quadratic polynomial (x^2+5x+6) are

(a) -2 and -3 (b) 3 and 4
(c) 3 and 2 (d) 2 and 1

12. Zeroes of $p(z)=z^2-27$ are ..... and .....

(a) $\pm 3\sqrt{3}$ (b) $+3$
(c) $+9$ (d) $+\sqrt{3}$ and $-\sqrt{3}$

13. The zeroes of the quadratic polynomial $f(x)=abx^2+(b^2-ac)x-bc$ are

(a) $\frac{b}{ac}$ and $\frac{c}{b}$ (b) $\frac{ab}{c}$ and $\frac{a}{b}$
(c) $\frac{-b}{a}$ and $\frac{c}{b}$ (d) $\frac{b}{a}$ and $\frac{-c}{b}$

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14. The number of polynomials having zeroes as -2 and 5 is ***[NCERT Exemplar]***
(a) 1 (b) 2
(c) 3 (d) more than 3

15. 1 and 2 are the zeroes the polynomial $x^2 - 3x + 2$
(a) True (b) False
(c) Can't say (d) Partially true/false

16. Every real number is the zeroes of zero polynomial
(a) True (b) False
(c) Can't say (d) Partially true/False

17. $p(x) = x - 1$ and $g(x) = x^2 - 2x + 1$, $p(x)$ is a factor of $g(x)$
(a) True (b) False
(c) Can't Say (d) Partially True/False

18. The value of k for which 3 is a zero of polynomial $2x^2 + x + k$ is .....
(a) 21 (b) 20
(c) –21 (d) 18

19. If zeroes α and β of a polynomial $x^2 - 7x + k$ are such that $\alpha - \beta = 1$, then the value of k is
(a) 21 (b) 12
(c) 9 (d) 8

20. Sum of zeroes of Quadratic polynomial
$$= -\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2}$$
(a) True (b) False
(c) Can't say (d) Partially true/false

21. If α and β are zeroes of the quadratic polynomial $x^2 - 6x + a$ the value of 'a', if $3\alpha + 2\beta = 20$ is -12
(a) True (b) False
(c) Can't say (d) Partially True/False

22. If one of the zeroes of a quadratic polynomial of the form $x^2 + ax + b$ is the negative of the other, then it
(a) has no linear term and the constant term is negative
(b) has no linear term and the constant term is positive
(c) can have a linear term but the constant term is negative
(d) can have a linear term but the constant term is positive

23. If p and q are zeroes of $3x^2 + 2x - 9$, then value of $p - q$ is
(a) -3 (b) $-\frac{2}{3}$
(c) $\pm\frac{4\sqrt{7}}{3}$ (d) None of these

24. The polynomial whose zeroes are $(\sqrt{2}+1)$ and $(\sqrt{2}-1)$ is
(a) $x^2+2\sqrt{2}x+1$ (b) $x^2-2\sqrt{2}x+1$
(c) $x^2+2\sqrt{2}x-1$ (d) $x^2-2\sqrt{2}x-1$

25. If α and β are the zeroes of the polynomial $2y^2 + 7y + 5$, then the value of $\alpha + \beta + \alpha\beta$ is
(a) -1 (b) 0
(c) 1 (d) 2

26. If α and β are the zeroes of the quadratic polynomial $f(x) = 3x^2 - 5x - 2$, then $\alpha^3 + \beta^3$ is equal to
(a) $\frac{215}{27}$ (b) $\frac{357}{21}$
(c) $\frac{115}{28}$ (d) $\frac{325}{31}$

27. If α and β are the zeroes of $4x^2 + 3x + 7$, then the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ is
(a) $-\frac{8}{7}$ (b) $-\frac{3}{7}$
(c) $\frac{2}{7}$ (d) $\frac{6}{8}$

28. If the zeroes of the quadratic polynomial $x^2 + (a+1)x + b$ are 2 and -3, then ***[NCERT Exemplar]***
(a) $a = -7, b = -1$ (b) $a = 5, b = -1$
(c) $a = 2, b = -6$ (d) $a = 0, b = -6$

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29. If the sum and difference of zeroes of quadratic polynomial are -3 and -10, respectively. Then, the difference of the squares of zeroes is
(a) 20 (b) 30
(c) 15 (d) 25

30. If sum and product of zeroes of quadratic polynomial are, respectively 8 and 12, then their zeroes are
(a) 2 and 6 (b) 3 and 4
(c) 2 and 8 (d) 2 and 5

31. If m and n are the zeroes of the polynomial $3x^2 + 11x - 4$, then find the value of $\frac{m}{n} + \frac{n}{m}$
(a) $\frac{145}{12}$ (b) $-\frac{145}{12}$
(c) $\frac{145}{7}$ (d) $\frac{-145}{15}$

32. If one zero of the polynomial $3x^2 - 8x + 2k + 1$ is seven times the other, then the value of k is
(a) $\frac{2}{5}$ (b) $\frac{2}{3}$
(c) $\frac{2}{7}$ (d) $\frac{3}{2}$

33. If sum of the squares of zeroes of the quadratic polynomial $f(x) = x^2 - 4x + k$ is 20, then the value of k is
(a) -2 (b) -3
(c) -4 (d) 2

34. If α and β are zeroes of the polynomial $x^2 - p(x+1) + c$ such that $(\alpha+1)(\beta+1) = 0$, then the value of c is
(a) -2 (b) 2
(c) -1 (d) 1

35. The value of k such that the polynomial $x^2 - (k+6)x + 2(2k-1)$ has sum of its zeroes equal to half of their product is *[CBSE 2019]*
(a) -4 (b) 4 (c) -7 (d) 7

36. The sum and the product of zeroes of the polynomial $f(x) = 4x^2 - 27x + 3k^2$ are equal the value of k is
(a) $k = 3$ (b) $k = -3$
(c) $k = \pm 3$ (d) $k = 2$

37. If α and β are the zeroes of the quadratic polynomial $f(x) = x^2 - 4x + 3$, then the value of $\alpha^4\beta^3 + \alpha^3\beta^4$ is
(a) 104 (b) 108
(c) 112 (d) 5

38. The quadratic polynomial, the sum of whose zeroes is -5 and their product is 6, is *[CBSE 2020]*
(a) $x^2 + 5x + 6$ (b) $x^2 - 5x + 6$
(c) $x^2 - 5x - 6$ (d) $-x^2 + 5x + 6$

39. The quadratic polynomial whose zeroes are $2\sqrt{7}$ and $-5\sqrt{7}$ is
(a) $x^2 - 3\sqrt{7}x - 70$ (b) $x^2 + 3\sqrt{7}x + 70$
(c) $x^2 + 3\sqrt{7}x - 70$ (d) $x^2 - 3\sqrt{7}x + 70$

40. The quadratic polynomial, whose zeroes are $3 + \sqrt{2}$ and $3 - \sqrt{2}$, is
(a) $x^2 - 3x + 5$ (b) $x^2 - 6x + 7$
(c) $x^2 - 7x + 6$ (d) $x^2 - 8x + 12$

41. If α and β are the zeroes of the quadratic polynomial $f(x) = x^2 + x - 2$, then the polynomial whose zeroes are $2\alpha + 1$ and $2\beta + 1$ is
(a) $x^2 + 9$ (b) $x^2 - 4$
(c) $x^2 - 9$ (d) $x^2 + 4$

42. If α and β are zeroes of a quadratic polynomial $x^2 - 5$, then the quadratic polynomial whose zeroes are $1 + \alpha$ and $1 + \beta$ is
(a) $x^2 + 2x + 24$ (b) $x^2 - 2x - 24$
(c) $x^2 - 2x + 24$ (d) None of these

43. The number of value of k for which the quadratic polynomial $kx^2 + x + k$ has equal zeroes is
(a) 4 (b) 1 (c) 2 (d) 3

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44. $p(x) = 5x^3 - 3x^2 + 7x + 2$, then match the value of Column I with that of Column II

	Column I		Column II
A.	$p(1)$	P.	2
B.	$p(0)$	Q.	11
C.	$p(5)$	R.	– 13
D.	$p(-1)$	S.	– 64
E.	$p(-2)$	T.	587

	A	B	C	D	E
(a)	Q	T	R	P	S
(b)	Q	R	T	S	P
(c)	Q	P	T	R	S
(d)	T	R	Q	S	P

45. If α and β are the zeroes of the polynomial $2x^2 - 4x + 5$, then match the value of Column I with that of Column II

	Column I		Column I
A.	$\frac{1}{\alpha} + \frac{1}{\beta}$	1.	– 6
B.	$(\alpha - \beta)^2$	2.	$\frac{-4}{25}$
C.	$\frac{1}{\alpha^2} + \frac{1}{\beta^2}$	3.	$\frac{-2}{5}$
D.	$\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$	4.	$\frac{4}{5}$

	A	B	C	D
(a)	4	1	2	3
(b)	4	2	1	3
(c)	1	2	3	4
(d)	1	4	2	3

Assertion-Reasoning MCQs

Directions (Q. Nos. 46-55) Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) A is true, R is true; R is a correct explanation for A.
(b) A is true, R is true; R is not a correct explanation for A.
(c) A is true; R is False.
(d) A is false; R is true.

46. **Assertion (A)** $x^2 + 4x + 5$ has two zeroes.

Reason (R) A quadratic polynomial can have atmost two zeroes.

47. **Assertion (A)** The factor of $\frac{3}{2}x^2 - 8x - \frac{35}{2}$ is $\frac{1}{2}(x-7)(3x+5)$

Reason (R) The factors are calculated by dividing the coefficients by 2 and expression is obtained by splitting the middle term

48. **Assertion (A)** A quadratic polynomial having 4 and 3 as zeroes is $x^2 - 7x - 12$

Reason (R) The quadratic polynomial having α and β as zeroes is given by $p(x) = x^2 - (\alpha + \beta)x + \alpha \cdot \beta$

49. **Assertion (A)** Zeroes of $f(x) = x^2 - 4x - 5$ are 5, –1.

Reason (R) The polynomial whose zeroes are $2 + \sqrt{3}$, $2 - \sqrt{3}$ is $x^2 - 4x + 7$

50. **Assertion (A)** If α and β are the zeroes of the polynomial $x^2 + 2x - 15$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is $\frac{2}{15}$.

Reason (R) If α and β are the zeroes of a quadratic polynomial $ax^2 + bx + c$, then $\alpha + \beta = -\frac{b}{a}$ and $\alpha\beta = \frac{c}{a}$

51. **Assertion (A)** If one zero of the polynomial $p(x) = (k+18)x^2 + 11x + 4k$ is the reciprocal of the other zero, then $k = 6$

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Reason (R) If $(x-\alpha)$ and $(x-\beta)$ are the factor of the polynomial $p(x)$, then α and β are the zeroes of the $p(x)$

52. **Assertion (A)** If the zeroes of x^2+px+q are two consecutive integers, then $p^2-1=4q$

Reason (R) If α, β are zeroes of $(x-a)(x-b)-c$, then a, b are zeroes of $(x-\alpha)(x-\beta)+c$

53. **Assertion (A)** If the zeroes of the polynomial $f(x)=(k^2+4)x^2+4kx+(k^3-9)$ are equal in magnitude but opposite in sign, then value of k is zero

Reason (R) A quadratic polynomial whose zeroes are α and β is $x^2+(\alpha+\beta)x+\alpha\beta$

54. **Assertion (A)** If m and n are the zeroes of the polynomial $3x^2+11x-4$, then $12(m^2+n^2)+145mn=0$

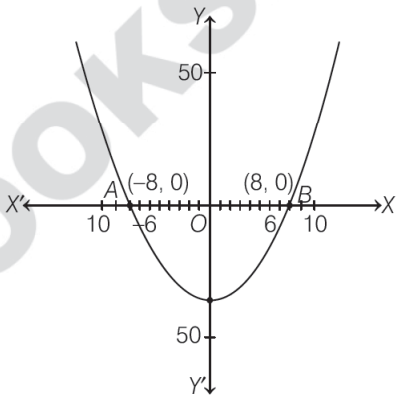
Reason (R) If α and β are the zeroes of the polynomial ax^2+bx+c, then $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}=\frac{b^2}{ac}+2$

55. **Assertion (A)** If x^2+x-12 divides $p(x)=x^3+ax^2+bx-84$ exactly, then $a=-8$ and $b=-5$

Reason (R) When a polynomial $p(x)$ is completely divided by $(x-\alpha)$, then $p(x)=0$.

Case Based MCQs

56. While playing in garden, Rohit saw a Nest and asked her elder brother what is that he replied that it's a nest made by bird to live themselves. Also he told him that the shape of the nest formed is parabolic. The mathematical representation of the nest structure is shown in the graph.



Based on the above information, answer the following questions.

(i) Graph of a quadratic polynomial is _____ in shape.

(a) straight line (b) parabolic
(c) circular (d) None of these

(ii) The expression of the polynomial represented by the graph is

(a) x^2-49
(b) x^2-64
(c) x^2-36
(d) x^2-81

(iii) Find the value of the polynomial represented by the graph when $x=8$

(a) –2 (b) –1
(c) 0 (d) 1

(iv) The sum of zeroes of the polynomial x^2-2x-4 is

(a) –1 (b) –2
(c) 2 (d) 1

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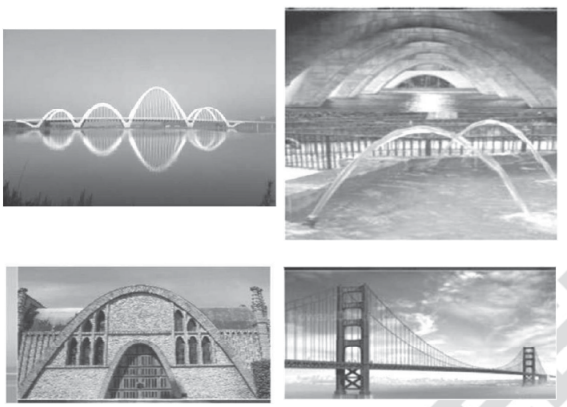
(v) If the sum of zeroes of polynomial $ax^2 + 5x - 3a$ is equal to their product, then find the value of a

(a) -5 (b) -3

(c) $-\frac{5}{3}$ (d) $\frac{5}{3}$

57. The below picture are few natural examples of parabolic shape which is represented by a quadratic polynomial. A parabolic arch is an arch in the shape of a parabola.



In structures, their curve represents an efficient method of load, and so can be found in bridges and in architecture in a variety of forms. ***[CBSE Question Bank]***

Based on the above information, answer the following questions.

(i) In the standard form of quadratic polynomial, $ax^2 + bx + c$, a, b and c are

(a) All are real numbers

(b) All are rational numbers.

(c) 'a' is a non-zero real number, b and c are any real numbers.

(d) All are integers.

(ii) If the roots of the quadratic polynomial are equal, where the discriminant $D = b^2 - 4ac$, then

(a) $D > 0$

(b) $D < 0$

(c) $D \geq 0$

(d) $D = 0$

(iii) If α and $\frac{1}{\alpha}$ are the zeroes of the quadratic polynomial $2x^2 - x + 8k$, then k is

(a) 4 (b) $\frac{1}{4}$

(c) $\frac{-1}{4}$ (d) 2

(iv) The graph of $x^2 + 1 = 0$

(a) Intersects X-axis at two distinct points.

(b) Touches X-axis at a point.

(c) Neither touches nor intersects X-axis.

(d) Either touches or intersects X-axis.

(v) If the sum of the roots is $-p$ and product of the roots is $-\frac{1}{p}$, then the quadratic polynomial is

(a) $k\left(-px^2 + \frac{x}{p} + 1\right)$ (b) $k\left(px^2 - \frac{x}{p} - 1\right)$

(c) $k\left(x^2 + px - \frac{1}{p}\right)$ (d) $k\left(x^2 - px + \frac{1}{p}\right)$

58. Nirahua's father gave him some money to buy papaya from the market at the rate of $p(x) = x^2 - 23x + 120$. Let α, β are the zeroes of $p(x)$.

Based on the above information, answer the following questions.

(i) Find the value of α and β, where $\alpha < \beta$

(a) $-8, -16$ (b) 8, 16

(c) 8, 15 (d) 4, 9

(ii) Find the value of $\alpha + \beta + \alpha\beta$

(a) 151 (b) 158

(c) 143 (d) 155

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(iii) The value of $p(2)$ is

(a) 80 (b) 81
(c) 83 (d) 78

(iv) If α and β are zeroes of $x^2 + 3x - 10$, then $\frac{1}{\alpha} + \frac{1}{\beta} =$

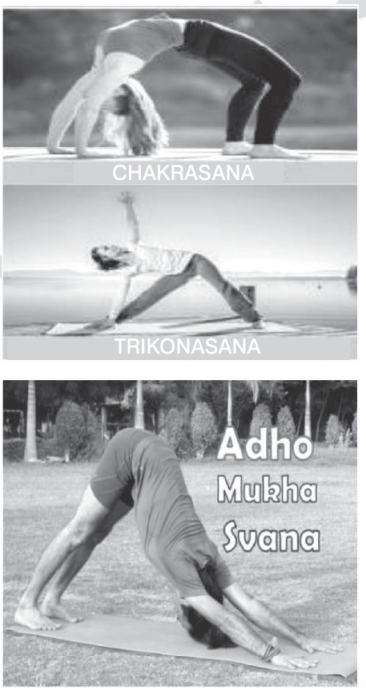
(a) 3/10 (b) 1/3
(c) 1/4 (d) 1/5

(v) If sum of zeroes of $q(x) = kx^2 + 2x + 3k$ is equal to their product, then $k =$

(a) 2/3 (b) 1/3
(c) −2/3 (d) −1/3

59. An asana is a body posture, originally and still a general term for a sitting meditation pose, and later extended in hatha yoga and modern yoga as exercise, to any type of pose or position, adding reclining, standing, inverted, twisting, and balancing poses. In the figure, one can observe that poses can be related to representation of quadratic polynomial.

[CBSE Question Bank]



Based on the above information, answer the following questions.

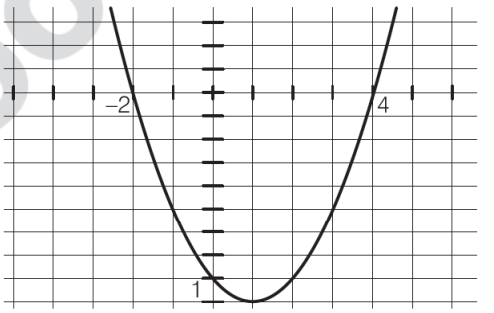
(i) The shape of the poses shown is

(a) Spiral
(b) Ellipse
(c) Linear
(d) Parabola

(ii) The graph of parabola opens downwards, if ..... .

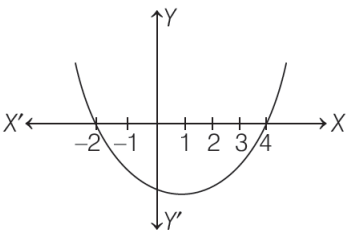
(a) $a \geq 0$ (b) $a = 0$
(c) $a < 0$ (d) $a > 0$

(iii) In the graph, how many zeroes are there for the polynomial?



(a) 0 (b) 1
(c) 2 (d) 3

(iv) The two zeroes in the below shown graph are



(a) 2, 4 (b) −2, 4
(c) −8, 4 (d) 2, −8

(v) The zeroes of the quadratic polynomial $4\sqrt{3}x^2 + 5x - 2\sqrt{3}$ are

(a) $\frac{2}{\sqrt{3}}, \frac{\sqrt{3}}{4}$ (b) $-\frac{2}{\sqrt{3}}, \frac{\sqrt{3}}{4}$
(c) $\frac{2}{\sqrt{3}}, -\frac{\sqrt{3}}{4}$ (d) $-\frac{2}{\sqrt{3}}, -\frac{\sqrt{3}}{4}$

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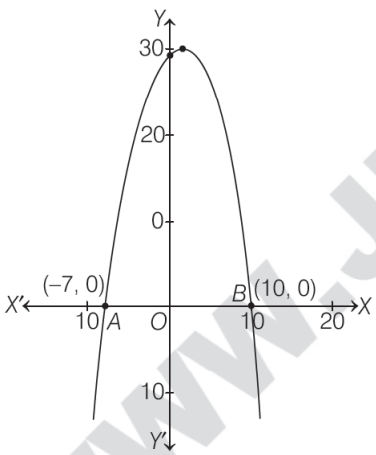
60. Two friend, Aanchal and Amarjeet during their summer vacations went to Rishikesh. They decided to go for trekking. While trekking they observes that the trekking path is in the shape of a parabola. The mathematical representation of the track is shown in the graph.



Based on the above information, answer the following questions.

(i) The zeroes of the polynomial whose graph is given are

(a) 4, 7 (b) – 4, 7

(c) 4, 3 (d) – 7, 10

(ii) What will be the expression of the given polynomial $p(x)$

(a) $x^2 - 3x - 70$

(b) $-x^2 + 4x + 28$

(c) $x^2 - 4x + 28$

(d) $-x^2 + 3x + 28$

(iii) Product of zeroes of the given polynomial is

(a) – 28 (b) 28

(c) – 70 (d) 30

(iv) The zeroes of the polynomial $9x^2 - 5$ are

(a) $\frac{3}{\sqrt{5}}, \frac{-3}{\sqrt{5}}$ (b) $\frac{2}{\sqrt{5}}, \frac{-2}{\sqrt{5}}$

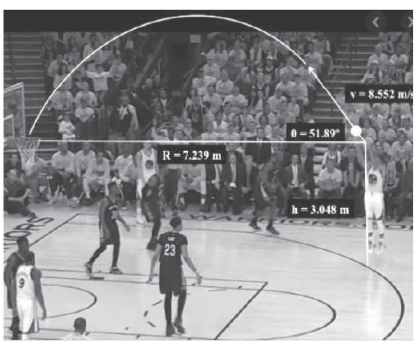
(c) $\frac{\sqrt{5}}{3}, \frac{-\sqrt{5}}{3}$ (d) $\frac{\sqrt{5}}{2}, \frac{-\sqrt{5}}{2}$

(v) If $f(x) = x^2 - 13x + 1$, then $f(3)$ is

(a) 35 (b) – 29

(c) 36 (d) – 36

61. Basketball and soccer are played with a spherical ball. Even though an athlete dribbles the ball in both sports, a basketball player uses his hands and a soccer player uses his feet. Usually, soccer is played outdoors on a large field and basketball is played indoor on a court made out of wood. The projectile (path traced) of soccer ball and basketball are in the form of parabola representing quadratic polynomial. ***[CBSE Question Bank]***



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Based on the above information, answer the following questions.

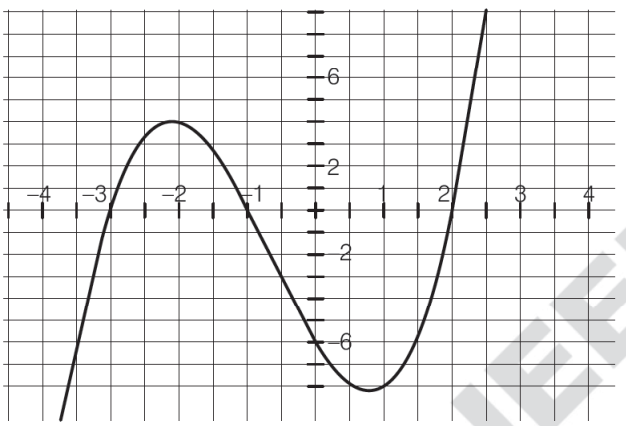
(i) The shape of the path traced shown is

(a) Spiral (b) Ellipse
(c) Linear (d) Parabola

(ii) The graph of parabola opens downwards, if ..... .

(a) $a = 0$ (b) $a < 0$
(c) $a > 0$ (d) $a \geq 0$

(iii) Observe the following graph and answer.



In the above graph, how many zeroes are there for the polynomial?

(a) 0
(b) 1
(c) 2
(d) 3

(iv) The three zeroes in the above shown graph are

(a) 2, 3, −1
(b) −2, 3, 1
(c) −3, −1, 2
(d) −2, −3, −1

(v) What will be the expression of the polynomial?

(a) $x^3 + 2x^2 - 5x - 6$
(b) $x^3 + 2x^2 - 5x + 6$
(c) $x^3 + 2x^2 + 5x - 6$
(d) $x^3 + 2x^2 + 5x + 6$

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ANSWERS

Multiple Choice Questions

1. (d)	2. (c)	3. (a)	4. (b)	5. (c)	6. (a)	7. (a)	8. (d)	9. (b)	10. (c)
11. (a)	12. (a)	13. (c)	14. (d)	15. (a)	16. (a)	17. (a)	18. (c)	19. (b)	20. (a)
21. (b)	22. (a)	23. (c)	24. (b)	25. (a)	26. (a)	27. (b)	28. (d)	29. (b)	30. (a)
31. (b)	32. (b)	33. (a)	34. (c)	35. (d)	36. (c)	37. (b)	38. (a)	39. (c)	40. (b)
41. (c)	42. (b)	43. (c)	44. (c)	45. (a)					

Assertion-Reasoning MCQs

46. (a)	47. (c)	48. (a)	49. (c)	50. (a)	51. (b)	52. (b)	53. (c)	54. (c)	55. (d)

Case Based MCQs

56. (i) - (b); (ii) - (b); (iii) - (c); (iv) - (c); (v) - (d)
57. (i) - (c); (ii) - (d); (iii) - (b); (iv) - (c); (v) - (c)
58. (i) - (c); (ii) - (c); (iii) - (d); (iv) - (a); (v) - (c)
59. (i) - (d); (ii) - (c); (iii) - (b); (iv) - (b); (v) - (b)
60. (i) - (d); (ii) - (a); (iii) - (c); (iv) - (c); (v) - (b)
61. (i) - (d); (ii) - (b); (iii) - (d); (iv) - (c); (v) - (a)

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SOLUTIONS

1. $\frac{1}{x+2}$ is not a polynomial

Since, the exponent of variable is negative

2. Given, $f(x) = ax^2 - 3(a-1)x - 1$

and 2 is zero of $f(x)$,

$$f(2) = 0$$
$$f(2) = a(2)^2 - 3(a-1) \times 2 - 1$$
$$0 = 4a - 6a + 6 - 1$$
$$2a = 5$$
$$a = \frac{5}{2}$$

3. Given that, one of the zeroes of the quadratic polynomial say $p(x) = (k-1)x^2 + kx + 1$ is -3,

then $p(-3) = 0$

$\Rightarrow (k-1)(-3)^2 + k(-3) + 1 = 0$

$\Rightarrow 9(k-1) - 3k + 1 = 0$

$\Rightarrow 9k - 9 - 3k + 1 = 0$

$\Rightarrow 6k - 8 = 0$

$\therefore k = \frac{4}{3}$

4. Given, 2 is the zero of the quadratic polynomial.

We have, $f(x) = x^2 + 3x + k$

$$f(2) = 0$$
$\Rightarrow (2)^2 + 3 \times 2 + k = 0$

$\Rightarrow 4 + 6 + k = 0 \Rightarrow k = -10$

5. Let $f(x) = 3x^2 - 2kx + 2m$

2 and 3 are zeroes of $f(x)$

$$f(2) = 0 \text{ and } f(3) = 0$$
$$f(2) = 3(2)^2 - 2k \times 2 + 2m$$
$$0 = 12 - 4k + 2m$$
$$m - 2k = -6 \quad \ldots\text{(i)}$$
$$f(3) = 3(3)^2 - 2k \times 3 + 2m$$
$$0 = 27 - 6k + 2m$$
$$2m - 6k = -27 \quad \ldots\text{(ii)}$$

From Eqs. (i) and (ii) we get, $m = 9$ and $k = \frac{15}{2}$

6. -4 is a zero of $x^2 - 2x - (7p + 3)$

Let $f(x) = x^2 - 2x - (7p + 3)$

$$f(-4) = 0$$
$\Rightarrow 0 = (-4)^2 - 2 \times (-4) - (7p + 3)$

$\Rightarrow 0 = 16 + 8 - (7p + 3)$

$\Rightarrow 7p + 3 = 24$

$\Rightarrow 7p = 24 - 3 = 21$

$\therefore p = \frac{21}{7} = 3$

7. A linear polynomial intersects the X-axis at only one point.

8. For any quadratic polynomial $ax^2 + bx + c$, $a \neq 0$, the graph of the corresponding equation $y = ax^2 + bx + c$ has one of the two shapes either open upwards like $\cup$ or open downwards like $\cap$ depending on whether $a > 0$ or $a < 0$. These curves are called parabolas.

So, option (d) cannot be possible.

Also, the curve of a quadratic polynomial crosses the X-axis on at most two points but in option (d) the curve crosses the X-axis on the three points, so it does not represent the quadratic polynomial

9. parabola

The graph of a quadratic function is always a parabola, irrespective of the values of x and y

10. Let α, β are the roots of the given equation $2 - \sqrt{3}$

Comparing the given polynomial $x^2 - 4x + 1$ with the standard equation $ax^2 + bx + c$ we get $a = 1$, $b = -4$ and $c = 1$.

Sum of zeroes

$$\alpha + \beta = \frac{-b}{a} = 4$$
$$2 + \sqrt{3} + \beta = 4 \Rightarrow \beta = 2 - \sqrt{3}$$

11. Given,

Quadratic polynomial $(x^2 + 5x + 6)$

We have to find the zeroes of $x^2 + 5x + 6$

By factorization,

$$x^2 + 3x + 2x + 6 = 0$$
$$x(x+3) + 2(x+3) = 0$$
$$(x+3)(x+2) = 0$$
$$x = -3, x = -2$$

Hence, zeroes $x = -3$, $x = -2$

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12. $p(z) = 0$

$z^2 - 27 = 0$

$z^2 = 27$

$(z)^2 = 27$

$z = \pm 3\sqrt{3}$

13. $abx^2 + (b^2 - ac)x - bc = 0$

$\Rightarrow abx^2 - acx + b^2x - bc = 0$

$\Rightarrow ax(bx - c) + b(bx - c) = 0$

$\Rightarrow (ax + b)(bx - c) = 0$

Hence, $x = -\frac{b}{a}, \frac{c}{b}$ are zeroes.

14. The equation of a quadratic polynomial is $x^2 -$ (sum of zeroes) $x +$ product of zeroes

Sum of zeroes $= -2 + 5 = 3$

and product of zeroes $= -2 \times 5 = -10$

$\therefore$ Equation $= x^2 - 3x - 10$.

We know that, the zeroes do not change if the polynomial is divided or multiplied by a constant.

$\therefore kx^2 - 3kx - 10k$ will also have -2 and 5 as their zeroes. As k can take any real value there can be many polynomial having -2 and 5 as their zeroes

15. (True) Put 1 in $x^2 - 3x + 2$

$1 - 3 + 2 = 0$

1 satisfy the equation

Put 2 in $x^2 - 3x + 2$

$4 - 3 \times 2 + 2 = 0$

16. (True) Every real number is a zeroes of the zero polynomial hence the answer is true.

17. $p(x) = 0$

$x - 1 = 0$

$x = 1$

$g(x) = x^2 - 2x + 1$

According to question,

$p(x)$ is a factor of $g(x)$

$g(1) = 0$

$g(1) = 1 - 2 + 1 = 0$

So, $p(x)$ is a factor of $g(x)$

18. Given, 3 is a zero of polynomial $2x^2 + x + k$

Let $f(x) = 2x^2 + x + k$

$f(3) = 0$

$0 = 2(3)^2 + 3 + k$

$k = -(18 + 3)$

$k = -21$

19. α and β are zeroes of $x^2 - 7x + k$

We know that,

Sum of zeroes $(\alpha + \beta) = \frac{-b}{a} = \frac{7}{1}$ ...(i)

$\alpha \cdot \beta = \frac{c}{a} = k$

$\alpha - \beta = 1$ [Given] ...(ii)

From Eqs. (i) and (ii) we get $\alpha = 4$ and $\beta = 3$

$k = \alpha \cdot \beta$

$k = 4 \times 3 = 12$

20. (True) We know that,

Sum of zeroes of quadratic polynomial is

$$\frac{-b}{a} = -\left[\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2}\right]$$

21. False

$f(\alpha) = f(\beta) = 0$

[$\therefore \alpha$ and β are the zeroes of $x^2 - 6x + a$]

$\alpha^2 - 6\alpha + a = 0$

$\beta^2 - 6\beta + a = 0$

$\therefore \alpha + \beta = 6$ ...(i)

$3\alpha + 2\beta = 20$ [Given] ...(ii)

From Eqs. (i) and (ii) we get $\alpha = 8, \beta = -2$

$\beta^2 - 6\beta + a = 0$

$a = 6 \times (-2) - (-2)^2$

$= -12 - 4 = -16$

22. Let $p(x) = x^2 + ax + b$.

Now, product of zeroes $= \frac{\text{Constant term}}{\text{Coefficient of } x^2}$

Let α and β be the zeroes of $p(x)$.

$\therefore$ Product of zeroes $(\alpha \cdot \beta) = \frac{b}{1}$

$\Rightarrow \alpha\beta = b$ ...(i)

Given that, one of the zeroes of a quadratic polynomial $p(x)$ is negative of the other.

$\therefore \alpha\beta < 0$

So, $b < 0$ [from Eq. (i)]

Hence, b should be negative

Put $a = 0$, then, $p(x) = x^2 + b = 0$

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$\Rightarrow \quad x^2 = -b$

$\Rightarrow \quad x = \pm\sqrt{-b} \quad [\because b < 0]$

Hence, if one of the zeroes of quadratic polynomial $p(x)$ is the negative of the other, then it has no linear term i.e. $a = 0$ and the constant term is negative i.e. $b < 0$.

23. Given, p and q are the zeroes of quadratic equations

$\therefore\ p + q = \frac{-2}{3}$ and $pq = -3$

$\therefore\ p - q = \pm\sqrt{(p+q)^2 - 4pq}$

$= \pm\sqrt{\left(\frac{-2}{3}\right)^2 - 4\times(-3)} = \pm\sqrt{\frac{4}{9} + 12} = \pm\frac{4\sqrt{7}}{3}$

24. Sum of roots $= (\sqrt{2}+1) + \sqrt{2} - 1 = 2\sqrt{2}$

Product of roots $= (\sqrt{2}+1)(\sqrt{2}-1) = 2 - 1 = 1$

$\therefore$ Polynomial is

$x^2 -$ (sum of roots) $x +$ product of roots

$x^2 - 2\sqrt{2}x + 1$

25. α and β are the zeroes of $2y^2 + 7y + 5$

We know that,

$$\alpha + \beta = -\frac{b}{a} = -\frac{7}{2}$$

$$\alpha\cdot\beta = \frac{c}{a} = \frac{5}{2}$$

$$\Rightarrow (\alpha+\beta) + (\alpha\cdot\beta) = -\frac{7}{2} + \frac{5}{2} = \frac{-7+5}{2} = -1$$

26. α and β are the zeroes of quadratic polynomial.

$$f(x) = 3x^2 - 5x - 2$$

$\therefore$ We know that,

$$\alpha + \beta = -\frac{b}{a} = \frac{-(-5)}{3} = \frac{5}{3}$$

$$\alpha\cdot\beta = \frac{c}{a} = -\frac{2}{3}$$

$$\alpha^3 + \beta^3 = (\alpha+\beta)(\alpha^2 - \alpha\cdot\beta + \beta^2)$$

$$= (\alpha+\beta)[(\alpha+\beta)^2 - 3\alpha\cdot\beta]$$

$$= \frac{5}{3}\left[\left(\frac{5}{3}\right)^2 - 3\times\left(-\frac{2}{3}\right)\right]$$

$$= \frac{125}{27} + 2\times\frac{5}{3}$$

$$= \frac{125+90}{27} = \frac{215}{27}$$

27. α and β are the zeroes of $4x^2 + 3x + 7$

$$\alpha + \beta = \frac{-\text{Coefficient of } x}{\text{Coefficient of } x^2} = -\frac{3}{4}$$

$$\alpha\cdot\beta = \frac{\text{Constant term}}{\text{Coefficient of } x^2} = \frac{7}{4}$$

$$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\cdot\beta} = \frac{-\frac{3}{4}}{\frac{7}{4}} = -\frac{3}{7}$$

28. Let $p(x) = x^2 + (a+1)x + b$

Given that, 2 and -3 are the zeroes of the quadratic polynomial $p(x)$

$\therefore \quad p(2) = 0$ and $p(-3) = 0$

$\Rightarrow \quad 2^2 + (a+1)(2) + b = 0$

$\Rightarrow \quad 4 + 2a + 2 + b = 0$

$\Rightarrow \quad 2a + b = -6 \quad \ldots(i)$

and $(-3)^2 + (a+1)(-3) + b = 0$

$\Rightarrow \quad 9 - 3a - 3 + b = 0$

$\Rightarrow \quad 3a - b = 6 \quad \ldots(ii)$

On adding Eqs. (i) and (ii), we get

$$5a = 0 \Rightarrow a = 0$$

Put the value of a in Eq. (i), we get

$$2\times 0 + b = -6$$

$\Rightarrow \quad b = -6$

So, the required values are $a = 0$ and $b = -6$

29. We have, $\alpha + \beta = -3$ and $\alpha - \beta = -10$ (assuming $\alpha < \beta$)

$\therefore \quad \alpha = -\frac{13}{2}$ and $\beta = \frac{7}{2}$

Now, $\quad \alpha^2 - \beta^2 = 30$

30. Let the zeroes of the quadratic polynomial are α and β

$\alpha + \beta = 8 \quad \ldots(i)$

and $\quad \alpha\cdot\beta = 12 \quad \ldots(ii)$

Substitute value of $\beta = 8 - \alpha$ in Eq. (ii)

$$\alpha(8-\alpha) = 12$$

$$\alpha^2 - 8\alpha + 12 = 0$$

$$\alpha^2 - 6\alpha - 2\alpha + 12 = 0$$

$$\alpha(\alpha-6) - 2(\alpha-6) = 0$$

$$\alpha = 6, \alpha = 2$$

If $\alpha = 6$, then $\beta = 2$

If $\alpha = 2$, then $\beta = 6$

Hence, the two zeroes are 2 and 6.

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31. m and n zeroes of $3x^2 + 11x - 4$,

$m + n = -\frac{11}{3}$, $m \cdot n = -\frac{4}{3}$

$\Rightarrow \quad \frac{m}{n} + \frac{n}{m} = \frac{m^2 + n^2}{m \cdot n} = \frac{(m+n)^2 - 2m \cdot n}{mn}$

$\Rightarrow \quad \frac{\left(\frac{-11}{3}\right)^2 - 2 \times \left(-\frac{4}{3}\right)}{-\frac{4}{3}} = -\frac{145}{12}$

32. Let the zeroes of the polynomial $3x^2 - 8x + 2k + 1$ be α, β

$\Rightarrow \quad \alpha + \beta = \frac{8}{3}$

We have, $\alpha = 7\beta$

$\Rightarrow \quad 7\beta + \beta = \frac{8}{3}$

$\Rightarrow \quad \beta = \frac{1}{3}$

$\Rightarrow \quad \alpha = \frac{7}{3}$ and $\beta = \frac{1}{3}$

$\alpha \cdot \beta = \frac{2k+1}{3}$

$\frac{7}{3} \times \frac{1}{3} = \frac{2k+1}{3}$

$2k = \frac{4}{3} \Rightarrow k = \frac{2}{3}$

33. Let α and β be the zeroes of $f(x)$.

Given, $\alpha^2 + \beta^2 = 20$

$(\alpha + \beta)^2 - 2\alpha\beta = 20 \quad \ldots(i)$

For the equation, $f(x) = x^2 - 4x + k$

$\alpha + \beta = 4$

$\alpha\beta = k$

Put these values in Eq. (i)

$\Rightarrow \quad (4)^2 - 2k = 20$

$\Rightarrow \quad 16 - 2k = 20$

$\Rightarrow \quad 2k = -4$

$\Rightarrow \quad k = -2$

34. Given, α and β are the zeroes of polynomial $x^2 - p(x+1) + c$ which can be written as $x^2 - px + c - p$.

So, sum of zeroes, $\alpha + \beta = p \quad \ldots(i)$

$\left[\because \text{sum of zeroes} = \frac{-\text{coefficient of } x}{\text{coefficient of } x^2}\right]$

and product of zeroes, $\alpha\beta = c - p \quad \ldots(ii)$

$\left[\because \text{product of zeroes} = \frac{\text{constant term}}{\text{coefficient of } x^2}\right]$

Also, $(\alpha + 1)(\beta + 1) = 0$ [given]

$\Rightarrow \quad \alpha\beta + (\alpha + \beta) + 1 = 0$

$\Rightarrow \quad c - p + p + 1 = 0$

[from Eqs. (i) and (ii)]

$\Rightarrow \quad c = -1$

35. Let α and β are the roots of given quadratic equation

$$x^2 - (k+6)x + 2(2k-1) = 0$$

Now, sum of roots $= \alpha + \beta$

$= -\left\{\frac{-(k+6)}{1}\right\} = k + 6$

Product of roots $= \alpha\beta = \frac{2(2k-1)}{1} = 2(2k-1)$

According to question,

Sum of roots (zeroes) $= \frac{1}{2} \times$ products of roots (zeroes)

$\Rightarrow \quad k + 6 = \frac{1}{2} \times 2(2k-1)$

$\Rightarrow \quad k + 6 = 2k - 1$

$\Rightarrow \quad 6 + 1 = 2k - k \Rightarrow k = 7$

36. Let α and β are the zeroes of the polynomial $f(x) = 4x^2 - 27x + 3k^2$

$$\alpha + \beta = \frac{27}{4}, \alpha \cdot \beta = \frac{3k^2}{4}$$

As sum of zeroes would be equal to product of zeroes

$\alpha + \beta = \alpha\beta$

$\frac{27}{4} = \frac{3k^2}{4}$

$k^2 = 9$

$k = \pm 3$

37. α and β are the zeroes of $f(x) = x^2 - 4x + 3$

We know that,

$$\alpha + \beta = -\frac{b}{a} = 4$$

and $\alpha \cdot \beta = \frac{c}{a} = 3$

$\Rightarrow \quad \alpha^4\beta^3 + \alpha^3\beta^4 = \alpha^3\beta^3(\alpha + \beta)$

$\Rightarrow \quad (\alpha\beta)^3(\alpha + \beta) = (3)^3(4)$

$= 4 \times 27 = 108$

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38. Let α and β are the zeroes of quadratic polynomial

$\therefore$ Sum of zeroes, $\alpha + \beta = -5$ and product of zeroes, $\alpha\beta = 6$ [given]

Now, required polynomial

$= x^2 -$ (sum of zeroes) $x +$ product of zeroes

$= x^2 - (-5)x + 6$

$= x^2 + 5x + 6$

39. Sum of zeroes $= 2\sqrt{7} + (-5\sqrt{7}) = -3\sqrt{7}$

Product of zeroes $= 2\sqrt{7} \times (-5\sqrt{7}) = -70$

The quadratic polynomial are

$x^2 -$ (sum of zeroes) $x +$ product of zeroes

$x^2 - (-3\sqrt{7})x - 70$

$= x^2 + 3\sqrt{7}x - 70$

40. Sum of zeroes $= 3 + \sqrt{2} + 3 - \sqrt{2} = 6$

Product of zeroes $= (3 + \sqrt{2})(3 - \sqrt{2})$

$= 9 - 2 = 7$

The quadratic polynomial is

$= x^2 -$ (sum of zeroes) $x +$ product of zeroes

$= x^2 - 6x + 7$

41. Given quadratic polynomial

$$f(x) = x^2 + x - 2$$

$\alpha + \beta = -1$ and $\alpha \cdot \beta = -2$

Sum of zeroes i.e., $(2\alpha + 1, 2\beta + 1)$

$= 2\alpha + 1 + 2\beta + 1$

$= 2(\alpha + \beta + 1)$

$= 2(-1 + 1) = 0$

Product of zeroes i.e., $(2\alpha + 1, 2\beta + 1)$

$= (2\alpha + 1)(2\beta + 1)$

$= 4\alpha\beta + 2(\alpha + \beta) + 1$

$= 4(-2) + 2(-1) + 1$

$= -8 - 2 + 1 = -9$

The quadratic polynomial whose zeroes are $(2\alpha + 1), (2\beta + 1)$ are

$= x^2 -$ (sum of zeroes) $x +$ product of zeroes

$= x^2 - 0 \times x + (-9) = x^2 - 9$

42. Let $p(x) = x^2 - 5$

For finding the zeroes of $p(x)$, put $p(x) = 0$.

$\therefore \quad x^2 - 5 = 0 \Rightarrow x = \pm 5$

Let $\alpha = 5$ and $\beta = -5$

Now, $1 + \alpha = 1 + 5 = 6$ and $1 + \beta = 1 - 5 = -4$

Thus, 6 and -4 are the zeroes of new quadratic polynomial.

Therefore the new quadratic polynomial is

$x^2 -$ (sum of zeroes) $x +$ product of zeroes

$\therefore$ Required polynomial

$= x^2 - [6 + (-4)]x + 6 \times (-4)$

$= x^2 - 2x - 24$

43. Let $f(x) = kx^2 + x + k$

For equal roots. Its discriminant should be zero i.e. $D = b^2 - 4ac = 0$

$\Rightarrow \quad 1 - 4k \cdot k = 0 \Rightarrow k = \pm \frac{1}{2}$

So, for two values of k, given quadratic polynomial has equal zeroes.

44. $p(x) = 5x^3 - 3x^2 + 7x + 2$

(A) $p(1) = 5 - 3 + 7 + 2 = 11$

(B) $p(0) = 5(0)^3 - 3(0)^2 + 7 \times 0 + 2 = 2$

(C) $p(5) = 5(5)^3 - 3(5)^2 + 7 \times 5 + 2$

$= 625 - 75 + 35 + 2 = 587$

(D) $p(-1) = 5(-1)^3 - 3(-1)^2 + 7 \times (-1) + 2$

$= -5 - 3 - 7 + 2 = -13$

(E) $p(-2) = 5(-2)^3 - 3(-2)^2 + 7 \times (-2) + 2$

$= -40 - 12 - 14 + 2 = -64$

45. $\alpha + \beta = -\left(-\frac{4}{2}\right) = 2$ and $\alpha \cdot \beta = \frac{5}{2}$

(A) $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\beta + \alpha}{\alpha \cdot \beta} = \frac{2 \times 2}{5} = \frac{4}{5}$

(B) $(\alpha - \beta)^2 = \alpha^2 + \beta^2 - 2\alpha \cdot \beta$

$= (\alpha + \beta)^2 - 4\alpha\beta$

$= (2)^2 - 4 \times \frac{5}{2}$

$= 4 - 10 = -6$

(C) $\frac{1}{\alpha^2} + \frac{1}{\beta^2} = \frac{\beta^2 + \alpha^2}{\alpha^2\beta^2}$

$= \frac{(\alpha + \beta)^2 - 2\alpha \cdot \beta}{(\alpha \cdot \beta)^2}$

$= \frac{(2)^2 - 2 \times \frac{5}{2}}{\left(\frac{5}{2}\right)^2}$

$= \frac{4 - 5}{\frac{25}{4}} = -\frac{4}{25}$

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(D) $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}=\frac{\alpha^2+\beta^2}{\alpha\cdot\beta}$

$$=\frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}$$

$$=\frac{(2)^2-2\times\frac{5}{2}}{\frac{5}{2}}$$

$$=\frac{4-5}{\frac{5}{2}}=\frac{-2}{5}$$

46. **Assertion** Consider the given polynomial x^2+4x+5

Because the degree of the polynomial is 2. It is a quadratic polynomial

We know that, the quadratic polynomial has atmost two zeroes

$\therefore x^2+4x+5$ has two zeroes

$\therefore$ Assertion is true

Reason Clearly, Reason is true

Hence, both Assertion and Reason are true and Reason is a correct explanation of Assertion

47. The expression is calculated by splitting the middle term

Let be $f(x)=\frac{3}{2}x^2-8x-\frac{35}{2}$

$$=\frac{1}{2}[3x^2-16x-35]$$

$$=\frac{1}{2}(3x^2-21x+5x-35]$$

$$=\frac{1}{2}[3x(x-7)+5(x-7)]$$

$$=\frac{1}{2}[(3x+5)(x-7)]$$

Assertion is true but Reason is false.

48. Let $\alpha=4$ and $\beta=3$

Then $\alpha+\beta=7$ and $\alpha\cdot\beta=12$

$\therefore$ Required polynomial $=x^2$

$$-(\alpha+\beta)x+\alpha\cdot\beta=x^2-7x-12$$

So, that Assertion is true.

Both the Assertion and Reason are true and Reason is a correct explanation of Assertion.

49. **Assertion** Given, $f(x)=x^2-4x-5$

Splitting the middle term

$$f(x)=x^2-5x+x-5$$

$$=x(x-5)+1(x-5)$$

$$=(x+1)(x-5)$$

$$f(x)=0$$

$$x=-1 \text{ and } x=5 \text{ (True)}$$

Reason We know that, the polynomial is

$x^2-(\alpha+\beta)x+\alpha\cdot\beta$

$x^2-(2+\sqrt{3}+2-\sqrt{3})x+(2+\sqrt{3})\cdot(2-\sqrt{3})$

$x^2-4x+(4-3)$

x^2-4x+1

Assertion is true and Reason is false

50. Let $f(x)=x^2+2x-15$

$\alpha+\beta=-2$

and $\alpha\cdot\beta=-15$

$$\frac{1}{\alpha}+\frac{1}{\beta}=\frac{\alpha+\beta}{\alpha\cdot\beta}$$

$$=\frac{-2}{-15}=\frac{2}{15}$$

Assertion is true.

Reason is true.

So, Assertion is true, Reason is true; Reason is a correct explanation of Assertion.

51. Let $\alpha, \frac{1}{\alpha}$ be the zeroes of $p(x)$, then

$$\alpha\cdot\frac{1}{\alpha}=\frac{4k}{k+18}$$

$$\Leftrightarrow \quad \frac{4k}{k+18}=1$$

$$4k=k+18$$

$$3k=18$$

$$k=6$$

Assertion is true, Reason is true, and Reason is not correct explanation for assertion

52. **Assertion** Let α, β be the zeroes of given polynomial x^2+px+q

$\therefore \quad \alpha-\beta=1 \quad \ldots(i)$

and $\quad \alpha+\beta=-p$

$\alpha\cdot\beta=q \quad \ldots(ii)$

from Eq. (i), squaring $(\alpha-\beta)^2=1$

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$\Rightarrow \quad (\alpha+\beta)^2 - 4\alpha\beta = 1$

$\Rightarrow \quad (-p)^2 - 4q = 1 \quad$ (using (ii))

$\Rightarrow \quad p^2 - 1 = 4q$

Reason Given, $p(x) = (x-a)(x-b) - c$

$= x^2 - (a+b)x + (ab - c)$

$\therefore \quad \alpha + \beta = -\dfrac{\{-(a+b)\}}{1} = a + b$

$\Rightarrow \quad a + b = \alpha + \beta \quad \ldots$(i)

$\{\because \alpha$ and β are zeroes of $p(x)\}$

and $\quad \alpha\beta = \dfrac{(ab-c)}{1} = ab - c$

$\Rightarrow \quad ab = \alpha\beta + c$

Now, family of polynomials having a and b as its zeroes is given by $k[x^2 - (a+b)x + ab]$

$= k[x^2 - (\alpha+\beta)x + (\alpha\beta + c)\}$

[Using Eqs. (i) and (ii)]

Now, Taking $k = 1$, the polynomial with a and b as its zeroes

$= x^2 - (\alpha+\beta)x + \alpha\beta + c$

$= (x-\alpha)(x-\beta) + c$

Assertion is the true, Reason is true but Reason is not a correct explanation for Assertion.

53. Let the roots are α and $-\alpha$

Sum of zero $= \dfrac{-\text{Coefficient of } x}{\text{Coefficient of } x^2}$

$\alpha + (-\alpha) = \dfrac{-4k}{k^2+4}$

$0 = 4k$

Thus, $k = 0$

Hence, Assertion is true but Reason is false.

54. Let $f(x) = 3x^2 + 11x - 4$

$= 3x^2 + 12x - x - 4$

$= 3x(x+4) - 1(x+4)$

$= (3x-1)(x+4)$

Let $\quad m = \dfrac{1}{3}$

and $\quad n = -4$

$12(m^2 + n^2) + 145mn$

$= 12\left(\dfrac{1}{9} + 16\right) + 145 \times \left(\dfrac{1}{3}\right) \times (-4)$

$= 12\left(\dfrac{1+144}{9}\right) - \dfrac{145 \times 4}{3}$

$= \dfrac{12 \times 145}{9} - \dfrac{145 \times 4}{3} = 0$

Given, α and β are roots of $ax^2 + by + c$

$\therefore \alpha + \beta = \dfrac{-b}{a}, \alpha\beta = \dfrac{c}{a}$

$\therefore \dfrac{\alpha}{\beta} + \dfrac{\beta}{\alpha} = \dfrac{\alpha^2+\beta^2}{\alpha\beta} = \dfrac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha\beta}$

$= \dfrac{(\alpha+\beta)^2}{\alpha\beta} - 2 = \dfrac{b^2}{ac} - 2$

Hence, Assertion is true but Reason is false.

55. Let $g(x) = x^2 + x - 12$

$= x^2 + 4x - 3x - 12$

$= x(x+4) - 3(x+4)$

$= (x-3)(x+4)$

$p(3) = 0 = p(-4)$

$p(3) = 3^3 + a(3)^2 + b(3) - 84 = 0$

$27 + 9a + 3b - 84 = 0$

$9a + 3b = 57 \quad \ldots$(i)

$p(-4) = (-4)^3 + a(-4)^2 + b(-4) - 84 = 0$

$\Rightarrow \quad -64 + 16a - 4b - 84 = 0$

$4a - b = 37$

$12a - 3b = 111 \quad \ldots$(ii)

Adding Eqs. (i) and (ii)

$21a = 168$

$a = 8$

Substitute $a = 8$ in Eq. (i)

$9 \times 8 + 3 \times b = 57$

$72 + 3b = 57$

$3b = -15$

$b = -5$

Hence, Assertion is false but Reason is true.

56. (i) Graph of a quadratic polynomial is parabolic in shape.

(ii) $(x^2 - 64)$ is expression of the polynomial represented because $A(-8, 0)$ and $B(8, 0)$ i.e. on this quadratic equation $(x^2 - 64)$.

(iii) Let $f(x) = x^2 - 64$

$f(8) = (8)^2 - 64 = 64 - 64 = 0$

(iv) Given, $x^2 - 2x - 4$

Sum of zeroes $= -b/a = \dfrac{-(-2)}{1} = 2$

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(v) Given, $ax^2 + 5x - 3a$

According to question,
Sum of zero = Product of zero

$$\frac{-5}{a} = \frac{-3a}{a}$$

$$\therefore \quad a = \frac{5}{3}$$

57. (i) In the standard form of quadratic polynomial $ax^2 + bx + c$; 'a' is a non-zero real number, and b and c are any real number.

(ii) In a quadratic polynomial, if roots are equal, then discriminant, $D = 0$.

(iii) Given, α and $\frac{1}{\alpha}$ are the zeroes of quadratic polynomial $2x^2 - x + 8k$.

Now, product of zeroes,

$$\alpha \times \frac{1}{\alpha} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$$

$$\Rightarrow \quad 1 = \frac{8k}{2}$$

$$\Rightarrow \quad k = \frac{2}{8} = \frac{1}{4}$$

(iv) Given equation is $x^2 + 1 = 0$.

$$x^2 = -1$$

It gives imaginary roots.

Hence, it is neither touches nor intersects X-axis.

(v) Given, sum of roots $= -p$

and product of roots $= -\frac{1}{p}$

$\therefore$ Quadratic polynomial

$$= k\,[x^2 - (\text{Sum of roots})\,x + \text{Product of roots}]$$

$$= k\left[x^2 - (-p)x + \left(-\frac{1}{p}\right)\right]$$

$$= k\left(x^2 + px - \frac{1}{p}\right)$$

58. (i) Given, $x^2 - 23x + 120 = p(x)$

Let α, β are the zeroes of $p(x)$

$$x^2 - 23x + 120 = 0$$

$$\Rightarrow x^2 - 15x - 8x + 120 = 0$$

$$\Rightarrow x(x - 15) - 8(x - 15) = 0$$

$$\Rightarrow \quad (x - 8)(x - 15) = 0$$

$$\Rightarrow \quad x = 8,\ x = 15$$

(ii) $\alpha + \beta + \alpha \cdot \beta$

(Sum of zeroes) + (Product of zeroes)

$= -(-23) + 120$

$= 23 + 120 = 143$

(iii) $p(x) = x^2 - 23x + 120$

$p(2) = (2)^2 - 23 \times 2 + 120$

$p(2) = 4 - 46 + 120 = 78$

(iv) Given, $x^2 + 3x - 10$

$$\alpha + \beta = -3,\ \alpha \cdot \beta = -10$$

$$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha \cdot \beta}$$

$$= \frac{-3}{-10} = \frac{3}{10}$$

(v) Given, $q(x) = kx^2 + 2x + 3k$

Sum of zeroes = equal to their product

$$\frac{-2}{k} = \frac{3k}{k}$$

$$k = -2/3$$

59. (i) The shape of given poses are parabolic.

(ii) The graph of parabola opens downwards, if $a < 0$.

(iii) In the given graph, we see that curve cut the X-axis at exactly one point.

Hence, number of zeroes in the given polynomial is 1.

(iv) The curve intersect X-axis at points $x = -2$ and $x = 4$.

Hence, two zeroes in the given graph are -2 and 4.

(v) Let $p(x) = 4\sqrt{3}x^2 + 5x - 2\sqrt{3}$

$$= 4\sqrt{3}x^2 + (8 - 3)x - 2\sqrt{3}$$

[by splitting middle term]

$$= 4\sqrt{3}\,x^2 + 8x - 3x - 2\sqrt{3}$$

$$= 4x(\sqrt{3}x + 2) - \sqrt{3}(\sqrt{3}x + 2)$$

$$= (4x - \sqrt{3})(\sqrt{3}x + 2)$$

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For finding the zeroes, put $p(x) = 0$

$\therefore \quad (4x - \sqrt{3})(\sqrt{3}x + 2) = 0$

$\Rightarrow \quad 4x - \sqrt{3} = 0$ and $\sqrt{3}x + 2 = 0$

$\Rightarrow \quad x = \frac{\sqrt{3}}{4}$ and $x = -\frac{2}{\sqrt{3}}$

60. (i) Point $A(-7, 0)$ and $B(10, 0)$ lies on this parabolic shape graph.

Its mean -7 and 10 are zeroes of the polynomial $(x + 7)(x - 10)$

(ii) $(x + 7)(x - 10)$

$\Rightarrow \quad x^2 + 7x - 10x - 70 \Rightarrow x^2 - 3x - 70$

(iii) Product of zeroes $= c / a$

Given, $(x^2 - 3x - 70)$

Product of zeroes $= -70$

(iv) Let be, $f(x) = 9x^2 - 5$

$f(x) = 0$

$9x^2 - 5 = 0$

$x^2 = 5/9$

$x = \pm\sqrt{5/9} = \pm\sqrt{5}/3$

(v) Given, $f(x) = x^2 - 13x + 1$

$f(3) = (3)^2 - 13 \times 3 + 1$

$f(3) = 9 + 1 - 39 = -29$

61. (i) The shape of the path traced shown in the given figure is the form of parabola.

(ii) The graph of parabola opens downwards, if $a < 0$.

(iii) In the given graph, we see that curve intersect the X-axis at three points. Hence, number of zeroes in the given polynomial are 3.

(iv) The given curve intersect the X-axis at points $x = -3, -1$ and 2.

Hence, three zeroes in thze given graph are $-3, -1, 2$.

(v) Since, given polynomial has three zeroes.

So, it will be a cubic polynomial.

Now, sum of zeroes $= -3 - 1 + 2 = -2$

Sum of product of two zeroes at a time

$= -3 \times (-1) + (-1) \times 2 + 2 \times (-3)$

$= 3 - 2 - 6$

$= -5$

and product of all zeroes $= -3 \times -1 \times 2 = 6$

$\therefore$ Required cubic polynomial

$= x^3 -$ (Sum of zeroes) x^2

$+$ (Sum of product of two zeroes at a time) $x -$ (Product of three zeroes)

$= x^3 - (-2)\, x^2 + (-5)x - (6)$

$= x^3 + 2x^2 - 5x - 6$

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03

Pair of Linear Equations in Two Variables

Quick Revision

Two linear equations in the same two variables, say x and y, are called pair of linear equations (or system of pair equations) in two variables.

The general form of pair of linear equations in two variables x and y is

$$a_1 x + b_1 y + c_1 = 0$$

and $$a_2 x + b_2 y + c_2 = 0,$$

where a_1, b_1, c_1 and a_2, b_2, c_2 are all real numbers and $a_1^2 + b_1^2 \neq 0,\ a_2^2 + b_2^2 \neq 0$.

Solution of a Pair of Linear Equations in Two Variables

Any pair of values of x and y which satisfies both the equations, $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, is called a solution of a given pair of linear equations.

Solution of a Pair of Linear Equations by Graphical Method

Let us consider a pair of linear equations in two variables, $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$.

To find the solution graphically, there are three cases arise

***Case* I** When the graph of system of linear equations will represent two intersecting lines, then coordinates of point of intersection say (a, b) is the solution of the pair of linear equations. This is called **consistent** pair of linear equations.

***Case* II** When the graph of system of linear equations will represent two parallel lines, then there is no point of intersection and consequently there is no pair of values of x and y which satisfy both equations. Thus, given system of equations have **no solution**. This is called **inconsistent** pair of linear equations.

***Case* III** When the graph of system of linear equations will represent coincident or overlapping lines, there are infinitely many common points. Thus, the given system of equations have **infinitely many solutions**.

Such pair of linear equations is called **dependent pair** of linear equations and it is always **consistent**.

Nature of Lines and Consistency

The nature of lines and consistency corresponding to linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, is shown in the table given below

Compare the ratios	Graphical representation	Algebraic interpretation	Consistency
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Intersecting lines	Exactly one solution (unique)	System is consistent
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Coincident lines	Infinitely many solutions	System is consistent (dependent)
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	Parallel lines	No solution	System is inconsistent

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Algebraic Methods for Solving a Pair of Linear Equations

There are three methods for solving a pair of linear equations

1. Substitution Method

In this method, value of one variable can be found out in terms of other variable from one of the given equation and this value is substituted in other equation, then we get an equation in one variable, which can be solved easily.

2. Elimination Method

In this method, one variable out of the two variables is eliminated by making the coefficients of that variable equal in both the equations.

After eliminating that variable, the left equation is an equation in another variable, which can be solved easily.

Value of one variable obtained in this way can be substituted in any one of the two equations to find the value of other variable.

Equations Reducible to a Pair of Linear Equations

Sometimes, equations are not linear but they can be reduced to a pair of linear equations by making some suitable substitutions.

(i) If the given equations involve $\frac{1}{x}$ and $\frac{1}{y}$, then put $\frac{1}{x} = p$ and $\frac{1}{y} = q$ to convert into linear form.

(ii) If the given equations involve $\frac{1}{x \pm a}$ and $\frac{1}{y \pm b}$, then put $\frac{1}{x \pm a} = p$ and $\frac{1}{y \pm b} = q$ to convert into linear form.

(iii) If the given equations involve $\frac{1}{x+y}$ and $\frac{1}{x-y}$, then put $\frac{1}{x+y} = p$ and $\frac{1}{x-y} = q$ to convert into linear form.

Some Important Points

(i) Suppose present age of one person as x years and of the other as y years. Then, 'a' years ago, age of 1st person was $(x-a)$ years and 2nd person was $(y-a)$ years. After 'b' years, age of 1st person will be $(x+b)$ years and 2nd person will be $(y+b)$ years.

(ii) Suppose the fare of a full ticket may be taken as ₹ x and the reservation charges may be taken as ₹ y, so that 1 full fare = ₹ $(x+y)$ and 1 half fare = ₹ $\left(\frac{x}{2}+y\right)$.

(iii) Two digit number $= 10x + y$, where x and y are respectively the ten and unit digit. On interchanging the position of digits, new number becomes $10y + x$.

(iv) Let the numerator of the fraction be x and denominator be y. Then, the fraction is x/y.

(v) Speed $= \frac{\text{Distance}}{\text{Time}}$

(vi) Let the speed of boat in still water be x km/h and speed of stream be y km/h. Then, the speed of boat downstream $= (x+y)$ km/h and speed of boat upstream $= (x-y)$ km/h.

(vii) If a person can do a piece of work in n days, then he will do $1/n$ of the work in one day and *vice-versa*.

(viii) (a) Sum of angles of a triangle is 180°.

(b) Opposite angles of a parallelogram are equal.

(c) In parallelogram, sum of adjacent angles is 180°.

(d) In cyclic quadrilateral, sum of opposite angles is 180°.

(e) Area of rectangle = Length × Breadth, Perimeter of rectangle = 2 (Length + Breadth)

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Objective Questions

Multiple Choice Questions

1. The pair of equations $y = 0$ and $y = -7$ has *[NCERT Exemplar]*
(a) one solution
(b) two solutions
(c) infinitely many solutions
(d) no solution

2. The pair of equations $x = a$ and $y = b$ graphically represents lines which are *[NCERT Exemplar]*
(a) parallel
(b) intersecting at (b, a)
(c) coincident
(d) intersecting at (a, b)

3. Akhila went to a fair in her village. She wanted to enjoy rides on the giant wheel and play hoopla. If each ride costs ₹ 3 and a game of hoopla costs ₹ 4, then she spent ₹ 20. The linear equation to represent this condition is
(a) $3x + 4y = 27$ (b) $4x + 3y = 5$
(c) $3x + 4y = 20$ (d) None of these

4. A fraction becomes $\frac{4}{5}$, if 2 is added to both numerator and denominator, if however 4 is subtracted from both numerator and denominator, then the fraction becomes $\frac{1}{2}$. The algebraical representation of situation is
(a) $5x - 4y + 2 = 0, x - y = 0$
(b) $5x - 4y + 2 = 0, 2x - y - 4 = 0$
(c) $x + 4y = 0, y + 2x = 0$
(d) None of the above

5. Romila went to a stationary stall and purchased 2 pencils and 3 erasers for ₹9. Her friend Sonali saw the new variety of pencils and erasers with Romila, and she also bought 4 pencils and 6 erasers of the same kind for ₹18. The algebraic representation of situation is
(a) $2x + 3y = 9, 3x + 5y = 18$
(b) $2x + 4y = 8, 4x + 6y = 18$
(c) $2x + 3y = 9, 4x + 6y = 18$
(d) None of the above

6. $3x - y = 3, 9x - 3y = 9$ has infinite solution.
(a) True
(b) False
(c) Cannot say
(d) Partially true/false

7. The number of common solutions for the system of linear equations $5x + 4y + 6 = 0$ and $10x + 8y = 12$ is ..... .
(a) 0 (b) 1
(c) 2 (d) None of these

8. On comparing the ratios $a_1 / a_2, b_1 / b_2$ and c_1/c_2 and without drawing them, the pair of linear equation is $3x - 5y + 8 = 0, 7x + 6y - 9 = 0$
(a) parallel
(b) intersecting
(c) coincident
(d) None of the above

9. If a pair of linear equations is consistent, then the lines will be *[NCERT Exemplar]*
(a) parallel
(b) always coincident
(c) intersecting or coincident
(d) always intersecting

10. If a pair of linear equations is given by $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ and $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$. In this case, the pair of linear equations is consistent.
(a) True
(b) False
(c) Cannot say
(d) Partially true/false

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11. If the lines intersect at a point, then that point gives the unique solution of the two equations. In this case, the pair of equations is ..... .

(a) Consistent (b) Cannot say
(c) Inconsistent (d) None of these

12. If the lines are parallel, then the pair of equations has no solution. In this case, the pair of equations is ..... .

(a) Consistent (b) Inconsistent
(c) Cannot say (d) None of these

13. Which of the following pair of equations are inconsistent?

(a) $3x-y=9,\ x-\frac{y}{3}=3$
(b) $4x+3y=24,\ -2x+3y=6$
(c) $5x-y=10,\ 10x-2y=20$
(d) $-2x+y=3,\ -4x+2y=10$

14. The pair of linear equations are $4x-5y-12=0, 10y+20=8x$

(a) consistent (b) inconsistent
(c) can't say (d) None of these

15. A pair of linear equations which has a unique solution $x=2$ and $y=-3$ is *[NCERT Exemplar]*

(a) $x+y=1$ and $2x-3y=-5$
(b) $2x+5y=-11$ and $4x+10y=-22$
(c) $2x-y=1$ and $3x+2y=0$
(d) $x-4y-14=0$ and $5x-y-13=0$

16. The pair of equations $x+2y+5=0$ and $-3x-6y+1=0$ has

(a) a unique solution
(b) exactly two solutions
(c) infinitely many solutions
(d) no solution

17. One equation of a pair of dependent linear equations is $-5x+7y-2=0$. The second equation can be *[NCERT Exemplar]*

(a) $10x+14y+4=0$ (b) $-10x-14y+4=0$
(c) $-10x+14y+4=0$ (d) $10x-14y+4=0$

18. If the lines given by $2x+ky=1$ and $3x-5y=7$ has unique solution, then the value of k is

(a) $-10/3$
(b) $-5/3$
(c) $2/3$
(d) for all real value except $\frac{-10}{3}$

19. The value of k for which the system of linear equations $x+2y=3$, $5x+ky+7=0$ is inconsistent is *[CBSE 2020]*

(a) $-\frac{14}{3}$ (b) $\frac{2}{5}$
(c) 5 (d) 10

20. The value of 'k' for which the system of equations $kx-5y=2$; $6x+2y=7$ has no solution is

(a) -15
(b) $\frac{-5}{2}$
(c) $\frac{2}{7}$
(d) None of the above

21. For what value of k, will the following pair of linear equations have infinitely many solutions?

$$2x+3y=4 \text{ and } (k+2)x+6y=3k+2$$

(a) 1 (b) 2
(c) 3 (d) 4

22. If the lines given by $3x+2ky=2$ and $2x+5y=1$ are parallel, then the value of k is *[NCERT Exemplar]*

(a) $-\frac{5}{4}$ (b) $\frac{2}{5}$
(c) $\frac{15}{4}$ (d) $\frac{3}{2}$

23. For what value of p, will the following system of linear equations represent parallel lines?

$$-x+py=1 \text{ and } px-y=1$$

(a) 2 (b) 3
(c) 1 (d) None of these

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24. The value of a for which the lines $x = 1$, $y = 2$ and $a^2x + 2y - 20 = 0$ are concurrent, is
(a) 1 (b) 8
(c) -4 (d) -2

25. The value of x and y for the following system of equations $x + 8y = 19$ and $2x + 11y = 28$, (by substitution method) is
(a) 3, 2 (b) 2, 3
(c) 6, 3 (d) 3, 4

26. Solve the following system of linear equations
$$ax + by - a + b = 0$$
and $$bx - ay - a - b = 0.$$
The value of x and y are
(a) 1, –1 (b) –1,1
(c) 1, 0 (d) 0, 2

27. The difference between two numbers is 26 and one number is three times the other number. The numbers are
(a) 39 and 26 (b) 39 and 41
(c) 39 and 13 (d) None of these

28. Two numbers are in the ratio 5 : 6. If 8 is subtracted from each of the numbers, the ratio becomes 4 : 5, then the numbers are ..... and ..... .
(a) 48, 20 (b) 40, 28
(c) 40, 48 (d) 20, 24

29. Using elimination method, all the possible solutions of the following pair of linear equations is
$2x + 3y = 8$ and $4x + 6y = 7$
(a) Consistent (b) $x = 2, y = 3$
(c) No solution (d) All real values

30. Find the values of x and y in the following equations.
$$x - 3y = 8 \text{ and } 5x + 3y = 10$$
(a) $x = 3, y = -\frac{5}{3}$ (b) $x = -3, y = \frac{5}{3}$
(c) $x = -3, y = \frac{-5}{3}$ (d) None of these

31. The values of x and y for the following pair of linear
$41x + 53y = 135$ and $53x + 41y = 147$.
(a) $x = 2, y = 3$ (b) $x = 1, y = 2$
(c) $x = 3, y = 2$ (d) $x = 2, y = 1$

32. If $2x + 3y = 5$ and $3x + 2y = 10$, then $x - y =$ ..... .
(a) 3 (b) 4
(c) 5 (d) 6

33. If $x = a$ and $y = b$ is the solution of the equations $x - y = 2$ and $x + y = 4$, then the values of a and b are 3 and 2, respectively
(a) True (b) False
(c) Cannot say (d) Partially true/false

34. The pair of equations
$3^{x+y} = 81, 81^{x-y} = 3$ has
(a) no solution
(b) unique solution
(c) infinitely many solutions
(d) $x = 2\frac{1}{8}, y = 1\frac{7}{8}$

35. If the angles of a triangle are x, y and $40°$ and the difference between the two angles x and y is $30°$. Then, the value of x and y is $85°$ and $55°$ respectively.
(a) True (b) False
(c) Can't say (d) Partially true/false

36. The sum of a two-digit number and the number formed by interchanging its digits is 110. If 10 is subtracted from the first number, the new number is 4 more than 5 times the sum of the digits in the first number. Then, the first number is 64.
(a) True (b) False
(c) Cannot say (d) Partially true/false

37. The area of a rectangle increases by 76 sq units, if the length and breadth is increased by 2 units. However, if the length is increased by

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3 units and breadth is decreased by 3 units, the area of sets reduced by 21 sq units. Find the breadth of the rectangle.

(a) 9 units (b) 16 units
(c) 18 units (d) 21 units

38. A fraction becomes 4/5 when 1 is added to each of the numerator and denominator. However, if we subtract 5 from each of them, it becomes 1/2. Then, numerator of the fraction is

(a) 6 (b) 7
(c) 8 (d) 9

39. Six years hence, a man's age will be three times the age of his son and three years ago he was nine times as old as his son. The present age of the man is

(a) 28 (b) 30
(c) 32 (d) 34

40. Aruna has only ₹ 1 and ₹ 2 coins with her. If the total number of coins that she has is 50 and the amount of money with her is ₹ 75, then the number of ₹ 1 and ₹ 2 coins is

(a) 24, 24 (b) 25, 25
(c) 26, 26 (d) None of these

41. From a bus stand in Delhi, if we buy 2 tickets to Pitampura and 3 tickets to Dilshad Garden, the total cost is ₹ 46 but if we buy 3 tickets to Pitampura and 5 tickets to Dilshad Garden, the total cost is ₹ 74. Then, the fares from the bus stand to Pitampura and to Dilshad Garden is

(a) ₹ 8; ₹ 100 (b) ₹ 10, ₹ 8
(c) ₹ 8; ₹ 10 (d) ₹ 20, ₹ 5

42. The value of x and y of the following pair of equation is

$$\frac{2}{x}+\frac{3}{y}=13\,;\ \frac{5}{x}-\frac{4}{y}=-2$$

(a) $x=2, y=3$ (b) $x=\frac{1}{3}, y=\frac{1}{2}$
(c) $x=\frac{1}{2}, y=\frac{1}{3}$ (d) $x=3, y=2$

43. The value of x and y of the following pairs of equations by reducing them to a pair of linear equations is

$$\frac{2}{\sqrt{x}}+\frac{3}{\sqrt{y}}=2;\ \frac{4}{\sqrt{x}}-\frac{9}{\sqrt{y}}=-1$$

(a) $x=4, y=9$
(b) $x=2, y=3$
(c) $x=8, y=18$
(d) None of the above

44. The values of x and y in the pair of equation $x+4y=27xy$, $x+2y-21xy$ is

(a) $x=3, y=15$ (b) $x=15, y=3$
(c) $x=\frac{1}{15}, y=\frac{1}{3}$ (d) $x=\frac{1}{3}, y=\frac{1}{15}$

45. The value of x and y in $\frac{5}{x+1}-\frac{2}{y-1}=\frac{1}{2}; \frac{10}{x+1}+\frac{2}{y-1}=\frac{5}{2}$, where $x\neq-1$ and $y\neq1$, is

(a) $x=4, y=5$ (b) $x=5, y=4$
(c) $x=\frac{1}{4}, y=\frac{1}{5}$ (d) None of these

46. A train covered a certain distance at a uniform speed. If the train would have been 10 km/h faster, it would have taken 2 h less than the scheduled time and if the train was slower by 10 km/h, it would have taken 3 h more than the scheduled time. Then, the distance covered by the train is

(a) 50 km (b) 300 km
(c) 600 km (d) 12 km

47. The ratio of incomes of two persons is 9 : 7 and the ratio of their expenditures is 4 : 3. If each of them manages to save ₹ 2000 per month, then find their monthly incomes. Form a pair of linear equations from the above data and by elimination method, the value of monthly incomes are

(a) 18000, 14000
(b) 20000, 12000
(c) 22000, 10000
(d) None of the above

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48. A boatman rows his boat 35 km upstream and 55 km downstream in 12 h. He can row 30 km upstream and 44 km downstream in 10 h, then the speed of the boat in still water is

(a) 8 km/h (b) 3 km/h
(c) 5 km/h (d) 11 km/h

49. Match the Column

	Column I		Column II
A.	$2x + 3y = 40$ $6x + 5y = 10$	1.	Coincident lines
B.	$2x + 3y = 40$ $6x + 9y = 50$	2.	Intersecting lines
C.	$2x + 3y = 10$ $4x + 6y = 20$	3.	Parallel lines

Codes

	A	B	C		A	B	C
(a)	1	2	3	(b)	3	2	1
(c)	2	3	1	(d)	1	3	2

50. Column-II give value of x and y for pair of equation given in Column-II.

	Column I		Column II
A.	$2x + y = 8$, $x + 6y = 15$	(p)	(3, 4)
B.	$5x + 3y = 35$, $2x + 4y = 28$	(q)	(4, 5)
C.	$15x + 4y = 61$ $4x + 15y = 72$	(r)	(3, 2)

Codes

	A	B	C		A	B	C
(a)	r	p	q	(b)	p	r	q
(c)	r	q	p	(d)	None of these		

Assertion-Reasoning MCQs

Directions (Q. Nos. 46-54) Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) A is true, R is true; R is a correct explanation for A.
(b) A is true, R is true; R is not a correct explanation for A.
(c) A is true; R is False.
(d) A is false; R is true.

51. **Assertion (A)** $4x + 3y = 18$ is a line which is parallel to X-axis.

Reason (R) The graph of linear equation $ax = b$, where $a \neq 0$ is parallel to Y-axis.

52. **Assertion (A)** The value of $q = \pm 2$, if $x = 3$, $y = 1$ is the solution of the line $2x + y - q^2 - 3 = 0$.

Reason (R) The solution of the line will satisfy the equation of the line.

53. **Assertion (A)** The graphical representation of $x + 2y - 4 = 0$ and $2x + 4y - 12 = 0$ will be a pair of parallel lines.

Reason (R) Let $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ be two linear equations and if $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, then the pair of equations represent parallel lines and they have no solution.

54. **Assertion (A)** The graphical representation of $2x + y = 6$ and $2x - y + 2 = 0$ will be a pair of parallel lines.

Reason (R) When $k = -1$, then linear equations $5x + ky = 4$ and $15x + 3y = 12$ have infinitely many solutions.

55. **Assertion (A)** The value of k for which the system of equations $kx - y = 2$, $6x - 2y = 3$ has a unique solution is 3.

Reason (R) The system of linear equations

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

has a unique solutions, if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

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56. **Assertion (A)** Pair of linear equations : $9x + 3y + 12 = 0, 18x + 6y + 24 = 0$ have infinitely many solutions.

Reason (R) Pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ have infinitely many solutions, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

57. **Assertion (A)** If the system of equations $2x + 3y = 7$ and $2ax + (a + b)y = 28$ has infinitely many solutions, then $2a - b = 0$.

Reason (R) The system of equations $3x - 5y = 9$ and $6x - 10y = 8$ has a unique solution.

58. **Assertion (A)** When $k = -4$, then linear equations $x + (k + 1) = 5$, $(k + 1)x + 9y = 8k - 1$ have infinitely many solutions.

Reason (R) $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ have infinitely many solutions, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

59. **Assertion (A)** $x + y - 4 = 0$ and $2x + ky - 3 = 0$ has no solution if $k = 2$.

Reason (R) $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are consistent, if $\frac{a_1}{a_2} \neq \frac{k_1}{k_2}$.

60. **Assertion (A)** A two-digit number is obtained by either multiplying sum of the digits by 8 and adding 1 or by multiplying the difference of digits by 13 and adding 2. The number is 41.

Reason (R) The linear equations used are $7x - 2y + 1 = 0$ and $12x - 23y + 2 = 0$.

Case Based MCQs

61. From Rajiv Chowk Metro Station, if Charu buys 4 tickets to Karol Bagh and 6 tickets to Hauz Khas, then total cost is ₹ 92, but if she buys 6 tickets to Karol Bagh and 10 tickets to Hauz Khas, then total cost is ₹ 148.

Consider the fares from Rajiv Chowk to Karol bagh and that to hauz Khas as ₹ x and ₹ y respectively and answer the following questions.

(i) Ist situation can be represented algebraically as

(a) $3x - 5y = 74$
(b) $2x + 5y = 74$
(c) $2x - 3y = 46$
(d) $2x + 3y = 46$

(ii) 2nd situation can be represented algebraically as

(a) $5x + 3y = 74$ (b) $5x - 3y = 74$
(c) $3x + 5y = 74$ (d) $3x - 5y = 74$

(iii) Fare from Rajiv Chowk to Karol Bagh is

(a) ₹ 6 (b) ₹ 8
(c) ₹ 10 (d) ₹ 2

(iv) Fare from Rajiv Chowk to Hauz Khas

(a) ₹ 10 (b) ₹ 12
(c) ₹ 14 (d) ₹ 16

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(v) The system of linear equations represented by both situation has
(a) infinitely many solutions
(b) no solution
(c) unique solution
(d) None of the above

62. A test consists of 'True' or 'False' questions. One mark is awarded for every correct answer while $\frac{1}{4}$ mark is deducted for every wrong answer.
A student knew answers to some of the questions. Rest of the questions he attempted by guessing. He answered 120 questions and got 90 marks.

Type of question	Marks given for correct answer	Marks deducted for wrong answer
True/False	1	0.25

[CBSE Question Bank]

(i) If answer to all questions he attempted by guessing were wrong, then how many questions did he answer correctly?
(a) 96 (b) 92
(c) 90 (d) None of these

(ii) How many questions did he guess?
(a) 20 (b) 22
(c) 24 (d) 26

(iii) If answer to all questions he attempted by guessing were wrong and answered 80 correctly, then how many marks he got?
(a) 40 (b) 80
(c) 75 (d) 70

(iv) If answer to all questions he attempted by guessing were wrong, then how many questions answered correctly to score 95 marks?
(a) 95 (b) 100
(c) 120 (d) 80

(v) If answer to all questions he attempted by giving were wrong and answered 90 correctly, then how many marks he got?
(a) 90 (b) 100
(c) 95 (d) 80

63. Mr Jayant sahu arranged dinner party for some of his friends. The expenses of the dinner are partly constant and partly proportional to the number of guests. The expenses amount to ₹ 450 for 5 guest and ₹ 850 for 10 guests.

Denote the constant expense by ₹ x and proportional expense per person by ₹ y and answer the following questions.

(i) Represent both the situations algebraically
(a) $x+5y=850,\ x+10y=450$
(b) $x-5y=850,\ x-10y=450$
(c) $x+5y=450,\ x+10y=850$
(d) None of the above

(ii) Proportional expense for each person is
(a) ₹ 50 (b) ₹ 80
(c) ₹ 90 (d) ₹ 100

(iii) The fixed (or constant) expense for the party is
(a) ₹ 50 (b) ₹ 80
(c) ₹ 90 (d) ₹ 100

(iv) If there would be 12 guests at the dinner party, then what amount Mr Jayant has to pay?
(a) ₹ 1500 (b) ₹ 1300
(c) ₹ 1200 (d) ₹ 1010

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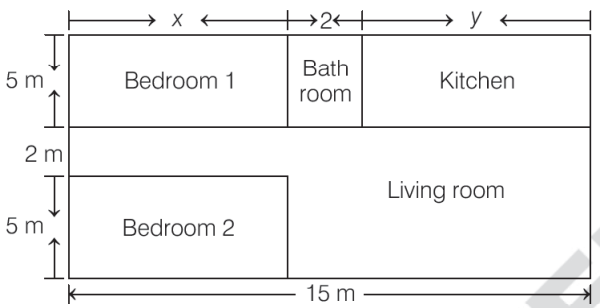
(v) The system of linear equations representing both the situations will have

(a) unique solution
(b) no solution
(c) infinitely many solutions
(d) None of the above

64. Amit is planning to buy a house and the layout is given below. The design and the measurement has been made such that areas of two bedrooms and kitchen together is 95 sq m.



[CBSE Question Bank]

Based on the above information, answer the following questions:

(i) Form the pair of linear equations in two variables from this situation.

(a) $2x + y = 19, x - y = 13$
(b) $2x + y = 19, x + y = 13$
(c) $2x - y = 13, x + y = 19$
(d) $2x - y = 19, x + y = 13$

(ii) Find the length of the outer boundary of the layout.

(a) 27 m (b) 30 m
(c) 54 m (d) None of these

(iii) Find the area of each bedroom and kitchen in the layout.

(a) 35 m^2, 15 m^2 (b) 27 m^2, 30 m^2
(c) 40 m^2, 30 m^2 (d) 30 m^2, 35 m^2

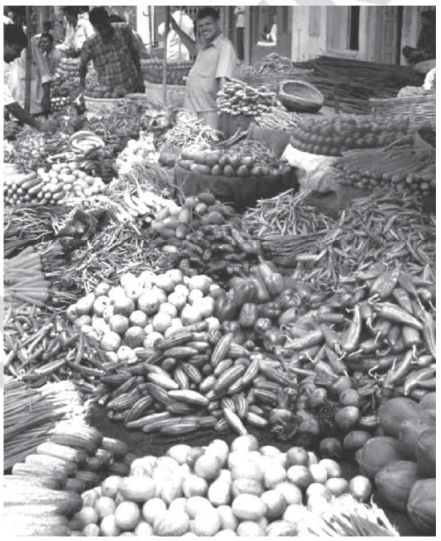
(iv) Find the area of living room in the layout.

(a) 75 m^2 (b) 65 m^2
(c) 72 m^2 (d) None of these

(v) Find the cost of laying tiles in kitchen at the rate of ₹ 50 per sq m.

(a) 1600 (b) 1525
(c) 1750 (d) 1250

65. Shivam usually go to a Vegetable shop with his mother. He observes the following two situations.



On 1st day : The cost of 4 kg of onion and 2 kg of tomato was ₹ 3200.

On 2nd day : The cost of 8 kg of onion and 4 kg of tomato was ₹ 6000.

Denoting the cost of 1 kg onion by ₹ x and cost of 1 kg tomato by ₹ y and answer the following questions.

(i) Represent algebraically the situation of day-I.

(a) $x + 2y = 1500$ (b) $2x + y = 1600$
(c) $x - 2y = 1500$ (d) None of these

(ii) Represent algebraically the situation of day-II.

(a) $2x + y = 1500$ (b) $2x - y = 1500$
(c) $x + 2y = 1500$ (d) $2x + y = 750$

(iii) The linear equation represented by day-I, intersect the X-axis at

(a) (0, 800) (b) (0, −800)
(c) (800, 0) (d) (−800, 0)

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(iv) The linear equation represented by day-II, intersect the Y-axis at

(a) (1500, 0) (b) (0, –1500)
(c) (–1500, 0) (d) (0, 1500)

(v) Linear equations represented by day-I and day-II situations, are

(a) non-parallel
(b) parallel
(c) intersect at one point
(d) overlapping each other

66. It is common that Governments revise travel fares from time to time based on various factors such as inflation (a general increase in prices and fall in the purchasing value of money) on different types of vehicles like auto, Rickshaws, taxis, Radio cab etc. The auto charges in a city comprise of a fixed charge together with the charge for the distance covered. Study the following situations.

Name of the city	Distance travelled (km)	Amount paid (in ₹)
City A	10	75
	15	110
City B	8	91
	14	145

Situation 1 In city A, for a journey of 10 km, the charge paid is ₹ 75 and for a journey of 15 km, the charge paid is ₹ 110.

Situation 2 In a city B, for a journey of 8 km, the charge paid is ₹ 91 and for a journey of 14 km, the charge paid is ₹ 145. ***[CBSE Question Bank]***

Refer situation 1

(i) If the fixed charges of auto rickshaw be ₹ x and the running charges be ₹ y km/h, the pair of linear equations representing the situation is

(a) $x + 10y = 110, x + 15y = 75$
(b) $x + 10y = 75, x + 15y = 110$
(c) $10x + y = 110, 15x + y = 75$
(d) $10x + y = 75, 15x + y = 110$

(ii) A person travels a distance of 50 km. The amount he has to pay is

(a) ₹ 155 (b) ₹ 255
(c) ₹ 355 (d) ₹ 455

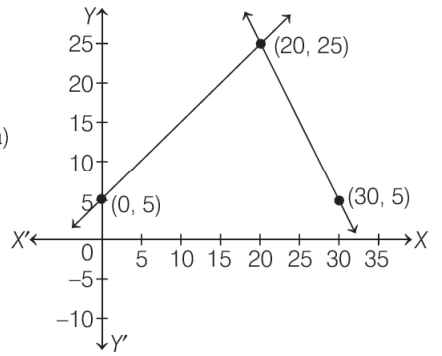
Refer situation 2

(iii) What will a person have to pay for travelling a distance of 30 km ?

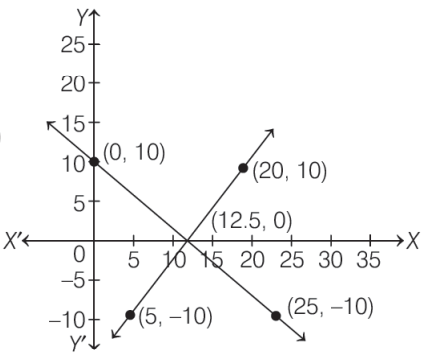
(a) ₹ 185 (b) ₹ 289
(c) ₹ 275 (d) ₹ 305

(iv) The graph of lines representing the conditions are: (situation 2)

(a)



(b)



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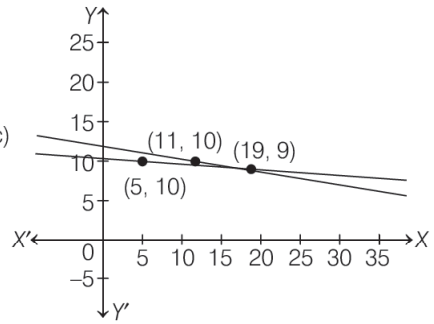
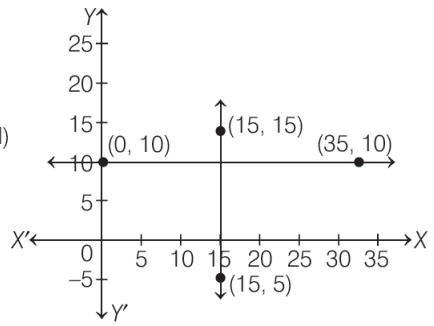
(c)



(d)



(v) The lines representing the conditions situation 2 are

(a) Parallel lines

(b) Intersecting lines

(c) Coincident lines

(d) None of the above

ANSWERS

Multiple Choice Questions

1. (d)	2. (d)	3. (c)	4. (b)	5. (c)	6. (a)	7. (a)	8. (b)	9. (c)	10. (b)
11. (a)	12. (b)	13. (d)	14. (b)	15. (b)	16. (d)	17. (d)	18. (d)	19. (d)	20. (a)
21. (b)	22. (c)	23. (c)	24. (c)	25. (a)	26. (a)	27. (c)	28. (c)	29. (c)	30. (a)
31. (d)	32. (c)	33. (b)	34. (d)	35. (a)	36. (a)	37. (b)	38. (b)	39. (b)	40. (b)
41. (c)	42. (c)	43. (a)	44. (d)	45. (a)	46. (c)	47. (a)	48. (a)	49. (c)	50. (c)

Assertion-Reasoning MCQs

51. (d)	52. (a)	53. (a)	54. (d)	55. (d)	56. (a)	57. (c)	58. (d)	59. (b)	60. (c)

Case Based MCQs

61. (i) (d) (ii) (c) (iii) (b) (iv) (a) (v) (c)

62. (i) (a) (ii) (c) (iii) (d) (iv) (b) (v) (c)

63. (i) (c) (ii) (b) (iii) (a) (iv) (d) (v) (a)

64. (i) (b) (ii) (c) (iii) (d) (iv) (a) (v) (c)

65. (i) (b) (ii) (a) (iii) (c) (iv) (d) (v) (b)

66. (i) (b) (ii) (c) (iii) (b) (iv) (c) (v) (b)

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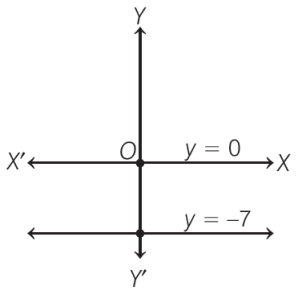
SOLUTIONS

1. The given pair of equations are $y = 0$ and $y = -7$.

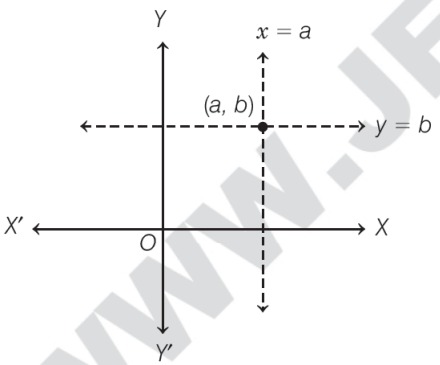


By graphically, both lines are parallel and having no solution.

2. By graphically in every condition, if $a, b > 0$; $a, b < 0$, $a > 0, b < 0$; $a < 0, b > 0$ but $a = b \neq 0$.

The pair of equations $x = a$ and $y = b$ graphically represents lines which are intersecting at (a, b).

If $a, b > 0$



Similarly, in all cases two lines intersect at (a, b).

3. First, identify the variable quantities and let these be x and y.

Let number of rides = x

and number of hoopla games played by her = y

Cost of 'x' rides = ₹ $3x$

Cost of 'y' hoopla games = ₹ $4y$

Total money spent = ₹ 20

Then, we write the given condition in terms of x and y.

Let the equation be $ax + by + c = 0$.

$\therefore$ Equation is $3x + 4y = 20$

4. Let the numerator of the fraction be x and denominator be y.

Then, the fraction is $\frac{x}{y}$. Now, according to condition I, we have

$$\frac{x+2}{y+2} = \frac{4}{5}$$

$\Rightarrow \quad 5x + 10 = 4y + 8$

[cross-multiply both sides]

$\Rightarrow \quad 5x - 4y + 2 = 0 \quad \ldots(i)$

and according to condition II, we have

$$\frac{x-4}{y-4} = \frac{1}{2}$$

[cross-multiply both sides]

$\Rightarrow \quad 2x - 8 = y - 4$

$\Rightarrow \quad 2x - y - 4 = 0 \quad \ldots(ii)$

Thus, the algebraic representation of given problem is

$5x - 4y + 2 = 0$

and $\quad 2x - y - 4 = 0$

5. Let the cost of 1 pencil be ₹ x and that of one eraser be ₹y.

It is given that Romila purchased 2 pencils and 3 erasers for ₹ 9.

$\therefore \; 2x + 3y = 9$

It is also given that Sonali purchased 4 pencils and 6 erasers for ₹18

$\therefore \; 4x + 6y = 18$

Algebraic Representation The algebraic representation of the given situation is

$2x + 3y = 9 \quad \ldots(i)$

$4x + 6y = 18 \quad \ldots(ii)$

6. Given, $3x - y = 3$

$9x - 3y = 9$

On comparison with the standard equation

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

$a_1 = 3, b_1 = -1, c_1 = -3$

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$$a_2 = 9,\ b_2 = -3,\ c_2 = -9$$

Here, $\frac{a_1}{a_2} = \frac{3}{9} = \frac{b_1}{b_2} = \frac{-1}{-3} = \frac{c_1}{c_2} = \frac{-3}{-9}$

So, the lines are coincident lines and hence infinite solution.

7. Given, $5x + 4y + 6 = 0$ and $10x + 8y - 12 = 0$

On comparison with standard equation

$$a_1 = 5,\ b_1 = 4,\ c_1 = 6$$
$$a_2 = 10,\ b_2 = 8,\ c_2 = -12$$

Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{5}{10} = \frac{4}{8} \neq \frac{6}{-12}$

These represents parallel lines so there is no any common solution

8. The given pair of linear equations is

$$3x - 5y + 8 = 0$$

and $\quad 7x + 6y - 9 = 0$

On comparing the given equations with standard form of pair of linear equations i.e.

$$a_1x + b_1y + c_1 = 0$$

and $\quad a_2x + b_2y + c_2 = 0$, we get

$$a_1 = 3,\quad b_1 = -5,\quad c_1 = 8$$

and $\quad a_2 = 7,\quad b_2 = 6,\quad c_2 = -9$

Here, $\frac{a_1}{a_2} = \frac{3}{7}$ and $\frac{b_1}{b_2} = \frac{-5}{6}$

$\because \quad \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\therefore$ The lines representing the given pair of linear equations will intersect at a point.

9. Condition for a consistent pair of linear equations

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

[intersecting lines having unique solution]

and $\quad \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

[coincident or dependent]

10. If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

This represents parallel lines and hence no solution (Inconsistent)

11. If lines are intersecting i.e. there is some solution and hence system of equations becomes consistent.

12. If lines are parallel i.e. no solution hence system becomes inconsistent.

13. On comparing the above equations with standard form of pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we get

(a) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ as $\frac{3}{1} = \frac{3}{1} = \frac{-9}{-3}$, consistent

(b) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ as $\frac{4}{-2} \neq -1$, consistent

(c) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ as $\frac{5}{10} = \frac{1}{2} = \frac{10}{20}$, consistent

(d) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ as $\frac{-2}{-4} = \frac{1}{2} \neq \frac{3}{10}$, inconsistent

14. The given pair of linear equations is

$4x - 5y - 12 = 0$ and $-8x + 10y + 20 = 0$

On comparing with standard form of pair of linear equations, we get

$$a_1 = 4,\ b_1 = -5,\ c_1 = -12$$

and $\quad a_2 = -8,\ b_2 = 10,\ c_2 = 20$

Here, $\frac{a_1}{a_2} = \frac{4}{-8} = -\frac{1}{2}$, $\frac{b_1}{b_2} = \frac{-5}{10} = -\frac{1}{2}$

and $\quad \frac{c_1}{c_2} = -\frac{12}{20} = -\frac{3}{5}$

$\because \quad \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\therefore$ Given pair of linear equations is inconsistent.

15. If $x = 2$, $y = -3$ is a unique solution of any pair of equation, then these values must satisfy that pair of equations.

From option (b),

$$\text{LHS} = 2x + 5y = 2(2) + 5(-3)$$
$$= 4 - 15 = -11 = \text{RHS}$$

and $\text{LHS} = 4x + 10y = 4(2) + 10(-3)$

$$= 8 - 30 = -22 = \text{RHS}$$

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16. Given, equations are $x + 2y + 5 = 0$

and $-3x - 6y + 1 = 0$

Here, $a_1 = 1, b_1 = 2, c_1 = 5$

and $a_2 = -3, b_2 = -6, c_2 = 1$

$\therefore \quad \frac{a_1}{a_2} = -\frac{1}{3}, \frac{b_1}{b_2} = -\frac{2}{6} = -\frac{1}{3}, \frac{c_1}{c_2} = \frac{5}{1}$

$\therefore \quad \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Hence, the pair of equations has no solution.

17. Condition for dependent linear equations

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = \frac{1}{k} \quad \ldots(i)$$

Given equation of line is, $-5x + 7y - 2 = 0$

Here, $a_1 = -5, b_1 = 7, c_1 = -2$

From Eq. (i), $-\frac{5}{a_2} = \frac{7}{b_2} = -\frac{2}{c_2} = \frac{1}{k}$ [say]

$\Rightarrow \quad a_2 = -5k, b_2 = 7k, c_2 = -2k$

where, k is any arbitrary constant.

Putting $k = 2$, then $a_2 = -10, b_2 = 14$

and $c_2 = -4$

$\therefore$ The required equation of line becomes

$$a_2x + b_2y + c_2 = 0$$

$\Rightarrow \quad -10x + 14y - 4 = 0$

$\Rightarrow \quad 10x - 14y + 4 = 0$

18. The given equations can be rewritten as $2x + ky - 1 = 0$ and $3x - 5y - 7 = 0$.

On comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we get

$a_1 = 2, b_1 = k, c_1 = -1$ and

$a_2 = 3, b_2 = -5, c_2 = -7$

For unique solution,

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{2}{3} \neq \frac{k}{-5} \Rightarrow k \neq \frac{-10}{3}$$

Thus, given lines have a unique solution for all real values of k, except $\frac{-10}{3}$.

19. The condition that system of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ is inconsistent, if

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \quad \ldots(i)$$

Given system of linear equations are

$x + 2y = 3$ or $x + 2y - 3 = 0$

and $5x + ky + 7 = 0$

Here, $a_1 = 1, \; b_1 = 2, \; c_1 = -3$

and $a_2 = 5, b_2 = k, c_2 = 7$

From Eq. (i), we get

$$\frac{1}{5} = \frac{2}{k} \neq -\frac{3}{7}$$

Taking Ist and IInd terms

$$\frac{1}{5} = \frac{2}{k} \Rightarrow k = 10$$

20. Given, pair of linear equations is

$kx - 5y - 2 = 0$ and $6x + 2y - 7 = 0$

Here, $a_1 = k, b_1 = -5, c_1 = -2$

and $a_2 = 6, b_2 = 2, c_2 = -7$

On comparing with standard form of pair of linear equations we get,

For no solution,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{k}{6} = \frac{-5}{2} \neq \frac{-2}{-7}$$

$\Rightarrow \quad \frac{k}{6} = -\frac{5}{2} \Rightarrow k = -15$

21. Given, pair of equations is $2x + 3y - 4 = 0$

and $(k + 2)x + 6y - (3k + 2) = 0$

On comparing the given equations with standard form i.e.

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we get

$a_1 = 2, \quad b_1 = 3, \quad c_1 = -4$

and $a_2 = k + 2, b_2 = 6,$

$c_2 = -(3k + 2)$

For infinitely many solutions,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\therefore \quad \underset{\text{I}}{\frac{2}{k+2}} = \underset{\text{II}}{\frac{3}{6}} = \underset{\text{III}}{\frac{-4}{-(3k+2)}} \quad \ldots(i)$$

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On taking I and II terms, we get

$$\frac{2}{k+2} = \frac{3}{6} \quad \Rightarrow \frac{2}{k+2} = \frac{1}{2}$$

$\Rightarrow \quad k+2 = 4 \quad \Rightarrow k = 2$

which also satisfies the last two terms of Eq. (i).

Hence, the required value of k is 2.

22. Condition for parallel lines is

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \quad \ldots(i)$$

Given lines, $3x + 2ky - 2 = 0$

and $\quad 2x + 5y - 1 = 0$

Here, $\quad a_1 = 3, b_1 = 2k, c_1 = -2$

and $\quad a_2 = 2, b_2 = 5, c_2 = -1$

From Eq. (i), $\quad \frac{3}{2} = \frac{2k}{5}$

$\therefore \quad k = \frac{15}{4}$

23. Given, pair of equations is

$$-x + py - 1 = 0 \quad \ldots(i)$$

and $\quad px - y - 1 = 0 \quad \ldots(ii)$

On comparing the given equations with standard form i.e. $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we get

$$a_1 = -1, b_1 = p, \quad c_1 = -1$$

and $\quad a_2 = p, \; b_2 = -1, c_2 = -1$

For parallel lines,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$$\Rightarrow \quad \underset{\text{I}}{\frac{-1}{p}} = \underset{\text{II}}{\frac{p}{-1}} \neq \underset{\text{III}}{\frac{-1}{-1}} \quad \ldots(iii)$$

On taking I and II terms, we get

$$\frac{-1}{p} = \frac{p}{-1}$$

$\Rightarrow \quad p^2 = 1 \Rightarrow p = \pm 1$

Since, $p = -1$ does not satisfy the last two terms of Eq. (iii).

$\therefore \; p = 1$ is the required value.

Hence, for $p = 1$, the given system of equations will represent parallel lines.

24. Given lines are $x = 1$, $y = 2$ and $a^2x + 2y - 20 = 0$.

Since, $x = 1$, $y = 2$ and $a^2x + 2y - 20 = 0$ are concurrent, i.e $x = 1$, $y = 2$ and $a^2x + 2y - 20 = 0$ having a common solution.

So, $x = 1$, $y = 2$ is a solution of given equation

$$a^2 \cdot 1 + 2 \cdot 2 - 20 = 0 \Rightarrow a^2 - 16 = 0$$

$\Rightarrow \quad a^2 = 16 \Rightarrow a = -4, 4$

25. Given equations are

$$x + 8y = 19 \quad \ldots(i)$$

and $\quad 2x + 11y = 28 \quad \ldots(ii)$

From Eq. (i), $\quad x = 19 - 8y \quad \ldots(iii)$

On substituting $x = 19 - 8y$ in Eq. (ii), we get

$$2(19 - 8y) + 11y = 28$$

$\Rightarrow \quad 38 - 16y + 11y = 28$

$\Rightarrow \quad 5y = 38 - 28 = 10$

$\Rightarrow \quad y = \frac{10}{5} = 2$

Now, on putting $y = 2$ in Eq. (iii), we get

$$x = 19 - 8 \times 2$$

$\Rightarrow \quad x = 19 - 16 = 3$

Thus, $x = 3$ and $y = 2$ is the required solution.

26. The given system can be rewritten as

$$ax + by = a - b \quad \ldots(i)$$

and $\quad bx - ay = a + b \quad \ldots(ii)$

From Eq. (i), we get

$$by = a - b - ax$$

$\Rightarrow \quad y = \frac{a - b - ax}{b} \quad \ldots(iii)$

On substituting the value of y in Eq. (ii), we get

$$bx - a\left[\frac{a - b - ax}{b}\right] = a + b$$

$\Rightarrow \quad b^2x - a(a - b - ax) = b(a + b)$

[multiplying both sides by b]

$\Rightarrow \quad b^2x - a^2 + ab + a^2x = ab + b^2$

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$\Rightarrow (b^2 + a^2)x = ab + b^2 + a^2 - ab$

$\Rightarrow \quad x = \dfrac{a^2 + b^2}{a^2 + b^2} = 1$

On substituting $x = 1$ in Eq. (iii), we get

$$y = \frac{a - b - a}{b} \Rightarrow y = \frac{-b}{b} = -1$$

Hence, solution of the given system is $x = 1$ and $y = -1$.

27. Let the two numbers be x and y $(x > y)$.

According to the question,

$x - y = 26$ ...(i)

and $x = 3y$ ...(ii)

On substituting the value of x from Eq. (ii) in Eq. (i), we get

$3y - y = 26$

$\Rightarrow \quad 2y = 26$

$\Rightarrow \quad y = 13$

On substituting $y = 13$ in Eq. (ii), we get

$x = 3 \times 13$

$\Rightarrow \quad x = 39$

Hence, the two numbers are 39 and 13.

28. Let the two numbers be x and y.

Then, by first condition, ratio of these two numbers = 5 : 6

$x : y = 5 : 6$

$\Rightarrow \quad \dfrac{x}{y} = \dfrac{5}{6} \Rightarrow y = \dfrac{6x}{5}$ ...(i)

and by second condition, then, 8 is subtracted from each of the numbers, then ratio becomes 4 : 5.

$$\frac{x - 8}{y - 8} = \frac{4}{5}$$

$\Rightarrow \quad 5x - 40 = 4y - 32$

$\Rightarrow \quad 5x - 4y = 8$ ...(ii)

Now, put the value of y in Eq. (ii), we get

$$5x - 4\left(\frac{6x}{5}\right) = 8$$

$\Rightarrow \quad 25x - 24x = 40$

$\Rightarrow \quad x = 40$

Put the value of x in Eq. (i), we get

$$y = \frac{6}{5} \times 40$$

$$= 6 \times 8 \quad = 48$$

Hence, the required numbers are 40 and 48.

29. Given, pair of linear equations is

$2x + 3y = 8$ ...(i)

and $4x + 6y = 7$ ...(ii)

On multiplying Eq. (i) by 2, to make the coefficients of x equal, we get the equation as

$4x + 6y = 16$ ...(iii)

On subtracting Eq. (ii) from Eq. (iii), we get

$(4x - 4x) + (6y - 6y) = 16 - 7$

$\Rightarrow \quad 0 = 9$

which is a false equation involving no variable.

So, the given pair of linear equations has no solution, i.e. this pair of linear equations is inconsistent.

30. Given equations are

$x - 3y = 8$ ...(i)

and $5x + 3y = 10$ ...(ii)

On adding Eqs. (i) and (ii), we get

$$6x = 18 \Rightarrow x = \frac{18}{6} = 3$$

On putting $x = 3$ in Eq. (i), we get

$$3 - 3y = 8 \Rightarrow 3y = 3 - 8 \Rightarrow y = \frac{-5}{3}$$

Hence, $x = 3$ and $y = \dfrac{-5}{3}$.

31. Given pair of linear equations is

$41x + 53y = 135$ ...(i)

and $53x + 41y = 147$ ...(ii)

On adding Eqs. (i) and (ii), we get

$94x + 94y = 282$

$\Rightarrow \quad x + y = 3$

[dividing both sides by 94] ...(iii)

On subtracting Eqs. (i) from (ii), we get

$12x - 12y = 12$

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$\Rightarrow \quad x - y = 1$

[dividing both sides by 12] ...(iv)

Now, adding Eqs. (iii) and (iv), we get

$$2x = 4 \Rightarrow x = 2$$

On substituting $x = 2$ in Eq. (iii), we get

$$y = 3 - 2 = 1$$

Hence, $x = 2$ and $y = 1$ is the required solution.

32. Given, $2x + 3y = 5$ ... (i)

$3x + 2y = 10$ ... (ii)

Multiply Eq. (i) by 3 and Eq. (ii) by 2, we get

$$6x + 9y = 15$$
$$6x + 4y = 20$$
$$\underline{- \quad - \quad -}$$
$$9y = -5$$
$$y = -1$$

Substitute $y = -1$ in Eq. (i), we get

$$2x + 3(-1) = 5$$
$$2x = 5 + 3$$
$$2x = 8$$
$$x = 4$$

$\therefore \; x - y = 4 - (-1) = 5$

33. Since, $x = a$ and $y = b$ is the solution of the equations $x - y = 2$ and $x + y = 4$, then these values will satisfy that equations

$a - b = 2$ ...(i)

and $a + b = 4$ ...(ii)

On adding Eqs. (i) and (ii), we get

$$2a = 6$$

$\therefore \quad a = 3$ and $b = 1$

34. Given,

$3^{x+y} = 81 \Rightarrow 3^{x+y} = 3^4 \Rightarrow x + y = 4$ ...(i)

and $81^{x-y} = 3 \Rightarrow 3^{4(x-y)} = 3^1 \Rightarrow 4(x - y) = 1$

$\Rightarrow \quad x - y = \frac{1}{4}$ ...(ii)

On adding Eqs. (i) and (ii), we get

$$2x = 4 + \frac{1}{4} = \frac{17}{4}$$

$\Rightarrow \quad x = \frac{17}{8} = 2\frac{1}{8}$

From Eq. (i), we get

$$y = \frac{15}{8} = 1\frac{7}{8}$$

35. Given that, x, y and $40°$ are the angles of a triangle.

$\therefore \quad x + y + 40° = 180°$

[since, the sum of all the angles of a triangle is 180°]

$\Rightarrow \quad x + y = 140°$ ...(i)

Also, $x - y = 30°$ ...(ii)

On adding Eqs. (i) and (ii), we get

$$2x = 170°$$

$\Rightarrow \quad x = 85°$

On putting $x = 85°$ in Eq. (i), we get

$$85° + y = 140°$$

$\Rightarrow \quad y = 55°$

Hence, the required values of x and y are 85° and 55°, respectively.

36. Let the digit at units and tens place in the given number be x and y respectively.

Then,

Number $= 10y + x$ ... (i)

Number formed by interchanging the digits

$= 10x + y$

According to the given conditions, we have

$(10y + x) + (10x + y) = 110$

and, $(10y + x) - 10 = 5(x + y) + 4$

$\Rightarrow \quad 11x + 11y = 110$

and, $4x - 5y + 14 = 0$

$\Rightarrow \quad x + y - 10 = 0$ ...(i)

and, $4x - 5y + 14 = 0$ ...(ii)

On multiplying Eq. (i) by 5, we get

$5x + 5y - 50 = 0$ ...(iii)

On adding Eqs. (ii) and (iii), we get

$$9x - 36 = 0$$

$\Rightarrow \quad 9x = 36$

$\Rightarrow \quad x = 4$

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From Eq. (i),

$$4 + y - 10 = 0$$

$\Rightarrow$ $y - 6 = 0$

$\Rightarrow$ $y = 6$

Putting the value of x and y in Eq. (i), we get

Number $= 10 \times 6 + 4 = 64$

37. Let the length of the rectangle be x units and the breadth y units.

Then, $(x + 2)(y + 2) = xy + 76$

$\Rightarrow$ $2x + 2y + 4 = 76$

$\Rightarrow$ $x + y = 36$ ...(i)

In the second case

$$(x + 3)(y - 3) = xy - 21$$

$\Rightarrow$ $3y - 3x - 9 = -21$

$\Rightarrow$ $3x - 3y = 21 - 9 = 12$

$\Rightarrow$ $x - y = 4$ ...(ii)

From Eq. (i),

$$y = 36 - x$$

Substituting the value of y in Eq. (ii), we get

$$x - (36 - x) = 4$$

$\Rightarrow$ $x - 36 + x = 4$

$\Rightarrow$ $2x = 40$

$\therefore$ $x = 20$ units

and $y = 36 - 20 = 16$ units

Hence, length = 20 units

and breadth = 16 units

38. Let the fraction be $\frac{x}{y}$.

Then, according to the question

$$\frac{x+1}{y+1} = \frac{4}{5}$$

$\Rightarrow$ $5x + 5 = 4y + 4$

$\Rightarrow$ $5x - 4y = -1$ ...(i)

and $\frac{x-5}{y-5} = \frac{1}{2}$

$\Rightarrow$ $2x - 10 = y - 5$

$\Rightarrow$ $2x - y = 5$ ...(ii)

On multiplying Eq. (i) by 2 and Eq. (ii) by 5 and then subtracting Eq. (ii) from Eq. (i), we get

$$10x - 8y = -2$$
$$10x - 5y = 25$$
$$- \quad + \quad -$$
$$-3y = -27$$

$\Rightarrow$ $y = 9$

On substituting the value of y in Eq. (i), we get

$$5x - 4 \times 9 = -1$$

$\Rightarrow$ $5x = -1 + 36$

$\Rightarrow$ $x = 7$

$\therefore$ Fraction $= \frac{7}{9}$

Therefore, numerator of this fraction is 7.

39. Let present age of man = x yr

and present age of son = y yr

Six years hence, men's age = $(x + 6)$ yr,

son's age = $(y + 6)$ yr

According to question,

$$(x + 6) = 3(y + 6) \Rightarrow x + 6 = 3y + 18$$

$\Rightarrow$ $x - 3y = 12$ ...(i)

and three years ago Men's age = $(x - 3)$ yr,

son's age = $(y - 3)$ yr

According to the question,

$$(x - 3) = 9(y - 3)$$

$\Rightarrow$ $x - 3 = 9y - 27$

$\Rightarrow$ $x - 9y = -24$ ...(ii)

On subtracting Eq. (ii) from Eq. (i), we get

$$6y = 36 \Rightarrow y = 6$$

On substituting the value of y in Eq. (i), we get

$$x - 18 = 12 \Rightarrow x = 30 \text{ yr}$$

40. Let the number of ₹ 1 coins = x

and the number of ₹ 2 coins = y

Then, by given condition,

$x + y = 50$ ...(i)

and $x \times 1 + y \times 2 = 75$

$\Rightarrow$ $x + 2y = 75$ ...(ii)

On subtracting Eq. (i) from Eq. (ii), we get

$$(x + 2y) - (x + y) = 75 - 50 \Rightarrow y = 25$$

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On substituting $y = 25$ in Eq. (i), we get

$$x + 25 = 50 \Rightarrow x = 25$$

Hence, she has 25 coins of ₹ 1 and 25 coins of ₹ 2.

41. Let fare from bus stand to Pitampura be ₹ x and to Dilshad Garden be ₹ y. According to the question, we have

Cost of 2 tickets to Pitampura + 3 tickets to Dilshad Garden = ₹ 46 and cost of 3 tickets to Pitampura + 5 tickets to Dilshad Garden = ₹ 74

∴ We get

$$2x + 3y = 46 \quad \ldots(i)$$

and $$3x + 5y = 74 \quad \ldots(ii)$$

Multiplying Eq. (i) by 3 and Eq. (ii) by 2, we get

$$6x + 9y = 138 \quad \ldots(iii)$$

and $$6x + 10y = 148 \quad \ldots(iv)$$

Subtracting Eq. (iii) from Eq. (iv), we get

$$y = 10$$

From Eq. (i),

$$2x + 3(10) = 46$$

$$\Rightarrow \quad 2x + 30 = 46$$

$$\Rightarrow \quad 2x = 16$$

$$\Rightarrow \quad x = 8$$

Hence, the fare from the bus stand in Delhi to Pitampura is ₹ 8 and the fare to Dilshad Garden is ₹ 10.

42. Given, pair of equations is not linear.

∴ Put $\frac{1}{x} = p$ and $\frac{1}{y} = q$, we get

$$2p + 3q = 13 \quad \ldots(i)$$

and $$5p - 4q = -2 \quad \ldots(ii)$$

which is a pair of linear equations.

Now, on multiplying Eq. (i) by 4 and Eq. (ii) by 3 and

then adding both of them, we get

$$(8p + 12q) + (15p - 12q) = 52 - 6$$

$$\Rightarrow \quad 8p + 15p = 52 - 6 \Rightarrow 23p = 46$$

$$\Rightarrow \quad p = \frac{46}{23} = 2$$

On putting $p = 2$ in Eq. (i), we get

$$2(2) + 3q = 13$$

$$\Rightarrow \quad 3q = 13 - 4 = 9 \Rightarrow q = \frac{9}{3} = 3$$

Since, $p = \frac{1}{x}$ and $q = \frac{1}{y}$

∴ $2 = \frac{1}{x}$ and $3 = \frac{1}{y}$

$\Rightarrow x = \frac{1}{2}$ and $y = \frac{1}{3}$, which is the required solution.

43. Given pair of equations is

$$\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2 \text{ and } \frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$$

On putting $\frac{1}{\sqrt{x}} = u$ and $\frac{1}{\sqrt{y}} = v$ in the given equations, we get

$$2u + 3v = 2 \quad \ldots(i)$$

and $$4u - 9v = -1 \quad \ldots(ii)$$

On multiplying Eq. (i) by 3 and then adding both of them, we get

$$3(2u + 3v) + 4u - 9v = 2 \times 3 - 1$$

$$\Rightarrow \quad 6u + 4u = 5 \Rightarrow 10u = 5 \Rightarrow u = \frac{1}{2}$$

On putting $u = \frac{1}{2}$ in Eq. (i), we get

$$2 \times \frac{1}{2} + 3v = 2 \Rightarrow 3v = 2 - 1 \Rightarrow v = \frac{1}{3}$$

If $u = \frac{1}{2}$, then by $u = \frac{1}{\sqrt{x}}$, we get

$$\sqrt{x} = \frac{1}{u}$$

$$\Rightarrow \quad \sqrt{x} = 2$$

$$\Rightarrow \quad x = 4 \text{ [squaring both sides]}$$

If $v = \frac{1}{3}$, then by $v = \frac{1}{\sqrt{y}}$, we get

$$\sqrt{y} = \frac{1}{v} \Rightarrow \sqrt{y} = 3 \Rightarrow y = 9$$

[squaring both sides]

∴ $x = 4$ and $y = 9$ is the required solution.

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44. Given equations are

$x + 4y = 27xy$ and $x + 2y = 21xy$

On dividing both sides of the above equations by xy, we get

$$\frac{1}{y} + \frac{4}{x} = 27 \quad \text{and} \quad \frac{1}{y} + \frac{2}{x} = 21$$

On putting $\frac{1}{y} = u$ and $\frac{1}{x} = v$, we get

$$u + 4v = 27 \quad \text{...(i)}$$

and $$u + 2v = 21 \quad \text{...(ii)}$$

On subtracting Eq. (ii) from Eq. (i), we get

$$2v = 6 \Rightarrow v = 3$$

On putting the value of v in Eq. (i), we get

$$u + 12 = 27 \Rightarrow u = 15$$

Now, $v = 3 \Rightarrow \frac{1}{x} = 3 \Rightarrow x = \frac{1}{3}$

and $u = 15 \Rightarrow \frac{1}{y} = 15 \Rightarrow y = \frac{1}{15}$

Hence, $x = \frac{1}{3}$ and $y = \frac{1}{15}$ is the required solution.

45. Let $\frac{1}{x+1} = u$ and $\frac{1}{y-1} = v$, then the given pair of linear equations becomes

$$5u - 2v = \frac{1}{2} \quad \text{... (i)}$$

and $$10u + 2v = \frac{5}{2} \quad \text{...(ii)}$$

On adding Eqs. (i) and (ii), we get

$$15u = \frac{1}{2} + \frac{5}{2} \Rightarrow 15u = \frac{6}{2} \Rightarrow u = \frac{1}{5}$$

On putting $u = \frac{1}{5}$ in Eq. (i), we get

$$5 \times \frac{1}{5} - 2v = \frac{1}{2} \Rightarrow v = \frac{1}{4}$$

Now, $u = \frac{1}{5} \Rightarrow \frac{1}{x+1} = \frac{1}{5}$

$\Rightarrow \quad x + 1 = 5 \Rightarrow x = 4$

and $v = \frac{1}{4} \Rightarrow \frac{1}{y-1} = \frac{1}{4} \Rightarrow y - 1 = 4 \Rightarrow y = 5$

Hence, $x = 4$ and $y = 5$, which is the required unique solution.

46. Let the actual speed of the train be x km/h and actual time taken be y h.

We know that,

Distance = Speed × Time

$\therefore$ Distance = xy km

According to the question,

$$xy = (x + 10)(y - 2)$$

$\Rightarrow \quad xy = xy - 2x + 10y - 20$

$\Rightarrow \quad 2x - 10y + 20 = 0$

$\Rightarrow \quad x - 5y + 10 = 0$

[dividing both sides by 2] ...(i)

and $xy = (x - 10)(y + 3)$

$\Rightarrow \quad xy = xy + 3x - 10y - 30$

$\Rightarrow \quad 3x - 10y - 30 = 0 \quad \text{...(ii)}$

On multiplying Eq. (i) by 3 and then subtracting Eq. (ii) from it, we get

$3 \times (x - 5y + 10) - (3x - 10y - 30) = 0$

$\Rightarrow \quad -5y = -60$

$\therefore \quad y = 12$

On putting $y = 12$ in Eq. (i), we get

$$x - 5 \times 12 + 10 = 0$$

$\Rightarrow \quad x - 60 + 10 = 0$

$\Rightarrow \quad x = 50$

Hence, the distance covered by train $xy = 50 \times 12 = 600$ km

47. Given, ratio of incomes = 9 : 7

and ratio of their expenditures = 4 : 3

Saving of each person = ₹ 2000

Let incomes of two persons be $9x$, $7x$ and their expenditures be $4y$, $3y$.

Then, linear equations so formed are

$$9x - 4y = 2000 \quad \text{...(i)}$$

and $$7x - 3y = 2000 \quad \text{...(ii)}$$

We make the coefficients of x numerically equal in both equations. On multiplying Eq.(i) by 7 and Eq. (ii) by 9, we get

$$63x - 28y = 14000 \quad \text{...(iii)}$$

and $$63x - 27y = 18000 \quad \text{...(iv)}$$

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On subtracting Eq. (iv) from Eq. (iii), we get

$$-28y + 27y = 14000 - 18000$$

$$\Rightarrow \quad -y = -4000 \Rightarrow y = 4000$$

On putting $y = 4000$ in Eq. (i), we get

$$9x - 4 \times 4000 = 2000$$

$$\Rightarrow \quad 9x = 2000 + 16000$$

$$\Rightarrow \quad x = \frac{18000}{9} = 2000$$

Thus, monthly income of both persons are 9(2000) and 7(2000), i.e. ₹ 18000 and ₹ 14000, respectively.

48. Let the speed of the boat in still water $= x$ km/h

and the speed of the stream $= y$ km/h

$\therefore$ The speed of the boat upstream $= (x - y)$ km/h

and the speed of the boat downstream $= (x + y)$ km/h

Time taken to go 35 km upstream $= \frac{35}{x - y}$ h

Time taken to go 55 km downstream $= \frac{55}{x + y}$ h

According to the question,

$$\frac{35}{x - y} + \frac{55}{x + y} = 12 \quad \ldots(i)$$

and

$$\frac{30}{x - y} + \frac{44}{x + y} = 10 \quad \ldots(ii)$$

Substituting $(x - y) = a$ and $(x + y) = b$, we get

$$\frac{35}{a} + \frac{55}{b} = 12 \quad \ldots(iii)$$

and

$$\frac{30}{a} + \frac{44}{b} = 10 \quad \ldots(iv)$$

Multiplying Eq. (iii) by 6 and Eq. (iv) by 7, we get

$$\frac{210}{a} + \frac{330}{b} = 72 \quad \ldots(v)$$

and

$$\frac{210}{a} + \frac{308}{b} = 70 \quad \ldots(vi)$$

Subtracting Eq. (vi) from Eq. (v), we get

$$\frac{22}{b} = 2$$

$$\Rightarrow \quad 2b = 22$$

$$\Rightarrow \quad b = 11$$

From Eq. (iii),

$$\frac{35}{a} + \frac{55}{11} = 12$$

$$\Rightarrow \quad \frac{35}{a} + 5 = 12$$

$$\Rightarrow \quad \frac{35}{a} = 7$$

$$\Rightarrow \quad 7a = 35$$

$$\Rightarrow \quad a = 5$$

Hence, $a = x - y = 5$ ...(vii)

and $b = x + y = 11$ ...(viii)

Solving Eqs. (vii) and (viii), we get

$$x = 8, y = 3$$

$\therefore$ The speed of the boat in still water $= 8$ km/h

49. (A) $a_1 = 2,\ b_1 = 3,\ c_1 = 40$

$a_2 = 6,\ b_2 = 5,\ c_2 = 10$

$$\frac{a_1}{a_2} = \frac{2}{6} = \frac{1}{3}, \frac{b_1}{b_2} = \frac{3}{5}, \frac{c_1}{c_2} = \frac{40}{10} = \frac{4}{1}$$

Here, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, so intersecting line

(B) $a_1 = 2, b_1 = 3,\ c_1 = 40$

$a_2 = 6,\ b_2 = 9,\ c_2 = 50$

$$\frac{a_1}{a_2} = \frac{2}{6} = \frac{1}{3}, \frac{b_1}{b_2} = \frac{3}{9} = \frac{1}{3}, \frac{c_1}{c_2} = \frac{40}{50} = \frac{4}{5}$$

Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ so parallel lines

(C) $a_1 = 2, b_1 = 3, c_1 = 10$

$a_2 = 4, b_2 = 6, c_2 = 20$

$$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2},$$

$$\frac{c_1}{c_2} = \frac{10}{20} = \frac{1}{2}$$

Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ so coincident line.

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50. (A) Given, $2x + y = 8$ (i)

and $x + 6y = 15$ ...(ii)

Multiplying Eq. (ii) by 2, we get

$2x + 12y = 30$ ...(iii)

Subtracting Eq. (i) from Eq. (iii), we get

$11y = 22$

$\Rightarrow$ $y = 2$

From Eq. (i), we get

$2x + 2 = 8$

$\Rightarrow$ $2x = 6$

$\Rightarrow$ $x = 3$

So, $(x, y) = (3, 2)$

(B) Given, $5x + 3y = 35$ ...(i)

and $2x + 4y = 28$ ...(ii)

On dividing Eq. (ii) by 2, we get

$x + 2y = 14$ ...(iii)

On multiplying Eq. (iii) by 5, we get

$5x + 10y = 70$ ...(iv)

On subtracting Eq. (i) from Eq. (iv), we get

$7y = 35$

$\Rightarrow$ $y = 5$

From Eq. (iii), we get

$x + 2(5) = 14$

$\Rightarrow$ $x + 10 = 14$

$\Rightarrow$ $x = 4$

So, $(x, y) = (4, 5)$

(C) Given, $15x + 4y = 61$ ...(i)

and $4x + 15y = 72$ ...(ii)

On multiplying Eq. (i) by 4 and Eq. (ii) by 15, we get

$60x + 16y = 244$ ...(iii)

and $60x + 225y = 1080$ ...(iv)

On subtracting Eq. (iii) from Eq. (iv), we get

$209y = 836$

$\Rightarrow$ $y = 4$

From Eq. (i), we get

$15x + 4(4) = 61$

$\Rightarrow$ $15x + 16 = 61$

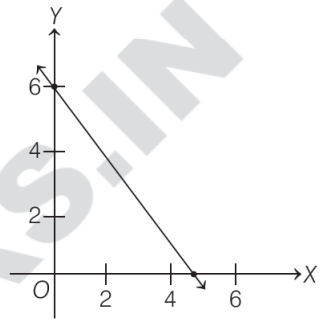
$\Rightarrow$ $15x = 45$

$\Rightarrow$ $x = 3$

So, $(x, y) = (3, 4)$

51. $4x + 3y = 18$

x	9/2	0
y	0	6



Assertion : False; **Reason :** True

52. As, $x = 3$, $y = 1$ is the solution of

$\Rightarrow$ $2x + y - q^2 - 3 = 0$

$\Rightarrow$ $2 \times 3 + 1 - q^2 - 3 = 0 \Rightarrow 4 - q^2 = 0$

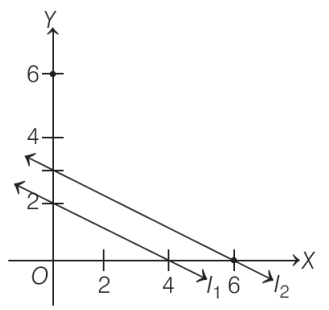
$\Rightarrow$ $q^2 - 4 = 0 \Rightarrow q = \pm 2$

Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

53. $l_1 : x + 2y - 4 = 0$ and $l_2 : 2x + 4y - 12 = 0$

x	4	0
y	0	2

x	6	0
y	0	3



so, the lines l_1 and l_2 are parallel to each other.

Assertion : True; **Reason :** True and is the correct explanation of assertion.

54. **Assertrion** We have,

$l_1 : 2x + y - 6 = 0$; $l_2 : 2x - y + 2 = 0$

$l_1 : y = 6 - 2x$; $l_2 : y = 2x + 2$

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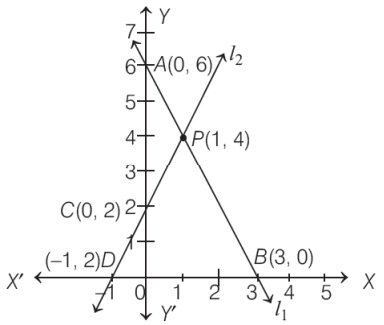
x	0	3
y	6	0

x	0	–1
y	2	0



From graph, it is clear that the given lines are not parallel lines.

Reason The linear equations $5x + ky - 4 = 0$ and $15x + 3y - 12 = 0$ have infinitely many solutions.

$\therefore \frac{5}{15} = \frac{k}{3} = \frac{-4}{-12} \Rightarrow \frac{1}{3} = \frac{k}{3} = \frac{1}{3} \Rightarrow k = 1$

Assertion (A) is false but Reason (R) is true.

55. Given system of linear equations has a unique solution, if

$$\frac{k}{6} \neq \frac{-1}{-2}$$
$$\frac{k}{6} \neq \frac{1}{2}$$
$$k \neq 3$$

So, Assertion is false and Reason is true.

56. From the given equations, we have

$$\frac{9}{18} = \frac{3}{6} = \frac{12}{24}$$
$$\frac{1}{2} = \frac{1}{2} = \frac{1}{2} \text{ i.e., } \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

57. Assertion : Given system of equations has infinitely many solutions if,

$$\frac{2}{2a} = \frac{3}{a+b} = \frac{-7}{-28}$$
$$\frac{1}{a} = \frac{3}{a+b} = \frac{1}{4}$$
$$3a = a + b \Rightarrow 2a - b = 0$$

Also, clearly $a = 4$, and $a + b = 12$

$$b = 8$$
$$2a - b = 8 - 8 = 0$$

For unique solution

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ or $\frac{3}{6} = \frac{-5}{-10}$ $[3(-10) = (-5)(6) = -30]$

Assertion is true But reason is false.

58. The given system of equations will have infinitely many solutions, if

$$\frac{1}{k+1} = \frac{k+1}{9} = \frac{5}{8k-1}$$

$\Rightarrow \frac{1}{k+1} = \frac{k+1}{9}$ and $\frac{k+1}{9} = \frac{5}{8k-1}$

$\Rightarrow (k+1)^2 = 9$ and $(k+1)(8k-1) = 45$

Now, $(k+1)^2 = 9$

$\Rightarrow k + 1 = \pm 3 \Rightarrow k = 2, -4$

We observe that $k = 2$ satisfies the equation $(k+1)(8k-1) = 45$ but $k = -4$ does not satisfy.

Hence, the given system of equations will have infinitely many solutions, if $k = 2$.

Assertion : False; **Reason :** True

59. For assertion, given equation has no solution if

$$\frac{1}{2} = \frac{1}{k} \neq \frac{-4}{-3} \text{ i.e. } \frac{4}{3}$$
$$k = 2\left[\frac{1}{2} \neq \frac{4}{3} \text{ holds}\right]$$

Assertion is true.

Both Assertion (A) and Reason (R) are true but reason (R) is not the correct explanation of assertion (A).

60. Let the digit at units place be x and the digit at ten's place be y. Then, number $= 10y + x$

According to the given condition, we have

$10y + x = 8(x + y) + 1 \Rightarrow 7x - 2y + 1 = 0$ ...(i)

and, $10y + x = 13(y - x) + 2$

$\Rightarrow \quad 14x - 3y - 2 = 0$ ...(ii)

On multiplying Eq. (i) by 2, we get

$14x - 4y + 2 = 0$ ...(iii)

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On subtracting Eq. (iii) from Eq. (ii), we get

$$y - 4 = 0 \Rightarrow y = 4$$

From Eq. (i)

$$7x - 2(4) + 1 = 0$$
$$\Rightarrow \quad 7x - 8 + 1 = 0$$
$$\Rightarrow \quad 7x - 7 = 0$$
$$\Rightarrow \quad 7x = 7$$
$$\Rightarrow \quad x = 1$$

Hence, the number $= 10y + x$

$$= 10 \times 4 + 1 = 41$$

Assertion : True; **Reason :** False

61. (i) Cost of 4 tickets to Karol Bagh $= 4x$

Cost of 6 tickets to Hauz Khas $= 6y$

Total cost $= 92$

Then, the situation can be represented algebraically as

$$4x + 6y = 92$$
$$2x + 3y = 46$$

(ii) Cost of 6 tickets to Karol Bagh $= 6x$

Cost of 10 tickets to Hauz Khas $= 10y$

Total cost $= 148$

Then, the situation can be represented algebraically as

$$6x + 10y = 148$$
$$3x + 5y = 74$$

(iii) We have, pair of linear equations as

$$2x + 3y = 46 \quad \ldots(i)$$
$$3x + 5y = 74 \quad \ldots(ii)$$

Multiply the first equation by 5 and second equation by 3.

$$10x + 15y = 230 \quad \ldots(iii)$$
$$9x + 15y = 222 \quad \ldots(iv)$$

Subtract the Eqs. (iv) for (iii)

$$x = 8$$

(iv) Put $x = 8$ into the Eq. (i)

$$2(8) + 3y = 46$$
$$3y = 46 - 16$$
$$3y = 30$$
$$y = 10$$

(v) Here, $a_1 = 2,\ b_1 = 3,\ c_1 = -46$

and $a_2 = 3, b_2 = 5, c_2 = -74$

$$\frac{a_1}{a_2} = \frac{2}{3}, \frac{b_1}{b_2} = \frac{3}{5}, \frac{c_1}{c_2} = \frac{-46}{-74} = \frac{23}{37}$$

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

Hence, the above pair of equation has unique solution.

62. Let the number of questions whose answer is known to the student be x and questions attempted by guessing be y.

Then, $\quad x + y = 120 \quad \ldots(i)$

and $\quad x - \frac{1}{4}y = 90$

$$\Rightarrow \quad 4x - y = 360 \quad \ldots(ii)$$

On adding Eqs. (i) and (ii), we get

$$5x = 480$$
$$\Rightarrow \quad x = \frac{480}{5} = 96$$

Put $x = 96$ in Eq. (i), we get

$$96 + y = 120 \Rightarrow y = 120 - 96 = 24$$

(i) He answered 96 questions correctly.

(ii) He guesses only 24 questions.

(iii) In out of 120 questions attempted 80 answered are correct and 40 guessing answered are wrong.

Then, he got the marks

$$= 80 - \frac{1}{4} \text{ of } 40 = 80 - \frac{1}{4} \times 40$$
$$= 80 - 10 = 70$$

(iv) According to the given condition,

$$x - \frac{1}{4} \text{ of } (120 - x) = 95$$
$$\Rightarrow \quad x - \frac{1}{4} \times (120 - x) = 95$$
$$\Rightarrow \quad 4x - 120 + x = 380$$
$$\Rightarrow \quad 5x = 500$$
$$\Rightarrow \quad x = 100$$

Hence, he answered correctly 100 questions to score 95 marks.

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(v) 100 answered are correct and 20 giving answered are wrong.

Then, he got the marks $= 100 - \frac{1}{4} \times 20$

$= 100 - 5 = 95$

63. (i) For the first case,

Cost (proportional) for 5 guests $= 5y$

Total cost $= 450$

Then, the situation is $x + 5y = 450$

For the second case,

Cost (proportional) for 10 guests $= 10y$

Total cost $= 850$

Then, the situation is $x + 10y = 850$

(ii) Given, $x + 5y = 450$ ...(i)

$x + 10y = 850$ ...(ii)

Subtract Eq. (i) from Eq. (ii)

$5y = 400$

$y = 80$

(iii) Put $y = 80$ in Eq. (i)

$x + 5(80) = 450$

$x = 450 - 400$

$x = 50$

(iv) Cost (proportional) for 12 guests

$= 12 \times 80 = 960$

Total cost $= 960 + 50 = 1010$

(v) Here, $a_1 = 1, b_1 = 5, c_1 = 450$

and $a_2 = 1, b_2 = 10, c_2 = 850$

$\frac{a_1}{a_2} = 1, \frac{b_1}{b_2} = \frac{5}{10} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{450}{850} = \frac{9}{17}$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Hence, unique solutions.

64. (i) From the given figure we see that area of two bedrooms $= 2(5x) = 10x$ m^2

Area of kitchen $= 5 \times y = 5y$ m^2

According to the question,

Area of the two bedrooms and area of kitchen $= 95$

$\therefore \quad 10x + 5y = 95$

$\Rightarrow \quad 2x + y = 19$

[divide both sides by 5] ... (i)

Also, length of the home = 15 cm

$\therefore \quad x + 2 + y = 15 \Rightarrow x + y = 13$ ...(ii)

Hence, pair of linear equations is

$2x + y = 19$ and $x + y = 13$

(ii) The length of the outer boundary of the layout $= 2(l + b)$

$= 2(15 + 12)$

$= 2(27)$

$= 54$ m

(iii) On solving Eqs. (i) and (ii), we get

$x = 6$ and $y = 7$

$\therefore$ Area of each bedroom

$= 5 \times x = 5 \times 6 = 30$ m^2

and area of kitchen

$= 5 \times y = 5 \times 7 = 35$ m^2

(iv) Area of living room

$= 15 \times (5 + 2)$

$-$ Area of bedroom 2

$= 15 \times 7 - 5 \times 6$

$= 105 - 30 = 75$ m^2

(v) Since, area of kitchen $= 5 \times y$

$= 5 \times 7 = 35$ m^2

But, it is also given, the cost of laying tiles in kitchen at the rate of ₹50 per m^2.

$\therefore$ Total cost of laying tiles in the kitchen

$= 35 \times 50 =$ ₹ 1750

65. (i) Cost of 4kg of onion $= 4x$

Cost of 2 kg of tomato $= 2y$

Total cost = 3200

Then, $4x + 2y = 3200$

$2x + y = 1600$

(ii) Cost of 8 kg of onion $= 8x$

Cost of 4 kg of tomato $= 4y$

Total cost = 6000

Then, $8x + 4y = 6000$

$\Rightarrow \quad 2x + y = 1500$

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(iii) When a line intersect the X-axis, its Y coordinate is zero, i.e., $y = 0$

Put $y = 0$ into $2x + y = 1600$

$\Rightarrow \quad 2x + 0 = 1600$

$\Rightarrow \quad x = 800$

(iv) When a line intersect the Y-axis, its X coordinate is zero, i.e., $x = 0$

Put $x = 0$ into $2x + y = 1500$

$\Rightarrow \quad 2(0) + y = 1500$

$y = 1500$

(v) Here $a_1 = 2, b_1 = 1, c_1 = 1600$

and $a_2 = 2, b_2 = 1, c_2 = 1500$

$\frac{a_1}{a_2} = \frac{2}{2} = 1, \frac{b_1}{b_2} = 1, \frac{c_1}{c_2} = \frac{1600}{1500} = \frac{16}{15}$

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Hence, the system have no solution {parallel lines}.

66. (i) As per the situation 1, the pair of linear equation representing the situation is

$x + 10y = 75$ and $x + 15y = 110$

(ii) On solving the above equations, we get

$$\begin{array}{r} x + 10y = 75 \\ x + 15y = 110 \\ - \quad - \quad - \\ \hline -5y = -35 \end{array}$$

$\Rightarrow \quad y = 7$

$\therefore \quad x + 10 \times 7 = 75$

$\Rightarrow \quad x = 75 - 70 = 5$

To travel a distance of 50 km, a person has to pay amount

$= x + 50y = 5 + 50 \times 7$

$= 5 + 350 =$ ₹ 355

(iii) As per the situation 2, the pair of linear is

$x + 8y = 91 \quad \ldots(i)$

and $\quad x + 14y = 145 \quad \ldots(ii)$

On solving Eqs. (i) 4and (ii), we get

$$\begin{array}{r} x + 8y = 91 \\ x + 14y = 145 \\ - \quad - \quad - \\ \hline -6y = -54 \end{array}$$

$\Rightarrow \quad y = 9$

Put $y = 9$ in Eq. (i), we get

$x + 8 \times 9 = 91$

$\Rightarrow \quad x = 91 - 72 = 19$

To travel a distance of 30 km, a person has to pay amount

$= x + 30 \times y$

$= 19 + 30 \times 9$

$= 19 + 270$

$=$ ₹ 289

(iv) In situation 2, the intersection point of two lines is (19, 9), which is shown in figure (c).

(v) From the graph, it is clear that both the lines are intersecting each other.

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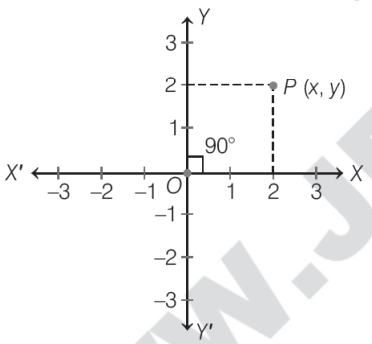
04

Coordinate Geometry

Quick Revision

Cartesian System

The system used to describe the position of a point in a plane, is called cartesian system. In cartesian system, there are two mutually perpendicular straight lines XX' and YY', which intersect each other at origin point O.



The horizontal line XOX' is called X-axis (or abscissa) and the vertical line YOY' is called Y-axis (or ordinate).

Distance between Two Points in a Cartesian Plane

The distance between any two points $P(x_1, y_1)$ and $Q(x_2, y_2)$ is given by

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

or $$PQ = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

i.e. $$PQ = \sqrt{(\text{Difference of abscissae})^2 + (\text{Difference of ordinates})^2}$$

If one coordinate is at origin say $P(x_1, y_1) = P(0, 0)$, then distance between two points is

$$PQ = \sqrt{x_2^2 + y_2^2}$$

Collinear Points

When three or more than three points lie on a same line, then they are called collinear points.

Suppose A, B and C are three points, then the condition for collinearity of three points is

$$AB + BC = AC$$

or $$AC + CB = AB$$

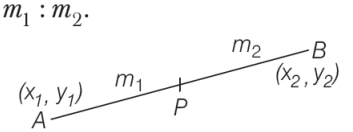
or $$BA + AC = BC$$

Section Formulae

In section formula, we find the coordinates of a point which divides the given line segment internally (or externally) in a given ratio.

Internal Division of a Line Segment

Let $A(x_1, y_1)$ and $B(x_2, y_2)$ are two points and $P(x, y)$ is a point on the line segment joining A and B such that $AP : BP = m_1 : m_2$, then point P is said to divide line segment AB internally in the ratio $m_1 : m_2$.



The coordinates of point P are given by

$$\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right).$$

Generally, for finding internal division ratio, we consider P divides AB in the ratio $k : 1$, then the coordinates of the point P will be

$$\left(\frac{kx_2 + x_1}{k+1}, \frac{ky_2 + y_1}{k+1}\right).$$

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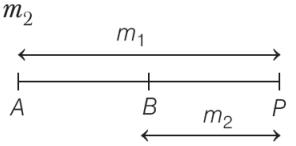
External Division of a Line Segment

If a point P divides line segment AB externally in the ratio $m_1 : m_2$



Then, coordinates of point P are

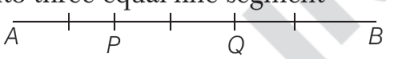
$$\left(\frac{m_1x_2 - m_2x_1}{m_1 - m_2}, \frac{m_1y_2 - m_2y_1}{m_1 - m_2}\right)$$

This formula is known as section formula for external division.

Coordinates of Mid-point of Line Segment

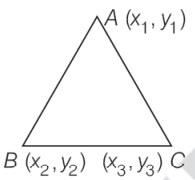
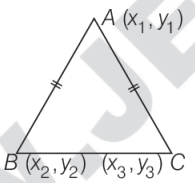
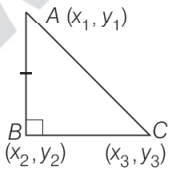
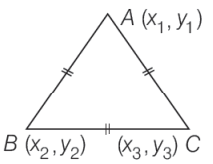
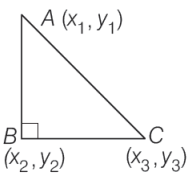
If the point P divides the line segment equally i.e., 1 : 1, then the coordinates of P will be $\left(\frac{x_1 + y_1}{2}, \frac{y_1 + y_2}{2}\right)$. This is also called **mid-point formula**.

Note Trisection of the line segment means, a line is divided into three equal line segment



i.e. $AP = PQ = QB$.

Different Types of Triangle and Their Conditions

Types of Triangle	Figures	Properties	Conditions
Scalene triangle		All sides are unequal.	$AB \neq BC \neq CA$
Isosceles triangle		Length of any two sides are equal.	$AB = AC \Rightarrow \angle C = \angle B$
Right isosceles triangle		Angle between two equal sides is 90°.	$AB = BC$ and $\angle B = 90°$
Equilateral triangle		Length of all the three sides are equal.	$AB = BC = CA$ and $\angle A = \angle B = \angle C = 60°$
Right angled triangle		Sum of the squares of two sides is equal to the square of third side. It is also called Pythagoras theorem.	$AC^2 = AB^2 + BC^2$

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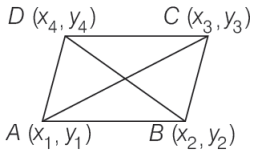
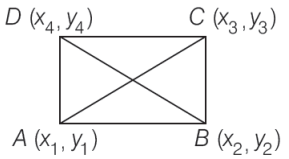
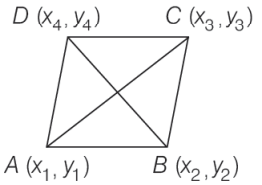
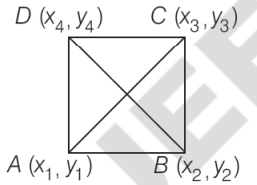
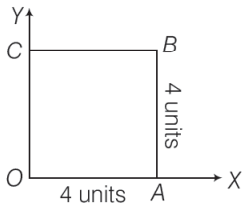
Different Types of Quadrilateral and Their Conditions

Types of Quadrilateral	Figures	Properties	Conditions
Parallelogram		Both pairs of opposite sides are equal. Diagonals bisect each other.	$AB = CD$, $AD = BC$ and $AC \neq BD$
Rectangle		A parallelogram with equal diagonals. Diagonals bisect each other.	$AB = CD$, $AD = BC$ and diagonal AC = diagonal BD
Rhombus		A parallelogram with all the sides are equal. Diagonals bisect each other at right angle.	$AB = BC = CD = DA$ and $AC \neq BD$
Square		A rhombus with equal diagonals. Diagonals bisect each other at right angle.	$AB = BC = CD = DA$ and diagonal AC = diagonal BD

Objective Questions

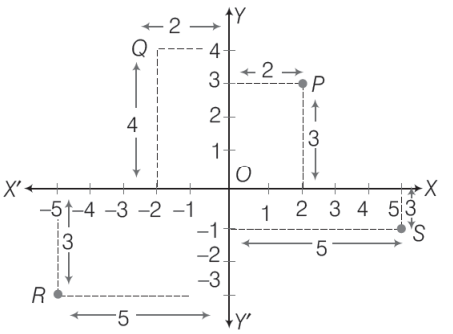
Multiple Choice Questions

1. In the given figure, O is the intersecting point of OA and OC and $OABC$ is a square of side 4 units, then the position of A, B and C is



(a) (4, 0) (4, 4) (0, 4)
(b) (4, 0) (0, 4) (4, 4)
(c) (0, 4) (4, 4) (4, 0)
(d) None of the above

2. In the given figure, the ordinates of the points P, Q, R and S is



(a) 2, −2, −5, 5
(b) 3, 4, −3, −1
(c) 3, 4, −5, 5
(d) 2, 4, −5, −1

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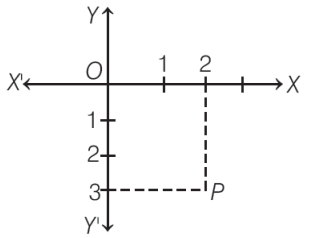
3. The coordinates of the point P as shown in the diagram will be



(a) (2, –3) (b) (–3, 2)
(c) (2, 3) (d) (3, 2)

4. The coordinate of the vertices of a rectangle whose length and breadth are 6 and 4 units, respectively. Its one vertex is at the origin. The longer side is on the X-axis and one of the vertices lies in second quadrant is

(a) (0, 0) (6, 4) (6, 0) (0, 4)
(b) (0, 0) (0, 4) (6, 0) (6, 4)
(c) (0, 0) (6, 4) (–6, 0) (6, 4)
(d) (0, 0) (0, 4) (–6, 4) (–6, 0)

5. The point $P(-4, 2)$ lies on the line segment joining the points $A(-4, 6)$ and $B(-4, -6)$.

(a) True (b) False
(c) Can't say (d) Partially True/False

6. The distance of the point $P(2, 3)$ from the X-axis is ***[NCERT Exemplar]***

(a) 2 units (b) 3 units
(c) 1 units (d) 5 units

7. The distance between the points $P(-6, 7)$ and $Q(-1, -5)$ is

(a) –6 units (b) 13 units
(c) 1 units (d) 5 units

8. The distance between the points $(a\cos\theta + b\sin\theta, 0)$ and $(0, a\sin\theta - b\cos\theta)$, is

(a) $a^2 + b^2$ (b) $a^2 - b^2$
(c) $\sqrt{a^2 + b^2}$ (d) $\sqrt{a^2 - b^2}$

9. The value of y, if the distance between the points $(2, y)$ and $(-4, 3)$ is 10 is

(a) 6 (b) –11 (c) 5 (d) 11

10. Point $P(0, 2)$ is the point of intersection of Y-axis and perpendicular bisector of line segment joining the points $A(-1, 1)$ and $B(3, 3)$.

(a) True (b) False
(c) Can'tsay (d) Partially True/False

11. If the distance between the points $(4, p)$ and $(1, 0)$ is 5, then the value of p is

(a) 4 (b) –4
(c) Both (a) and (b) (d) 0

12. A circle has its centre at the origin and a point $P(5, 0)$ lies on it. The point $Q(6, 8)$ lies outside the circle.

(a) True (b) False
(c) Can't say (d) Partially True/False

13. The radius of the circles whose centre is at $(0, 0)$ and which passes through the points $(-6, 8)$ is ..... .

(a) 10 units (b) 11 units
(c) 9 units (d) 8 units

14. Is the points $(1, -1)$, $(5, 2)$ and $(9, 5)$ are collinear?

(a) Yes
(b) No
(c) Can't find
(d) None of the above

15. If the point $P(2, 1)$ lies on the line segment joining points $A(4, 2)$ and $B(8, 4)$, then ..... .

(a) $AP = \frac{1}{3}AB$ (b) $AP = PB$
(c) $PB = \frac{1}{3}AB$ (d) $AP = \frac{1}{2}AB$

16. If the point $P(x, y)$ is equidistant from the points $A(5, 1)$ and $B(1, 5)$, then

(a) $y = 3x$ (b) $x = y$
(c) $x = -8y$ (d) $-8x = y$

17. A point on X-axis which is equidistant from the points $(1, 3)$ and $(-1, 2)$.

(a) (5/2, 0) (b) (5, 0)
(c) (4, 0) (d) (5/4, 0)

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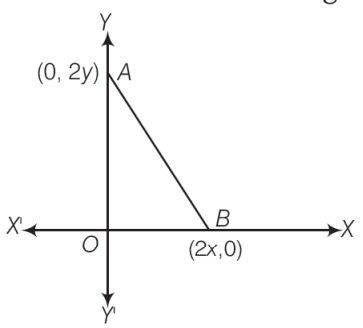
18. The point on X-axis, which is equidistant from the point (7, 6) and (–3, 4) is
(a) (0, 3) (b) (4, 3)
(c) (3, 0) (d) None of these

19. The coordinates of the point which is equidistant from the three vertices of the ΔAOB as shown in the figure is



(a) (x, y) (b) (y, x)
(c) $\left(\frac{x}{2}, \frac{y}{2}\right)$ (d) $\left(\frac{y}{2}, \frac{x}{2}\right)$

20. The coordinate of a point on Y-axis which is equidistant from the point $A(6, 5)$ and $B(-4, 3)$, will be
(a) (0, 9) (b) (0, –9)
(c) (0, 5) (d) (0, 3)

21. The radius of the circle whose end points of diameter are (24, 1) and (2, 23) is
(a) $22\sqrt{2}$ units (b) $23\sqrt{2}$ units
(c) $11\sqrt{2}$ units (d) None of these

22. If the points A (4, 3) and B $(x, 5)$ are on the circle with centre O (2, 3), then the value of x is
(a) 0 (b) 1
(c) 2 (d) 3

23. The perimeter of a triangle with vertices (0, 4), (0, 0) and (3, 0) is
[NCERT Exemplar]
(a) 5 units (b) 12 units
(c) 11 units (d) $(7 + \sqrt{5})$ units

24. If three points (0, 0), $(3, \sqrt{3})$ and $(3, \lambda)$ form an equilateral triangle, then λ equals
(a) 2 (b) – 3
(c) – 4 (d) None of these

25. If $AOBC$ is a rectangle whose three vertices are $A(0, 3)$, $O(0, 0)$ and $B(5, 0)$, then the length of its diagonal is
[NCERT Exemplar]
(a) 5 units (b) 3 units
(c) $\sqrt{34}$ units (d) 4 units

26. The points (3, 2), (–2, – 3) and (2, 3) form a triangle name the type of triangle formed.
(a) equilateral (b) isosceles
(c) right angle (d) None of these

27. (5, – 2), (6, 4) and (7, – 2) are the vertices of an …… triangle.
(a) equilateral (b) right angle
(c) isosceles (d) None of these

28. The points (– 4, 0), (4, 0) and (0, 3) are the vertices of a
(a) right angled triangle
(b) isosceles triangle
(c) equilateral triangle
(d) scalene triangle

29. The points (2, 3), (3, 4), (5, 6) and (4, 5) are the vertices of a
(a) Parallelogram (b) Triangle
(c) Square (d) None of these

30. The coordinates of the point which divides the line segment joining the points (4, – 3) and (9, 7) internally in the ratio 3 : 2 is
(a) (7, 3) (b) (3, 7)
(c) (35, 15) (d) (27, 21)

31. The point which divides the line segment joining the points (7, – 6) and (3, 4) in ratio 1 : 2 internally lies in the
[NCERT Exemplar]
(a) I quadrant
(b) II quadrant
(c) III quadrant
(d) IV quadrant

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32. If $P(9a-2, -b)$ divides line segment joining $A(3a+1, -3)$ and $B(8a, 5)$ in the ratio $3:1$, then the values of a and b is ***[NCERT Exemplar]***

(a) $a=-1, b=3$ (b) $a=-1, b=-3$
(c) $a=0, b=0$ (d) $a=1, b=-3$

33. The point $(-4, 6)$ divides the line segment joining the points $A(-6, 10)$ and $B(3, -8)$. The ratio is

(a) 1 : 2 (b) 7 : 2
(c) 2 : 7 (d) 4 : 1

34. If $P\left(\frac{a}{3}, 4\right)$ is the mid-point of the line segment joining the points $Q(-6, 5)$ and $R(-2, 3)$, then the value of a is

(a) -4 (b) -12
(c) 12 (d) -6

35. The fourth vertex D of a parallelogram $ABCD$ whose three vertices are $A(-2, 3)$, $B(6, 7)$ and $C(8, 3)$ is

(a) (0, 1) (b) (0, –1)
(c) (–1, 0) (d) (1, 0)

36. If $x-2y+k=0$ is a median of the triangle whose vertices are at points $A(-1, 3)$, $B(0, 4)$ and $C(-5, 2)$, then the value of k is

(a) 2 (b) 4
(c) 6 (d) 8

37. The perpendicular bisector of the line segment joining the points $A(1, 5)$ and $B(4, 6)$ cuts the Y-axis at

(a) (0, 13) (b) (0, –13)
(c) (0, 12) (d) (13, 0)

38. The point ..... lies on the perpendicular bisector of the line segment joining the points $A(-2, -5)$ and $B(2, 5)$.

(a) (0, 0) (b) (0, 2)
(c) (2, 0) (d) (–2, 0)

39. A line intersects the Y-axis and X-axis at the points P and Q, respectively. If $(2, -5)$ is the mid-point of PQ, then the coordinates of P and Q are, respectively

(a) (0, –5) and (2, 0)
(b) (0, 10) and (– 4, 0)
(c) (0, 4) and (– 10, 0)
(d) (0, – 10) and (4, 0)

40. ΔABC with vertices $A(-2, 0)$, $B(2, 0)$ and $C(0,2)$ is similar to ΔDEF with vertices $D(-4, 0)$, $E(4, 0)$ and $F(0, 4)$.

(a) True (b) False
(c) Can't say (d) Partially True/False

41. If (a, b) is the mid-point of the line segment joining the points $A(10, -6)$ and $B(k, 4)$ and $a-2b=18$, then the value of k is

(a) 30 (b) 22
(c) 4 (d) 40

42. Using section formula, check that the points $A(-3, -1)$, $B(1, 3)$ and $C(-1, 1)$ are collinear.

(a) Yes (b) No
(c) Can't say (d) None of these

43. The ratio, in which the Y-axis divides the line segment joining the points $(5, -6)$ and $(-1, -4)$ is

(a) 1 : 5 (b) 5 : 1
(c) 2 : 4 (d) None of these

44. Find the coordinates of the point which divides the join of $(-1, 7)$ and $(4, -3)$ in the ratio $2:3$.

(a) (1, 3) (b) (2, 6)
(c) (3, 4) (d) (4, 6)

45. The ratio in which the point $P(m, 6)$ divides the join $A(-4, 3)$ and $B(2, 8)$ is ..... .

(a) 2 : 3 (b) 1 : 2
(c) 3 : 2 (d) 2 : 1

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46. If the points A (6, 1), B (8, 2), C (9, 4) and D (p, 3) are the vertices of a parallelogram, taken in order, then the value of p is

(a) 5 (b) 6
(c) 8 (d) 7

47. The coordinates of point A, where AB is the diameter of a circle whose centre is (3, – 4) and B is (1, 4) is

(a) (2, 0)
(b) (12, –5)
(c) (5, –12)
(d) None of the above

48. The coordinates of the point of trisection of the line segment joining (2, – 3) and (4, – 1). (when the point is near the point (2, – 3)) is

(a) (10/3, –5/3)
(b) (8/3, –7/3)
(c) (3, –2)
(d) None of the above

Matching Type

49. List-II gives the coordinates of the point P that divides the line segment joining the points in the given ratio given in List-I, match them correctly.

	List I		List II
P.	$A(-1, 3)$ and $B(-5, 6)$ internally in the ratio 1 : 2	1.	(7, 3)
Q.	$A(-2, 1)$ and $B(1, 4)$ internally in the ratio 2 : 1	2.	(0, 3)
R.	$A(1, 7)$ and $B(3, 4)$ internally in the ratio 3 : 2	3.	$\left(\frac{11}{5}, \frac{26}{5}\right)$
S.	$A(4, -3)$ and $B(8, 5)$ internally in the ratio 3 : 1	4.	$\left(-\frac{7}{3}, 4\right)$

Codes

	P	Q	R	S		P	Q	R	S
(a)	4	2	3	1	(b)	3	2	4	1
(c)	1	4	3	2	(d)	3	1	2	4

50. Match the following

	List I		List II
P.	Distance between (– 6, 7) and (– 1, – 5) is	1.	– 3, 7
Q.	The value of k for which the distance between $A(k, -5)$ and $B(2, 7)$ is 13 units	2.	$x + y = 5$
R.	(x, y) is equidistant from (5, 1) and (–1, 5), if	3.	$3x = 2y$
S.	(x, y), (2, 3) and (4, 1) are collinear, if	4.	13 units

Codes

	P	Q	R	S		P	Q	R	S
(a)	3	4	2	1	(b)	1	2	4	3
(c)	4	1	3	2	(d)	3	2	4	1

Assertion-Reasoning MCQs

Directions (Q. Nos. 46-54) Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) A is true, R is true; R is a correct explanation for A.
(b) A is true, R is true; R is not a correct explanation for A.
(c) A is true; R is False.
(d) A is false; R is true.

51. **Assertion** There is no such point or X-axis which are at a distance c ($c < 3$) from the point (2, 3)

Reason The distance between two points (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

52. **Assertion** The distance of a points $P(x, y)$ from the origin is $\sqrt{x^2 - y^2}$.

Reason If $P(-1, 1)$ is the mid-point of the line segment joining $A(-3, b)$ and $B(1, b + 4)$, then value of b is –1.

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53. **Assertion** If the points A (4, 3) and B (x, 5) are on the circle with centre O (2 , 3), then find the value of x is 2.

Reason If three points (0, 0), (3, $\sqrt{3}$) and (3, λ) form an equilateral triangle, then λ equals to $\pm\sqrt{2}$.

54. **Assertion** Three points A, B, C are such that $AB + BC > AC$, then they are collinear.

Reason Three points are collinear if they lie on a straight line.

55. **Assertion** Points $A(6, 4)$, $B(-4, -6)$ and $C(4, 6)$ are such that $AB = \sqrt{200}$, $BC = \sqrt{208}$, $AC = \sqrt{8}$.

Since, $AB + BC > AC$, points A, B and C form a triangle.

Reason If $BC^2 = AB^2 + AC^2$, then ΔABC is a right triangle, right angled at A.

56. **Assertion** Points (3, 2), (–2, – 3) and (2, 3) form a right triangle.

Reason If (x, y) is equidistant from (3, 6) and (–3, 4), then $3x + y = 5$.

57. **Assertion** In quadrilateral $ABCD$, if $AB = BC = CD = DA$ and $AC = BD$, then $ABCD$ is a square.

Reason A quadrilateral is a square if all its sides are equal and the diagonals are equal.

58. **Assertion** The distance between the points $(10\cos 30°, 0)$ and $(0, 10\cos 60°)$ is 10 units

Reason Mid-point of line segment joining (a, b) and (c, d) is given by $\left(\frac{a-c}{2}, \frac{b-d}{2}\right)$.

59. **Assertion** The coordinates of the points which divide the line segment joining $A(2, -8)$ and $B(-3, -7)$ into three equal parts are $\left(\frac{1}{3}, \frac{-23}{3}\right)$ and $\left(\frac{-4}{3}, \frac{-22}{3}\right)$.

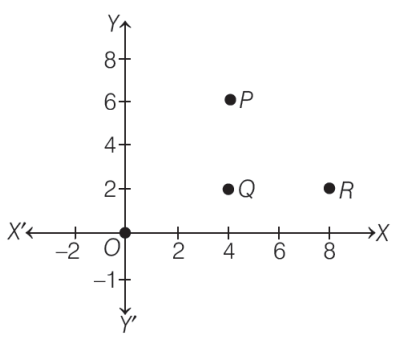
Reason The points which divide AB in the ratio 1 : 3 and 3 : 1 are called points to trisection of AB.

60. **Assertion** Mid-point of a line segment divides line in the ratio 1 : 1.

Reason If area of triangle is zero that means points are collinear.

Case Based MCQs

61. Malika and Karishma are friends living on the same street in Govindpuri. Karishma's house is at the intersection of one street with another street on which there is a temple. They both study in the same school and that is not far from Karishma's house.



Suppose the school is situated at the point O, i.e., the origin, Malika's house is at P Karishma's house is at Q and temple is at R.

Based on the above information, answer the following questions.

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(i) How far is Malika's house from Karishma's house?
(a) 3 units (b) 4 units
(c) 5 units (d) 2 units

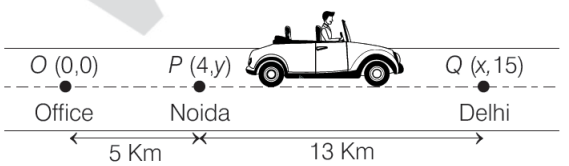
(ii) How far is the temple from Karishma's house?
(a) 3 units (b) 2 units
(c) 5 units (d) 4 units

(iii) How far is the temple from Malika's house?
(a) $2\sqrt{2}$ units (b) $3\sqrt{2}$ units
(c) $4\sqrt{2}$ units (d) None of these

(iv) Which of the following is true?
(a) *PQR* forms a scalene triangle
(b) *PQR* forms an isosceles triangle
(c) *PQR* forms an equilateral triangle
(d) None of the above

(v) How far is the school from Malika's house?
(a) $2\sqrt{13}$ units
(b) $\sqrt{5}$ units
(c) $(\sqrt{13}+\sqrt{5})$ units
(d) $(\sqrt{13}-\sqrt{5})$ units

62. Anmol is driving his car on a straight road towards East from his office to Noida and then to Delhi. At some point in between Noida and Delhi, he suddenly realises that there is not enough Petrol for the journey. Also, there is no Petrol pump on the road between these two cities.



Based on the above information, answer the following questions.

(i) The value of y is equal to
(a) 2 (b) 3
(c) 4 (d) 5

(ii) The value of x is equal to
(a) 4 (b) 5
(c) 8 (d) 9

(iii) If M is any point exactly in between Noida and Delhi, then coordinates of M are
(a) (3, 3) (b) (6.5, 9)
(c) (5, 5) (d) (6, 6)

(iv) The ratio in which Noida divides the line segment joining the office and Delhi is
(a) 1 : 4 (b) 2 : 1
(c) 3 : 2 (d) 2 : 3

(v) If Anmol analyse the CNG at the point M (the mid point of Noida-Delhi), then what should be his decision?
(a) Should he travel back to office
(b) Should try his luck to move towards Delhi
(c) Should be travel back to Noida
(d) None of the above

63. In order to conduct Sports Day activities in your School, lines have been drawn with chalk powder at a distance of 1 m each, in a rectangular shaped ground *ABCD*, 100 flowerpots have been placed at a distance of 1 m from each other along *AD*, as shown in given figure below. Niharika runs 1/4 th the distance *AD* on the 2nd line and posts a green flag. Preet runs $\frac{1}{5}$ th distance *AD* on the eighth line and posts a red flag. ***[CBSE Question Bank]***

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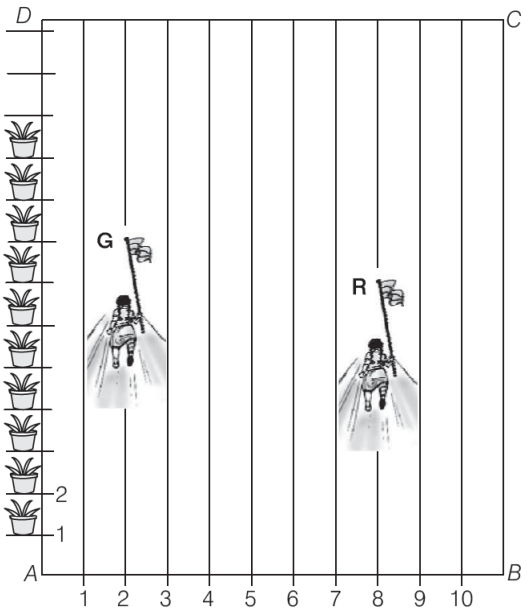

(i) Find the position of green flag
(a) (2, 25) (b) (2, 0.25)
(c) (25, 2) (d) (0, – 25)

(ii) Find the position of red flag
(a) (8, 0) (b) (20, 8)
(c) (8, 20) (d) (8, 0.2)

(iii) What is the distance between both the flags?
(a) $\sqrt{41}$ m (b) $\sqrt{11}$ m
(c) $\sqrt{61}$ m (d) $\sqrt{51}$ m

(iv) If Rashmi has to post a blue flag exactly halfway between the line segment joining the two flags, where should she post her flag?
(a) (5, 22.5) (b) (10, 22)
(c) (2, 8.5) (d) (2.5, 20)

(v) If Joy has to post a flag at 1/4th distance from green flag ,in the line segment joining the green and red flags, then where should he post his flag?
(a) (3.5, 24)
(b) (0.5, 12.5)
(c) (2.25, 8.5)
(d) (25, 20)

64. In a cinema hall, peoples are seated at a distance of 1 m from each other, to maintain the social distance due to CORONA virus pandemic. Let three peoples sit at points P, Q and R whose coordinates are (6, – 2), (9, 4) and (10, 6) respectively.

Based on the above information, answer the following questions.

(i) The distance between P and R is
(a) $\sqrt{5}$ units (b) $4\sqrt{5}$ units
(c) $3\sqrt{5}$ units (d) None of these

(ii) If a TC at the point I, lying on the straight line joining Q and R such that it divides the distance between them in the ratio of 1 : 2. Then coordinates of I are
(a) $\left(\frac{22}{3}, \frac{11}{3}\right)$ (b) $\left(\frac{28}{3}, \frac{14}{3}\right)$
(c) (6, 1) (d) (9, 1)

(iii) The mid-point of the line segment joining P and R is
(a) (1, 6) (b) (6, 1)
(c) $\left(\frac{11}{2}, 0\right)$ (d) None of these

(iv) The ratio in which Q divides the line segment joining P and R is
(a) 2 : 1 (b) 3 : 1
(c) 1 : 2 (d) None of these

(v) The points P, Q and R lies on
(a) a straight line
(b) an equilateral triangle
(c) a scalene triangle
(d) an isosceles triangle

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65. To raise social awareness about hazards of cancer, an organisation decided to start a campaign. 5 students were asked to prepare campaign banners in the shape of a triangle. The vertices of the triangle are, $A(0, 6)$, $B(6, 6)$ and $C(1, 1)$.

Based on the above information, answer the following questions.

(i) The coordinates of centroid of ΔABC are

(a) $\left(\frac{2}{3}, \frac{7}{3}\right)$ (b) $\left(\frac{7}{3}, \frac{13}{3}\right)$

(c) $\left(\frac{-2}{3}, \frac{7}{3}\right)$ (d) $\left(\frac{7}{3}, \frac{2}{3}\right)$

(ii) If S be the mid-point of line joining A and B, then coordinates of S are

(a) (4, 0) (b) (2, 0)

(c) (3, 6) (d) (0, 4)

(iii) If T be the mid-point of the line joining C and B, then coordinates of T are

(a) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{3}{2}, \frac{1}{2}\right)$

(c) $\left(\frac{1}{2}, \frac{3}{2}\right)$ (d) None of these

(iv) If U be the mid-point of line joining C and A then coordinates of U are

(a) $\left(-\frac{5}{2}, \frac{3}{2}\right)$ (b) $\left(\frac{1}{2}, \frac{7}{2}\right)$

(c) $\left(\frac{3}{2}, \frac{5}{2}\right)$ (d) $\left(\frac{5}{2}, \frac{3}{2}\right)$

(v) The coordinates of centroid of ΔSTU are

(a) $\left(\frac{2}{3}, \frac{7}{3}\right)$ (b) $\left(\frac{1}{3}, \frac{1}{3}\right)$

(c) $\left(-\frac{2}{3}, \frac{7}{3}\right)$ (d) $\left(\frac{7}{3}, \frac{13}{3}\right)$

ANSWERS

Multiple Choice Questions

1. (a)	2. (b)	3. (a)	4. (d)	5. (a)	6. (b)	7. (b)	8. (c)	9. (d)	10. (b)
11. (c)	12. (a)	13. (a)	14. (a)	15. (d)	16. (b)	17. (d)	18. (c)	19. (a)	20. (a)
21. (c)	22. (c)	23. (b)	24. (d)	25. (c)	26. (c)	27. (c)	28. (b)	29. (a)	30. (a)
31. (d)	32. (d)	33. (c)	34. (b)	35. (b)	36. (d)	37. (a)	38. (a)	39. (d)	40. (a)
41. (b)	42. (a)	43. (b)	44. (a)	45. (c)	46. (d)	47. (c)	48. (b)	49. (a)	50. (c)

Assertion-Reasoning MCQs

51. (a)	52. (d)	53. (c)	54. (d)	55. (b)	56. (b)	57. (a)	58. (c)	59. (c)	60. (b)

Case Based MCQs

61. (i) - (b); (ii) - (d); (iii) - (c); (iv) - (b); (v) - (a)
62. (i) - (b); (ii) - (d); (iii) - (b); (iv) - (a); (v) - (b)
63. (i) - (a); (ii) - (c); (iii) - (c); (iv) - (a); (v) - (a)
64. (i) - (b); (ii) - (b); (iii) - (d); (iv) - (b); (v) - (a)
65. (i) - (b); (ii) - (c); (iii) - (d); (iv) - (b); (v) - (d)

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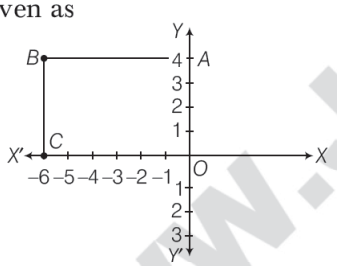
SOLUTIONS

1. Here, the point A lies on side OA, which is at a distance of 4 units from the intersection point O of the lines OX and OY, so its position will be $(4, 0)$ and point C lies on the side OC at a distance of 4 units from the intersection point O, so its position will be $(0, 4)$. Point B lies 4 units away from both the sides (or axes), so its position will be $(4, 4)$.

2. The y-coordinate is also called the ordinate so,
   for P : ordinate = 3
   for Q : ordinate = 4
   for R : ordinate = – 3
   for S : ordinate = – 1

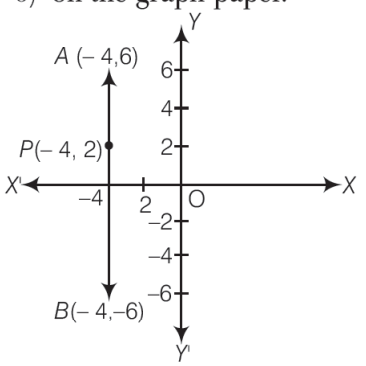
3. It is clear from the graph that point P has 3 unit distance from X-axis in negative y-direction and 2 unit distance from Y-axis in positive x-direction.
   Hence, coordinates of P are $(2, -3)$.

4. According to the question, the figure would be given as



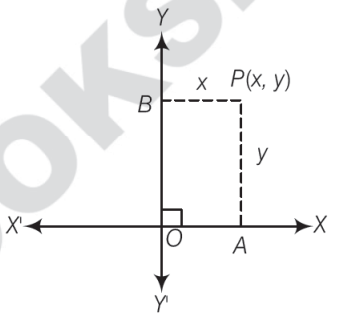
   Coordinates of point $O = (0, 0)$
   Coordinates of point $A = (0, 4)$
   Coordinates of point $B = (-6, 4)$
   Coordinates of point $C = (-6, 0)$

5. We plot all the points $P(-4, 2)$, $A(-4, 6)$ and $B(-4, -6)$ on the graph paper.



   From the figure, point $P(-4, 2)$ lies on the line segment joining the points $A(-4, 6)$ and $B(-4, -6)$.

6. We know that, if (x, y) is any point on the cartesian plane in first quadrant.
   Then, x = Perpendicular distance from Y-axis
   and y = Perpendicular distance from X-axis



   Distance of the point $P(2, 3)$ from the X-axis = Ordinate of a point $P(2, 3)$
   = 3 units.

7. Here, $x_1 = -6$, $y_1 = 7$, $x_2 = -1$ and $y_2 = -5$
   $\therefore$ Distance between two points,
   $$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
   [by distance formula]
   $$= \sqrt{(-1+6)^2 + (-5-7)^2}$$
   $$= \sqrt{(5)^2 + (-12)^2}$$
   $$= \sqrt{25 + 144} = \sqrt{169} = 13 \text{ units}$$

8. The given points are $(a\cos\theta + b\sin\theta, 0)$ and $(0, a\sin\theta - b\cos\theta)$.
   Here, $x_1 = a\cos\theta + b\sin\theta$, $y_1 = 0$
   $x_2 = 0$, $y_2 = a\sin\theta - b\cos\theta$
   $\therefore$ Required distance $= \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
   $$= \sqrt{(a\cos\theta + b\sin\theta - 0)^2 + (0 - a\sin\theta + b\cos\theta)^2}$$
   $$= \sqrt{(a\cos\theta + b\sin\theta)^2 + (b\cos\theta - a\sin\theta)^2}$$

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$$= \sqrt{\begin{array}{l} a^2\cos^2\theta + b^2\sin^2\theta + 2ab\cos\theta\sin\theta \\ + b^2\cos^2\theta + a^2\sin^2\theta - 2ab\sin\theta\cos\theta \end{array}}$$

$$= \sqrt{\cos^2\theta(a^2+b^2) + \sin^2\theta(a^2+b^2)}$$

$$= \sqrt{(a^2+b^2)(\cos^2\theta + \sin^2\theta)}$$

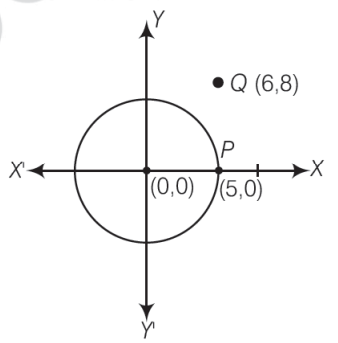
$$= \sqrt{a^2+b^2} \qquad [\because \cos^2\theta + \sin^2\theta = 1]$$

9. Let points are $A(2, y)$ and $B(-4, 3)$.
Here, $(x_1, y_1) = (2, y)$ and $(x_2, y_2) = (-4, 3)$
$\therefore$ Distance between two points,
$$AB = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$
[by distance formula]
$$\Rightarrow AB = \sqrt{(2+4)^2 + (y-3)^2}$$
$$\Rightarrow 10 = \sqrt{(6)^2 + y^2 + 9 - 6y}$$
$[\because AB = 10 \text{ and } (a-b)^2 = a^2 + b^2 - 2ab]$
On squaring both sides, we get
$$\Rightarrow (10)^2 = (6)^2 + y^2 + 9 - 6y$$
$$\Rightarrow 100 = 36 + y^2 + 9 - 6y$$
$$\Rightarrow 100 = 45 + y^2 - 6y$$
$$\Rightarrow y^2 - 6y - 55 = 0$$
$$\Rightarrow y^2 - 11y + 5y - 55 = 0$$
[by factorisation]
$$\Rightarrow y(y-11) + 5(y-11) = 0$$
$$\Rightarrow (y-11)(y+5) = 0$$
$$\Rightarrow y - 11 = 0 \text{ or } y + 5 = 0$$
$$\Rightarrow y = 11 \text{ or } y = -5$$
Hence, the required values of y are 11 and -5.

10. We know that, the points lies on perpendicular bisector of the line segment joining the two points is equidistant from these two points.
$$\therefore PA = \sqrt{(-1-0)^2 + (1-2)^2}$$
$$= \sqrt{1+1} = \sqrt{2} \text{ units}$$
$$PB = \sqrt{(3-0)^2 + (3-2)^2} = \sqrt{9+1} = 10 \text{ units}$$
$\because \quad PA \neq PB$
So, the point P does not lie on the perpendicular bisctor of AB.

11. According to the question, the distance between the points $(4, p)$ and $(1, 0) = 5$
i.e. $\sqrt{(1-4)^2 + (0-p)^2} = 5$
$\left[\because \text{distance between the points } (x_1, y_1) \text{ and } (x_2, y_2),\ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\right]$
$$\Rightarrow \sqrt{(-3)^2 + p^2} = 5$$
$$\Rightarrow \sqrt{9 + p^2} = 5$$
On squaring both the sides, we get
$$9 + p^2 = 25 \Rightarrow p^2 = 16 \Rightarrow p = \pm 4$$
Hence, the required value of p is ± 4.

12. First, we draw a circle and a point from the given information.



Now, distance between origin i.e. O(0, 0) and $P(5, 0)$, $OP = \sqrt{(5-0)^2 + (0-0)^2}$
$\left[\because \text{Distance between two points } (x_1, y_1) \text{ and } (x_2, y_2),\quad d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\right]$
$= \sqrt{5^2 + 0^2} = 5$ units
= Radius of circle and distance between origin $O(0, 0)$
and $Q(6, 8)$, $OQ = \sqrt{(6-0)^2 + (8-0)^2}$
$$= \sqrt{6^2 + 8^2} = \sqrt{36 + 64}$$
$$= \sqrt{100} = 10 \text{ units}$$
We know that, if the distance of any point from the centre is less than/equal to/ more than the radius, then the point is inside/on/outside the circle, respectively.

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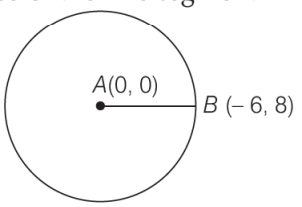
Here, we see that, $OQ > OP$

Hence, it is true that point Q (6, 8), lies outside the circle.

13. Let $A(0, 0)$ and $B(-6, 8)$ be the given points.

Now, radius of the circle is same as the distance of the line segment AB.



$$\therefore \quad AB = \sqrt{(-6-0)^2 + (8-0)^2}$$
$$= \sqrt{36+64} = \sqrt{100} = 10$$

Hence, radius of the circle is 10 units.

14. Let $A = (1, -1)$, $B = (5, 2)$ and $C = (9, 5)$.

Then, $AB = \sqrt{(5-1)^2 + (2+1)^2}$

$[\because \text{distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$

$$= \sqrt{(4)^2 + (3)^2} = \sqrt{16+9}$$
$$= \sqrt{25} = 5 \text{ units}$$
$$BC = \sqrt{(9-5)^2 + (5-2)^2}$$
$$= \sqrt{(4)^2 + (3)^2} = \sqrt{25} = 5 \text{ units}$$

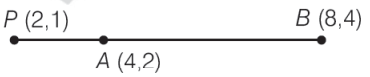
and $AC = \sqrt{(9-1)^2 + (5+1)^2}$

$$= \sqrt{(8)^2 + (6)^2} = \sqrt{100} = 10 \text{ units}$$

$\because$ Here, $AC = AB + BC$

$\therefore$ A, B and C are collinear points.

15. Given that, the point $P(2, 1)$ lies on the line segment joining the points $A(4, 2)$ and $B(8, 4)$, which shows in the figure below



Now, distance between $A(4, 2)$ and $P(2, 1)$,

$AP = \sqrt{(2-4)^2 + (1-2)^2}$

$\left[\because \text{ distance between two points two points } (x_1, y_1) \text{ and } B(x_2, y_2), \; d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\right]$

$$= \sqrt{(-2)^2 + (-1)^2} = \sqrt{4+1} = \sqrt{5} \text{ units}$$

Distance between $A(4, 2)$ and $B(8, 4)$,

$$AB = \sqrt{(8-4)^2 + (4-2)^2} = \sqrt{(4)^2 + (2)^2}$$
$$= \sqrt{16+4} = \sqrt{20} = 2\sqrt{5} \text{ units}$$

Distance between $B(8, 4)$ and $P(2, 1)$,

$$BP = \sqrt{(8-2)^2 + (4-1)^2}$$
$$= \sqrt{6^2 + 3^2} = \sqrt{36+9}$$
$$= \sqrt{45} = 3\sqrt{5} \text{ units}$$
$$\therefore \quad AB = 2\sqrt{5} = 2AP$$
$$\Rightarrow \quad AP = \frac{AB}{2}$$

Hence, required condition is $AP = \dfrac{AB}{2}$.

16. Given, point $P(x, y)$ is equidistant from the points $A(5,1)$ and $B(1, 5)$.

So, $AP = BP$

$\Rightarrow \quad AP^2 = BP^2$ [on squaring both sides]

$\Rightarrow \quad (x-5)^2 + (y-1)^2 = (x-1)^2 + (y-5)^2$

$[\because \text{distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$

$\Rightarrow \quad x^2 + 25 - 10x + y^2 + 1 - 2y$

$= x^2 + 1 - 2x + y^2 + 25 - 10y$

$[\because (a-b)^2 = a^2 + b^2 - 2ab]$

$\Rightarrow \quad -10x + 2x = -10y + 2y$

$\Rightarrow \quad -8x = -8y$

$\Rightarrow \quad x = y$

17. Let $A(x, 0)$ be any point on X-axis, which is equidistant from points $B(1, 3)$ and $(-1, 2)$.

$AB = AC$

$\Rightarrow \quad AB^2 = AC^2$

[squaring both sides]

$\Rightarrow (1-x)^2 + (3-0)^2 = (-1-x)^2 + (2-0)^2$

$[\because \text{distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$

$\Rightarrow \quad 1 + x^2 - 2x + 9 = 1 + x^2 + 2x + 4$

$\Rightarrow \quad 9 - 4 = 2x + 2x$

$\Rightarrow \quad 5 = 4x \Rightarrow x = 5/4$

Hence, point on X-axis is $(5/4, 0)$.

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18. Let $A(x, 0)$ be any point on the X-axis, which is equidistant from points $B(7, 6)$ and $C(-3, 4)$.

$\therefore \quad AB = AC$

$\Rightarrow \quad AB^2 = AC^2$ [on squaring both sides]

$\Rightarrow (7-x)^2 + (6-0)^2 = (-3-x)^2 + (4-0)^2$

$[\because \text{distance } = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$

$\Rightarrow 49 + x^2 - 14x + 36 = 9 + x^2 + 6x + 16$

$[\because (a-b)^2 = a^2 + b^2 - 2ab]$

$\Rightarrow \quad 20x = 60 \Rightarrow x = 3$

Hence, the required point is $A(3, 0)$.

19. Let the coordinate of the point which is equidistant from the three vertices $O(0, 0)$, $A(0, 2y)$ and $B(2x, 0)$ is $P(h, k)$.

Then, $PO = PA = PB$

$\Rightarrow \quad PO^2 = PA^2 = PB^2$ ...(i)

By distance formula,

$[\sqrt{(h-0)^2 + (k-0)^2}]^2$

$= [\sqrt{(h-0)^2 + (k-2y)^2}]^2$

$= [\sqrt{(h-2x)^2 + (k-0)^2}]^2$

$\Rightarrow \quad h^2 + k^2 = h^2 + (k-2y)^2$

$= (h-2x)^2 + k^2$ ...(ii)

Taking first two equations, we get

$h^2 + k^2 = h^2 + (k-2y)^2$

$\Rightarrow \quad k^2 = k^2 + 4y^2 - 4yk \Rightarrow 4y(y-k) = 0$

$\Rightarrow \quad y = k \quad [\because y \neq 0]$

Taking first and third equations, we get

$h^2 + k^2 = (h-2x)^2 + k^2$

$\Rightarrow \quad h^2 = h^2 + 4x^2 - 4xh$

$\Rightarrow \quad 4x(x-h) = 0$

$\Rightarrow \quad x = h \quad [\because x \neq 0]$

$\therefore$ Required points $= (h, k) = (x, y)$

20. Let point on Y-axis be $P(0, k)$. Then,

$PA^2 = PB^2$

$\Rightarrow (6-0)^2 + (5-k)^2 = (-4-0)^2 + (3-k)^2$

$\Rightarrow 36 + 25 + k^2 - 10k = 16 + 9 + k^2 - 6k$

$\Rightarrow \quad 4k = 36 \Rightarrow k = 9$

Hence, coordinates of point on Y-axis are $(0, 9)$.

21. The distance between ends points of the diameter gives the value of the diameter.

Here, the points are $(24, 1)$ and $(2, 23)$

$\therefore \quad d = \sqrt{(2-24)^2 + (23-1)^2}$

$= \sqrt{(-22)^2 + (22)^2}$

$= \sqrt{(22)^2 (1+1)}$

$= 22\sqrt{2}$ units

$\therefore$ Radius of a circle $r = \dfrac{d}{2} = \dfrac{22\sqrt{2}}{2}$

$= 11\sqrt{2}$ units

22. Since, A and B lie on the circle having centre O.

$OA = OB$

$\Rightarrow \sqrt{(4-2)^2 + (3-3)^2} = \sqrt{(x-2)^2 + (5-3)^2}$

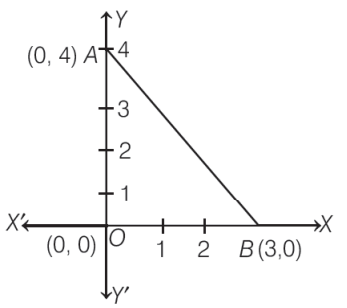
$\Rightarrow \quad 2 = \sqrt{(x-2)^2 + 4}$

$\Rightarrow \quad 4 = (x-2)^2 + 4$

$\Rightarrow \quad (x-2)^2 = 0$

$\Rightarrow \quad x = 2$

23. We plot the vertices of a triangle i.e., $(0, 4)$, $(0, 0)$ and $(3, 0)$ on the paper shown as given below



Now, perimeter of ΔAOB = Sum of the length of all its sides

$= d(AO) + d(OB) + d(AB)$

$\because$ Distance between the points (x_1, y_1) and (x_2, y_2), is

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$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

= Distance between $A(0, 4)$ and $O(0, 0)$
+ Distance between $O(0, 0)$ and $B(3, 0)$
+ Distance between $A(0, 4)$ and $B(3, 0)$

$$= \sqrt{(0-0)^2 + (0-4)^2} + \sqrt{(3-0)^2 + (0-0)^2} + \sqrt{(3-0)^2 + (0-4)^2}$$

$$= \sqrt{0+16} + \sqrt{9+0} + \sqrt{(3)^2 + (4)^2}$$

$$= 4 + 3 + \sqrt{9+16}$$

$$= 7 + \sqrt{25} = 7 + 5 = 12$$

Hence, the required perimeter of triangle is 12 units.

24. Let the given points are $A(0, 0)$, $B(3, \sqrt{3})$ and $C(3, \lambda)$.

Since, ΔABC is an equilateral triangle, therefore

$$AB = AC$$

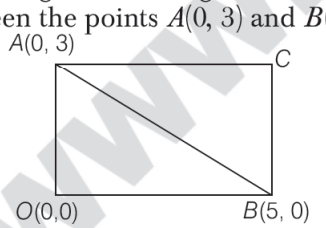
$$\Rightarrow \sqrt{(3-0)^2 + (\sqrt{3}-0)^2} = \sqrt{(3-0)^2 + (\lambda - 0)^2}$$

$$\Rightarrow \quad 9 + 3 = 9 + \lambda^2$$

$$\Rightarrow \quad \lambda^2 = 3$$

$$\Rightarrow \quad \lambda = \pm\sqrt{3}$$

25. Now, length of the diagonal AB = Distance between the points $A(0, 3)$ and $B(5, 0)$.



$\because$ Distance between the points (x_1, y_1) and (x_2, y_2),

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Here, $x_1 = 0$, $y_1 = 3$ and $x_2 = 5$, $y_2 = 0$

$\therefore$ Distance between the points $A(0, 3)$ and $B(5, 0)$

$$AB = \sqrt{(5-0)^2 + (0-3)^2}$$

$$= \sqrt{25+9} = \sqrt{34}$$

Hence, the required length of its diagonal is $\sqrt{34}$ units.

26. Let the points are $A(3,2)$, $B(-2,-3)$ and $C(2,3)$.

Then, $AB = \sqrt{(-2-3)^2 + (-3-2)^2}$

$$[\because \text{ distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\ ]$$

$$= \sqrt{(-5)^2 + (-5)^2} = \sqrt{25+25} = \sqrt{50}$$

$= 7.07$ units (approx)

$$BC = \sqrt{(2+2)^2 + (3+3)^2} = \sqrt{(4)^2 + (6)^2}$$

$= \sqrt{16+36} = \sqrt{52} = 7.21$ units (approx)

and $\quad CA = \sqrt{(3-2)^2 + (2-3)^2}$

$$= \sqrt{(1)^2 + (-1)^2} = \sqrt{1+1}$$

$= \sqrt{2} = 1.41$ (approx)

Also, $(\sqrt{52})^2 = (\sqrt{50})^2 + (\sqrt{2})^2$

$$\Rightarrow \quad BC^2 = AB^2 + CA^2$$

So, by converse of Pythagoras theorem, $\angle A = 90°$

Hence, ΔBAC is a right angled triangle.

27. Let $P(5, -2)$, $Q(6, 4)$ and $R(7, -2)$ are the given points.

Then, $PQ = \sqrt{(6-5)^2 + (4+2)^2}$

$$[\because\ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$$

$= \sqrt{1+36} = \sqrt{37}$ units

$$QR = \sqrt{(7-6)^2 + (-2-4)^2}$$

$= \sqrt{1+36} = \sqrt{37}$ units

Since, $PQ = QR$

$\therefore$ ΔPQR is an isosceles triangle.

28. Let $A(-4, 0)$, $B(4, 0)$, $C(0, 3)$ are the given vertices.

Now, distance between $A(-4, 0)$ and $B(4, 0)$,

$$AB = \sqrt{[4-(-4)]^2 + (0-0)^2}$$

$$\left[\because \text{ distance between two points } (x_1, y_1) \text{ and } (x_2, y_2),\ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\right]$$

$$= \sqrt{(4+4)^2} = \sqrt{8^2} = 8 \text{ units}$$

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Distance between $B(4, 0)$ and $C(0, 3)$,

$$BC = \sqrt{(0-4)^2 + (3-0)^2}$$
$$= \sqrt{16+9} = \sqrt{25} = 5 \text{ units}$$

Distance between $A(-4, 0)$ and $C(0, 3)$,

$$AC = \sqrt{[0-(-4)]^2 + (3-0)^2}$$
$$= \sqrt{16+9} = \sqrt{25} = 5 \text{ units}$$

$\because \quad BC = AC$

Hence, ΔABC is an isosceles triangle because an isosceles triangle has two sides equal.

29. Let the points are $A(2, 3)$, $B(3, 4)$, $C(5, 6)$ and $D(4, 5)$.

Then, by distance formula

$$AB = \sqrt{(3-2)^2 + (4-3)^2} = \sqrt{(1)^2 + (1)^2}$$
$$= \sqrt{2} \text{ units}$$
$$BC = \sqrt{(5-3)^2 + (6-4)^2}$$
$$= \sqrt{(2)^2 + (2)^2} = \sqrt{4+4}$$
$$= \sqrt{8} = 2\sqrt{2} \text{ units}$$
$$CD = \sqrt{(4-5)^2 + (5-6)^2}$$
$$= \sqrt{(-1)^2 + (-1)^2} = \sqrt{2} \text{ units}$$

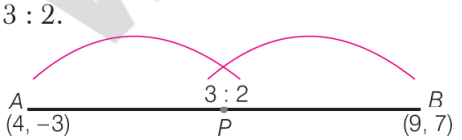
and $AD = \sqrt{(4-2)^2 + (5-3)^2} = \sqrt{(2)^2 + (2)^2}$

$$= \sqrt{4+4} = \sqrt{8} = 2\sqrt{2} \text{ units}$$

Here, $AB = CD$ and $AD = BC$ i.e. the opposite sides are equal. So, given points are vertices of a parallelogram.

30. Let $P(x, y)$ be the required point.

Then, P divides AB internally in the ratio $3 : 2$.



Here, $\dfrac{m_1}{m_2} = \dfrac{3}{2}$ and $(x_1, y_1) = (4, -3)$,

$(x_2, y_2) = (9, 7)$

Then, $P(x, y) =$

$$P\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$

[by section formula]

$$= P\left(\frac{3\times 9 + 2\times 4}{3+2}, \frac{3\times 7 + 2\times(-3)}{3+2}\right)$$
$$= P\left(\frac{27+8}{5}, \frac{21-6}{5}\right) = P\left(\frac{35}{5}, \frac{15}{5}\right)$$
$$= P(7, 3)$$

Therefore, $(7, 3)$ is the required point.

31. If $P(x, y)$ divides the line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$ internally in the ratio

$m : n$, then $x = \dfrac{mx_2 + nx_1}{m+n}$ and $y = \dfrac{my_2 + ny_1}{m+n}$

Given that, $x_1 = 7$, $y_1 = -6$, $x_2 = 3$, $y_2 = 4$, $m = 1$ and $n = 2$

$$\therefore \quad x = \frac{1(3) + 2(7)}{1+2}, \; y = \frac{1(4) + 2(-6)}{1+2}$$

[by section formula]

$$\Rightarrow \quad x = \frac{3+14}{3}, \; y = \frac{4-12}{3}$$
$$\Rightarrow \quad x = \frac{17}{3}, \; y = -\frac{8}{3}$$

So, $(x, y) = \left(\dfrac{17}{3}, -\dfrac{8}{3}\right)$ lies in IV quadrant.

[since, in IV quadrant, x-coordinate is positive and y-coordinate is negative]

32. Let $P(9a - 2, -b)$ divides AB internally in the ratio $3 : 1$.

By section formula,

$$9a - 2 = \frac{3(8a) + 1(3a+1)}{3+1}$$

[$\because$ internal section formula, the coordinates of point P divides the line segment joining the point (x_1, y_1) and (x_2, y_2) in the ratio $m_1 : m_2$ internally is $\left(\dfrac{m_2x_1 + m_1x_2}{m_1 + m_2}, \dfrac{m_2y_1 + m_1y_2}{m_1 + m_2}\right)$]

and $\quad -b = \dfrac{3(5) + 1(-3)}{3+1}$

$$\Rightarrow \quad 9a - 2 = \frac{24a + 3a + 1}{4}$$

and $\quad -b = \dfrac{15-3}{4}$

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$\Rightarrow \quad 9a - 2 = \dfrac{27a + 1}{4}$

and $\quad -b = \dfrac{12}{4}$

$\Rightarrow \quad 36a - 8 = 27a + 1$ and $b = -3$

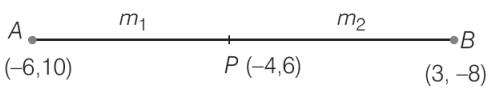
$\Rightarrow \quad 36a - 27a - 8 - 1 = 0$

$\Rightarrow \quad 9a - 9 = 0$

$\therefore \quad a = 1$

Hence, the required values of a and b are 1 and -3.

33. Let point $P(-4, 6)$ divides the line segment joining the points $A(-6, 10)$ and $B(3, -8)$ in the ratio $m_1 : m_2$.



By using section formula, we get

$$(-4, 6) = \left(\frac{3m_1 - 6m_2}{m_1 + m_2}, \frac{-8m_1 + 10m_2}{m_1 + m_2}\right) \quad \ldots(i)$$

On equating x-coordinate from both sides of Eq. (i), we get

$$-4 = \frac{3m_1 - 6m_2}{m_1 + m_2}$$

$\Rightarrow \quad -4(m_1 + m_2) = 3m_1 - 6m_2$

$\Rightarrow \quad -4m_1 - 4m_2 = 3m_1 - 6m_2$

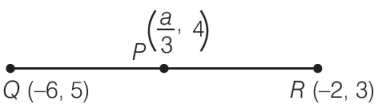
$\Rightarrow \quad -4m_1 - 3m_1 = -6m_2 + 4m_2$

$\Rightarrow \quad -7m_1 = -2m_2$

$\Rightarrow \quad \dfrac{m_1}{m_2} = \dfrac{2}{7}$

$$m_1 : m_2 = 2 : 7$$

34. Given that, $P\left(\dfrac{a}{3}, 4\right)$ is the mid-point of the line segment joining the points $Q(-6, 5)$ and $R(-2, 3)$, which shows in the figure given below



$\therefore$ Mid-point of $QR = P\left(\dfrac{-6-2}{2}, \dfrac{5+3}{2}\right)$

$= P(-4, 4)$

[since, mid-point of line segment having points (x_1, y_1) and $(x_2, y_2) = \left(\dfrac{(x_1 + x_2)}{2}, \dfrac{(y_1 + y_2)}{2}\right)$]

But mid-point $P\left(\dfrac{a}{3}, 4\right)$ is given.

$\therefore \quad \left(\dfrac{a}{3}, 4\right) = (-4, 4)$

On comparing the coordinates, we get

$$\frac{a}{3} = -4$$

$\Rightarrow \quad a = -12$

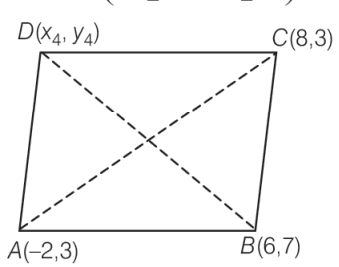
Hence, the required value of a is -12.

35. Let the fourth vertex of parallelogram, $D \equiv (x_4, y_4)$ and L, M be the middle points of AC and BD, respectively.

Then, $L \equiv \left(\dfrac{-2+8}{2}, \dfrac{3+3}{2}\right) \equiv (3, 3)$

[since, mid - point of a line segment having points (x_1, y_1) and $= \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$]

and $\quad M \equiv \left(\dfrac{6 + x_4}{2}, \dfrac{7 + y_4}{2}\right)$



Since, $ABCD$ is a parallelogram, therefore diagonals AC and BD will bisect each other. Hence, L and M are the same points.

$\therefore \quad 3 = \dfrac{6 + x_4}{2}$ and $3 = \dfrac{7 + y_4}{2}$

$\Rightarrow \quad 6 = 6 + x_4$ and $6 = 7 + y_4$

$\Rightarrow \quad x_4 = 0$ and $y_4 = 6 - 7$

$\therefore \quad x_4 = 0$ and $y_4 = -1$

Hence, the fourth vertex of parallelogram is $D \equiv (x_4, y_4) \equiv (0, -1)$

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36. Coordinate of the centroid G of ΔABC

$$= \left(\frac{-1+0-5}{3}, \frac{3+4+2}{3}\right) = (-2, 3)$$

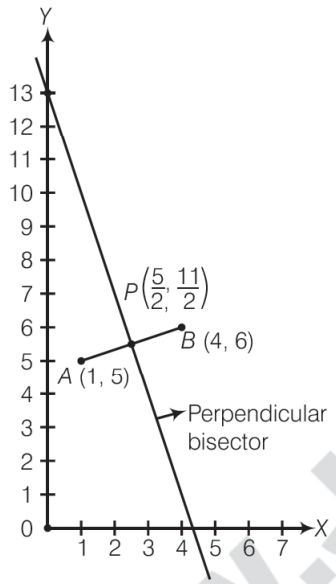
Since, G lies on the median $x - 2y + k = 0$.

So, G satisfy the equation $x - 2y + k = 0$.

$\therefore \quad -2 - 6 + k = 0$

$\Rightarrow \quad k = 8$

37. Firstly, we plot the points of the line segment on the paper and join them.



We know that, the perpendicular bisector of the line segment AB bisect the segment AB, i.e. perpendicular bisector of line segment AB passes through the mid-point of AB.

$\therefore$ Mid-point of $AB = \left(\frac{1+4}{2}, \frac{5+6}{2}\right)$

$\Rightarrow \quad P = \left(\frac{5}{2}, \frac{11}{2}\right)$

[$\because$ mid-point of line segment passes through the points (x_1, y_1) and (x_2, y_2) $= \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$]

Now, we draw a straight line on paper passes through the mid-point P.

We see that the perpendicular bisector cuts the Y-axis at the point (0, 13).

Hence, the required point is (0, 13).

38. We know that, the perpendicular bisector of the any line segment divides the line segment into two equal parts i.e., the perpendicular bisector of the line segment always passes through the mid-point of the line segment.

$\therefore$ Mid-point of the line segment joining the points $A(-2, -5)$ and $B(2, 5)$

$$= \left(\frac{-2+2}{2}, \frac{-5+5}{2}\right) = (0, 0)$$

[since, mid-point of any line segment which passes through the points (x_1, y_1) and $(x_2, y_2) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$]

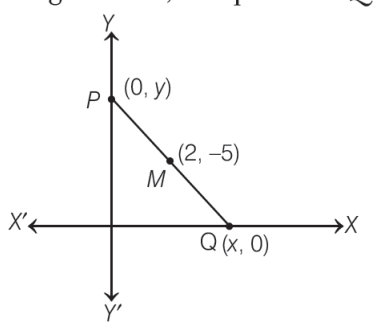
Hence, (0, 0) is the required point lies on the perpendicular bisector of the lines segment.

39. Let the coordinates of P and $Q(0, y)$ and $(x, 0)$, respectively.

So, the mid-point of $P(0, y)$ and $Q(x, 0)$ is $M\left(\frac{0+x}{2}, \frac{y+0}{2}\right)$.

[$\because$ mid-point of a line segment having points (x_1, y_1) and (x_2, y_2) $= \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$]

But it is given that, mid-point of PQ is $(2, -5)$.



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$\therefore \quad 2 = \dfrac{x+0}{2}$ and $-5 = \dfrac{y+0}{2}$

$\Rightarrow \quad 4 = x$ and $-10 = y$

$\Rightarrow \quad x = 4$ and $y = -10$

So, the coordinates of P and Q are $(0, -10)$ and $(4, 0)$.

40. $\therefore$ Distance between $A(-2,0)$ and $B(2, 0)$,

$AB = \sqrt{[2-(-2)]^2 + (0-0)^2}$

$= \sqrt{(4)^2 + 0} = \sqrt{16} = 4$ units

[$\because$ distance between the points (x_1, y_1) and (x_2, y_2), $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$]

Similarly, distance between $B(2, 0)$ and $C(0, 2)$, $BC = \sqrt{(0-2)^2 + (2-0)^2}$

$= \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$ units

In ΔABC, distance between $C(0, 2)$ and $A(-2, 0)$,

$CA = \sqrt{[0-(-2)]^2 + (2-0)^2}$

$= \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$ units

Distance between $F(0, 4)$ and $D(-4, 0)$,

$FD = \sqrt{(0+4)^2 + (0-4)^2} = \sqrt{4^2 + (-4)^2}$

$= \sqrt{16+16} = \sqrt{32} = 4\sqrt{2}$ units

Distance between $F(0, 4)$ and $E(4, 0)$,

$FE = \sqrt{(4-0)^2 + (0-4)^2} = \sqrt{4^2 + (-4)^2}$

$= \sqrt{16+16} = \sqrt{32} = 4\sqrt{2}$ units

and distance between $E(4, 0)$ and $D(-4, 0)$,

$ED = \sqrt{[4-(-4)]^2 + (0)^2}$

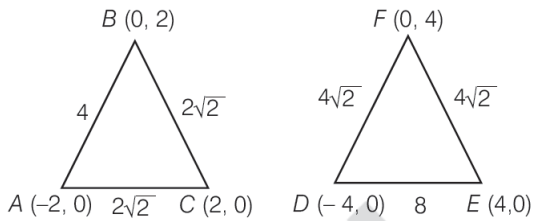
$= \sqrt{(4+4)^2 + 0} = \sqrt{8^2} = \sqrt{64} = 8$ units

Now, $\dfrac{AB}{DE} = \dfrac{4}{8} = \dfrac{1}{2}$, $\dfrac{AC}{DF} = \dfrac{2\sqrt{2}}{4\sqrt{2}} = \dfrac{1}{2}$,

$\dfrac{BC}{EF} = \dfrac{2\sqrt{2}}{4\sqrt{2}} = \dfrac{1}{2}$

$\therefore \quad \dfrac{AB}{DE} = \dfrac{AC}{DF} = \dfrac{BC}{EF}$

Here, we see that sides of ΔABC and ΔFDE are propotional.



Hence, both the triangles are similar.

[by SSS rule]

41. Given, point (a, b) is the mid-point of the line segment joining the points $A(10, -6)$ and $B(k, 4)$.

$\therefore$ Coordinate of mid-point of

$AB = \left(\dfrac{10+k}{2}, \dfrac{-6+4}{2}\right)$

$\Rightarrow \quad (a, b) = \left(\dfrac{10+k}{2}, -1\right)$

Equate the x and y-coordinates both sides, we get

$a = \dfrac{10+k}{2}$ and $b = -1$

Also, given relation is

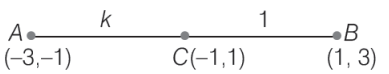
$a - 2b = 18$

$\therefore \quad \dfrac{10+k}{2} - 2(-1) = 18$

$\Rightarrow \quad \dfrac{10+k}{2} = 18 - 2 \Rightarrow 10 + k = 2 \times 16$

$\Rightarrow \quad k = 32 - 10 \Rightarrow k = 22$

42. Let $C(-1, 1)$ divides AB in the ratio $k:1$.



Then, by using section formula, we get

Coordinates of C are $\left(\dfrac{k-3}{k+1}, \dfrac{3k-1}{k+1}\right)$.

Thus, $C(-1, 1) = C\left(\dfrac{k-3}{k+1}, \dfrac{3k-1}{k+1}\right)$

On equating x-coordinate from both sides, we get

$-1 = \dfrac{k-3}{k+1} \Rightarrow -k - 1 = k - 3$

$\Rightarrow \quad -2k = -3 + 1 \Rightarrow -2k = -2 \Rightarrow k = 1$

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On equating y-coordinate from both sides, we get

$$1 = \frac{3k-1}{k+1}$$

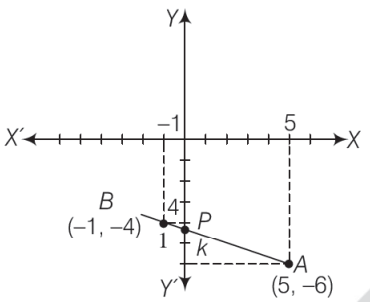
$\Rightarrow \quad k+1 = 3k-1$

$\Rightarrow \quad 2k = 2 \Rightarrow k = 1$

Since, in both cases value of k is same.
So, C divides AB in the ratio $1:1$, i.e. C is the mid-point of AB.

Hence, A, B and C are collinear.

43. Let AB be the given line segment with end points $A(5, -6)$ and $B(-1, -4)$. Also, let Y-axis divides AB in the ratio $k : 1$ at point P.



Then, by using section formula,

Coordinates of $P = \left(\frac{-k+5}{k+1}, \frac{-4k-6}{k+1}\right)$ ...(i)

Since, on the Y-axis, abscissa is 0.

So, x-coordinate of P will be zero.

On equating x-coordinate of P to 0, we get

$$\frac{-k+5}{k+1} = 0$$

$\Rightarrow \quad -k+5 = 0 \Rightarrow k = 5$

Thus, the required ratio is $5 : 1$.

44. Let the coordinates of a point are (x, y).

We have, $\quad x_1 = -1, y_1 = 7;$

$x_2 = 4, y_2 = -3$

and $\quad m_1 = 2, m_2 = 3$

$\therefore$ By using section formula,

$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}$$

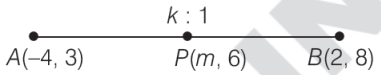
$$= \frac{2(4) + 3(-1)}{2+3} = \frac{8-3}{5} = \frac{5}{5} = 1$$

and $\quad y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2} = \frac{2(-3) + 3(7)}{2+3}$

$$= \frac{-6+21}{5} = \frac{15}{5} = 3$$

Hence, coordinates of the point are $(1, 3)$.

45. $A(-4, 3)$, $B(2, 8)$ and $P(m, 6)$



Let P divides the join of AB in the ratio of $k:1$.

$\therefore$ y-coordinate of $P = \frac{k \times 8 + 1 \times 3}{k+1}$

$\Rightarrow \quad 6 = \frac{8k+3}{k+1}$

$\Rightarrow \quad 6k + 6 = 8k + 3$

$\Rightarrow \quad 2k = 3$

$\Rightarrow \quad k = \frac{3}{2}$

$\therefore$ P divides the join of AB in the ratio of $3 : 2$.

46. Given, vertices of a parallelogram are $A(6, 1)$, $B(8, 2)$, $C(9, 4)$ and $D(p, 3)$.

Here, we have to find the value of p.

We know that, diagonals of a parallelogram bisect each other.

$\therefore$ Coordinates of mid-point of diagonal AC

= Coordinates of mid-point of diagonal BD

$\Rightarrow \quad \left(\frac{6+9}{2}, \frac{1+4}{2}\right) = \left(\frac{8+p}{2}, \frac{2+3}{2}\right)$

$\left[\because \text{mid-point} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)\right]$

$\Rightarrow \quad \left(\frac{15}{2}, \frac{5}{2}\right) = \left(\frac{8+p}{2}, \frac{5}{2}\right)$

On equating x-coordinate from both sides, we get

$\frac{15}{2} = \frac{8+p}{2} \Rightarrow 15 = 8 + p$

$\Rightarrow p = 15 - 8 \Rightarrow p = 7$

Hence, the required value of p is 7.

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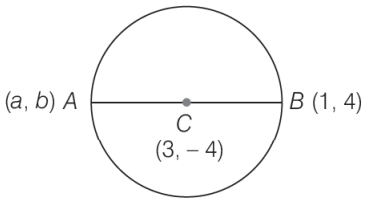
47. Let, AB be the diameter and C be the centre of the circle. Let coordinates of A be (a, b). Clearly, C will be the mid-point of AB.



$\therefore$ Coordinates of $C = \left(\frac{a+1}{2}, \frac{b+4}{2}\right)$

$$\left[\because \text{mid-point} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)\right]$$

$\Rightarrow \quad (3, -4) = \left(\frac{a+1}{2}, \frac{b+4}{2}\right)$

[given, coordinates of $C = (3, -4)$]

On comparing the coordinates of x and y from both sides, we get

$$\frac{a+1}{2} = 3 \quad \text{and} \quad \frac{b+4}{2} = -4$$

$\Rightarrow \quad a + 1 = 6 \quad$ and $\quad b + 4 = -8$

$\Rightarrow \quad a = 5$ and $b = -12$

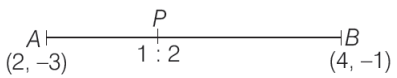
Hence, the coordinates of point A are $(5, -12)$.

48. Let P and Q be the points of trisection as shown below

Then, $AP : PB = 1 : 2$ and $AQ : QB = 2 : 1$

(i) When P divides AB in the ratio $1 : 2$.

Then, $\frac{m_1}{m_2} = \frac{1}{2}$



Here, $A(x_1, y_1) = (2, -3)$ and $B(x_2, y_2) = (4, -1)$

Now,

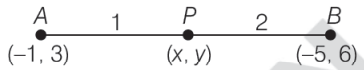
$$P(x, y) = P\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$

[by section formula]

$$= P\left(\frac{1\times 4 + 2\times 2}{1+2}, \frac{1\times(-1) + 2\times(-3)}{1+2}\right)$$

$$= P\left(\frac{4+4}{3}, \frac{-1-6}{3}\right) = P\left(\frac{8}{3}, \frac{-7}{3}\right)$$

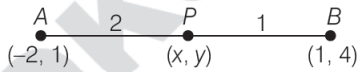
49. (P)



$$x = \frac{-5-2}{3} = -\frac{7}{3} \Rightarrow y = \frac{6+6}{3} = 4$$

$\therefore$ Point P is $\left(\frac{-7}{3}, 4\right)$

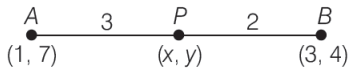
(Q)



$$x = \frac{2-2}{2+1} = 0, \; y = \frac{8+1}{2+1} = 3$$

$\therefore$ Point P is $(0, 3)$

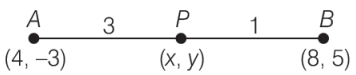
(R)



$$x = \frac{9+2}{5} = \frac{11}{5}, \; y = \frac{12+14}{5} = \frac{26}{5}$$

$\therefore$ Point P is $\left(\frac{11}{5}, \frac{26}{5}\right)$

(S)



$$x = \frac{24+4}{3+1} = 7, \; y = \frac{15-3}{3+1} = 3$$

$\therefore$ Point P is $(7, 3)$

50. (P) Distance between $(-6, 7)$ and $(-1, -5)$

$= \sqrt{(-1+6)^2 + (-5-7)^2} = \sqrt{(5)^2 + 12)^2}$

$= \sqrt{25 + 144} = \sqrt{169} = 13$ units

(Q)

The given points are $A(k, -5)$ and $B(2, 7)$.

Now, $AB = 13 \Rightarrow AB^2 = 169$

$\Rightarrow (2-k)^2 + (7+5)^2 = 169$

$\Rightarrow k^2 - 4k + 4 + 144 = 169$

$\Rightarrow k^2 - 4k - 21 = 0$

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$\Rightarrow (k-7)(k+3)=0$

$\Rightarrow k=7$ or $k=-3$

(R) $P(x, y)$, $A(5, 1)$, $B(-1, 5)$

$$PA = PB$$

$\Rightarrow \quad PA^2 = PB^2$

$\Rightarrow (5-x)^2+(1-y)^2=(-1-x)^2+(5-y)^2$

$\Rightarrow 25+x^2-10x+1+y^2-2y$

$=1+x^2+2x+25+y^2-10y$

$\Rightarrow \quad 3x=2y$

(S) (x, y), $(2, 3)$ and $(4, 1)$ are collinear,

then $x(3-1)+2(1-y)+4(y-3)=0$

$\Rightarrow 2x+2-2y+4y-12=0$

$\Rightarrow x+y=5$

51. Let a point on X-axis be $(x_1, 0)$, then its distance from the point $(2, 3)$

$\Rightarrow \quad \sqrt{(x_1-2)^2+9}=c$

$\Rightarrow \quad (x_1-2)^2+9=c^2$

$\Rightarrow \quad x_1-2=\sqrt{c^2-9}$

$\Rightarrow$ but $c<3 \Rightarrow c^2-9<0$

$\therefore x_1$ will be imaginary

Hence, both the Assertion are true and Reason is the correct explanation of Assertion.

52. The distance of point $P(x, y)$ from origin

$$=\sqrt{(x-0)^2+(y-0)^2}$$

$$=\sqrt{x^2+y^2}$$

Mid-point of $A(-3, b)$ and $B(1, b+4)$ is

$$\left(\frac{-3+1}{2}, \frac{b+b+4}{2}\right)=(-1, b+2)$$

$\therefore \; b+2=1 \Rightarrow b=-1$

Assertion is false but Reason is true.

53. Since, A and B lie on the circle having centre O.

$$OA = OB$$

$\Rightarrow \sqrt{(4-2)^2+(3-3)^2}$

$=\sqrt{(x-2)^2+(5-3)^2}$

$\Rightarrow \quad 2=\sqrt{(x-2)^2+4}$

$\Rightarrow \quad 4=(x-2)^2+4$

$\Rightarrow \quad (x-2)^2=0 \Rightarrow x=2$

Let the given points are $A(0, 0)$, $B(3, \sqrt{3})$ and $C(3, \lambda)$.

Since, ΔABC is an equilateral triangle, therefore

$$AB = AC$$

$\Rightarrow \sqrt{(3-0)^2+(\sqrt{3}-0)^2}$

$=\sqrt{(3-0)^2+(\lambda-0)^2}$

$\Rightarrow \quad 9+3=9+\lambda^2 \Rightarrow \lambda^2=3$

$\Rightarrow \quad \lambda=\pm\sqrt{3}$

Assertion is true but Reason is false.

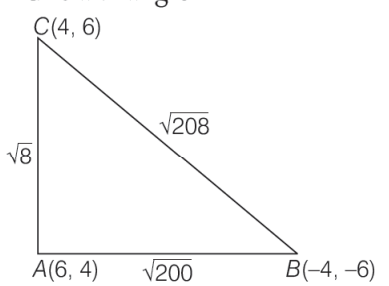
54. Three points A, B, C are collinear, if and onnly if $AB+BC=AC$ but here $AB+BC>AC$

$\therefore A, B, C$ are not collinear.

Hence, Assertion is false but Reason is true.

55. $\therefore AB+BC>AC$ and $AB+AC>BC$

$\therefore ABC$ is a triangle



[$\because$ Sum of the two sides is greater than third side]

Also, $BC^2=AB^2+AC^2$

$[\because (\sqrt{208})^2=(\sqrt{200})^2+(\sqrt{8})^2]$

$\therefore ABC$ is a right angled triangle.

Assertion is true Reason is true but is not the correct explanation of Assertion.

56. Let $A(3, 2)$, $B(-2, -3)$ and $C(2, 3)$.

$\therefore AB=\sqrt{(-2-3)^2+(-3-2)^2}=\sqrt{50}$ units

$BC=\sqrt{(-2-2)^2+(-3-3)^2}=\sqrt{52}$ units

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and $CA = \sqrt{(2-3)^2 + (3-2)^2} = \sqrt{2}$ units

$\therefore\ BC^2 = AB^2 + CA^2$

$\Rightarrow \Delta ABC$ is a right triangle.

Let $A'(3, 6)$, $B'(-3, 4)$ and $P(x, y)$

Since, P is equidistant from A' and B', then

$$PA' = PB'$$

$$\Rightarrow \quad PA'^2 = PB'^2$$

$$\Rightarrow (x-3)^2 + (y-6)^2 = (x+3)^2 + (y-4)^2$$

$$\Rightarrow x^2 - 6x + 9 + y^2 - 12y + 36 = x^2 + 6x + 9 + y^2 - 8y + 16$$

$$\Rightarrow \quad 12x + 4y = 20$$

$$\Rightarrow \quad 3x + y = 5$$

Both the statements are true but the Reason is not correct explanation of the Assertion.

57. In quadrilateral $ABCD$

$AB = BC = CD = DA$ and $AC = BD$

Now will sides of quadrilateral are equal and diagonals $AC = BD$

$\therefore$ Quadrilateral is a square.

Assertion is true Reason is true and is the correct explanation of Assertion.

58. Here, $x_1 = 10\cos 30°$, $y_1 = 0$ and $x_2 = 0$, $y_2 = 10\cos 60°$

$\therefore$ Distance between the points

$$= \sqrt{(0 - 10\cos 30°)^2 + (10\cos 60° - 0)^2}$$

$$= \sqrt{\left(-10 \times \frac{\sqrt{3}}{2}\right)^2 + \left(10 \times \frac{1}{2}\right)^2}$$

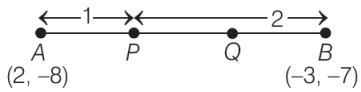
$$\left[\because \cos 30° = \frac{\sqrt{3}}{2} \text{ and } \cos 60° = \frac{1}{2}\right]$$

$$= \sqrt{\frac{300}{4} + \frac{100}{4}}$$

$$= \sqrt{\frac{400}{4}} = \sqrt{100} = 10 \text{ units}$$

Hence, Assertion is true but Reason is false as the mid-point is $\left(\frac{a+c}{2}, \frac{b+d}{2}\right)$.

59.



$AP : PB = 1 : 2$

$$\therefore \text{Coordinates of } P = \left(\frac{-3+4}{3}, \frac{-7-16}{3}\right) = \left(\frac{1}{3}, \frac{-23}{3}\right)$$

Also, $AQ : QB = 2 : 1$

$$\therefore \text{Coordinates of } Q = \left(\frac{-6+2}{3}, \frac{-14-8}{3}\right) = \left(\frac{-4}{3}, \frac{-22}{3}\right)$$

Hence, Assertion is true but Reason is false

60. Both the statements are true but the Reason is not the correct explanation of the Assertion.

61. (i) In the figure, the coordinates of points are $P(4, 6)$, $Q(4, 2)$ and $R(8, 2)$.

Given, Malika's house is at $P(4, 6)$ and Karishma's house at $Q(4, 2)$

$\therefore$ Required distance $= PQ$

$$= \sqrt{(2-6)^2 + (4-4)^2}$$

$$= \sqrt{16 + 0} = 4 \text{ units}$$

(ii) Given, Karishma's house is at $Q(4, 2)$ and temple is at $R(8, 2)$

$\therefore$ Required distance $= QR$

$$= \sqrt{(2-2)^2 + (8-4)^2}$$

$$= \sqrt{0 + 16}$$

$$= 4 \text{ units}$$

(iii) Given, Malika's house is at $P(4, 6)$ and temple is at $R(8, 2)$

$\therefore$ Required distance $= PR$

$$= \sqrt{(2-6)^2 + (8-4)^2}$$

$$= \sqrt{16 + 16}$$

$$= \sqrt{32}$$

$$= 4\sqrt{2} \text{ units}$$

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(iv) As, $PQ = QR = 4$ units

and $PR = 4\sqrt{2}$ units

i.e., $PQ = QR \neq PR$

Hence, ΔPQR is an isosceles triangle.

(v) Given, School is at $O(0, 0)$ and Malika's house is at $P(4, 6)$

$\therefore$ Required distance $= OP$

$$= \sqrt{(6-0)^2 + (4-0)^2}$$

$$= \sqrt{36+16}$$

$$= \sqrt{52} = 2\sqrt{13} \text{ units}$$

62. (i) As we have,

$$OP = 5 \text{ km}$$

$$\because \quad OP = \sqrt{(4)^2 + (y)^2}$$

$$25 = 16 + y^2 \qquad [\because OP = 5]$$

$$y^2 = 9$$

$$y = 3$$

(ii) As we have $PQ = 13$ km

$$PQ = \sqrt{(15-3)^2 + (x-4)^2}$$

$$169 = 144 + (x-4)^2$$

$$(x-4)^2 = 25$$

$$x - 4 = 5$$

$$x = 9$$

(iii) Given, Coordinates of P and Q are $P(4, 3)$ and $Q(9, 15)$

As, M is the mid point

$$\therefore M\left(\frac{4+9}{2}, \frac{3+15}{2}\right) = \left(\frac{13}{2}, \frac{18}{2}\right) = (6.5, 9)$$

(iv) Let P divides OQ in the ratio $K:1$

$$\therefore \quad 3 = \frac{K \times 15 + 1 \times 0}{K+1}$$

$$3K + 3 = 15K$$

$$12K = 3$$

$$K = \frac{1}{4} \quad \text{i.e., } 1:4$$

(v) Since, M is the mid-point of Noida and Delhi or $PM = MQ$

Hence, Anmol should try his luck moving towards Delhi.

63. (i) It can be observed that Niharika posted the green flag at $\frac{1}{4}$th distance of AD i.e. $\frac{1}{4} \times 100 = 25$ m from the starting point of 2nd line.

Therefore, the coordinates of this point G is $(2, 25)$.

(ii) Preet posted red flag at $\frac{1}{5}$th distance of AD,

i.e. $\frac{1}{5} \times 100 = 20$ m from the starting point of 8th line.

Therefore, the coordinates of this point R is $(8, 20)$.

(iii) Distance between these flags $= GR$

$$= \sqrt{(8-2)^2 + (25-20)^2}$$

$$= \sqrt{(6)^2 + (5)^2}$$

$$= \sqrt{36+25}$$

$$= \sqrt{61} \text{ m}$$

(iv) The point at which Rashmi should post her blue flag is the mid-point of the line joining these points.

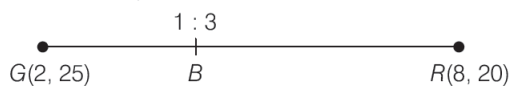
Let this point be $A(x, y)$.

$$x = \frac{2+8}{2}, \; y = \frac{25+20}{2}$$

$$x = \frac{10}{2} = 5, \; y = \frac{45}{2} = 22.5$$

Hence, $A(x, y) = (5, 22.5)$

(v) Let the point at which Joy post his flag be $B(x, y)$.



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Then, $x = \dfrac{1 \times 8 + 3 \times 2}{1 + 3}$,

$$y = \frac{1 \times 20 + 3 \times 25}{1 + 3}$$

$$x = \frac{14}{4} = 3.5,$$

$$y = \frac{95}{4} = 23.75 \approx 24$$

Hence, $B(x, y) = (3.5, 24)$

64. (i) Given, coordinates of $P(6, -2)$ and $R(10, 6)$

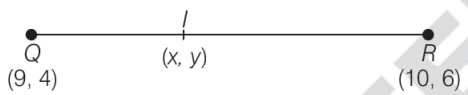
$\therefore$ Required distance

$$= \sqrt{(6 - (-2))^2 + (10 - 6)^2}$$

$$= \sqrt{64 + 16} = \sqrt{80}$$

$$= 4\sqrt{5} \text{ units}$$

(ii) Let the coordinates of I be (x, y)



By section formula,

$$x = \frac{1 \times 10 + 2 \times 9}{1 + 2} = \frac{10 + 18}{3} = \frac{28}{3}$$

$$y = \frac{1 \times 6 + 2 \times 4}{1 + 2} = \frac{6 + 8}{3} = \frac{14}{3}$$

Hence, the coordinates of I is

$$\left(\frac{28}{3}, \frac{14}{3}\right)$$

(iii) Given, coordinates of $P(6, -2)$ and $R(10, 6)$.

mid-point of

$$PR = \left(\frac{6 + 10}{2}, \frac{-2 + 6}{2}\right)$$

$$= \left(\frac{16}{2}, \frac{4}{2}\right) = (8, 2)$$

(iv) Let Q divides the segment PR in the ratio $K : 1$

Then, $9 = \dfrac{K \times 10 + 1 \times 6}{K + 1}$

$$9 = \frac{10K + 6}{K + 1}$$

$$9K + 9 = 10K + 6$$

$$K = 3$$

Hence, the ratio will be 3 : 1

(v) As, Q divides PR in the ratio 3 : 1

Hence, P, Q, R lies on a straight line.

65. (i) Here, $A(0, 6)$, $B(6, 6)$, $C(1, 1)$

$\therefore$ Coordinates of centroid of ΔABC

$$= \left(\frac{0 + 6 + 1}{3}, \frac{6 + 6 + 1}{3}\right)$$

$$= \left(\frac{7}{3}, \frac{13}{3}\right)$$

(ii) Given, Coordinates of A and B are (0, 6) and (6, 6).

Mid-point of $AB = \left(\dfrac{0 + 6}{2}, \dfrac{6 + 6}{2}\right)$

$$= \left(\frac{6}{2}, \frac{12}{2}\right) = (3, 6)$$

(iii) Given, Coordinates of B and C are (6, 6) and (1, 1)

Mid-point of $BC = \left(\dfrac{6 + 1}{2}, \dfrac{6 + 1}{2}\right)$

$$= \left(\frac{7}{2}, \frac{7}{2}\right)$$

(iv) Given, Coordinates of A and C are (0, 6) and (1, 1)

Mid-point of $AC = \left(\dfrac{0 + 1}{2}, \dfrac{6 + 1}{2}\right)$

$$= \left(\frac{1}{2}, \frac{7}{2}\right)$$

(v) Coordinates of S, T, and U are as $S(3, 6)$, $T\left(\dfrac{7}{2}, \dfrac{7}{2}\right)$ and $U\left(\dfrac{1}{2}, \dfrac{7}{2}\right)$

As we know, the centroid of triangle formed by joining the mid-points of sides of given triangle is same as that of the given triangle

Hence, centroid of $\Delta STU = \left(\dfrac{7}{3}, \dfrac{13}{3}\right)$

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05

Triangles

Quick Revision

Similar Figures

Two geometrical figures are said to be similar figures, if they have same shape but not necessarily the same size.

Similar Polygons

Two polygons of the same number of sides are similar, if

(i) all the corresponding angles are equal and

(ii) all the corresponding sides are in the same ratio (or proportion).

If only one condition from (i) and (ii) is true for two polygons, then they cannot be similar.

Scale Factor

The ratio that compares the measurements of two similar shapes, is called the scale factor or representative fraction. It is equal to the ratio of corresponding sides of two figures. We can use the ratio of corresponding sides to find unknown sides of similar shapes.

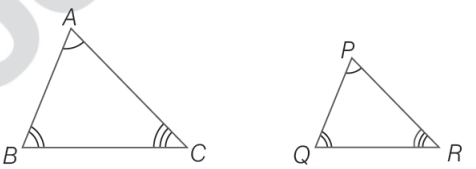
Similar Triangles

Two triangles are said to be similar, if

(i) their corresponding angles are equal and

(ii) their corresponding sides are proportional. (i.e. the ratios of the lengths of corresponding sides are same).

Symbolically it can be represented by the symbol '~'.



e.g. In ΔABC and ΔPQR, if

$$\angle A = \angle P, \quad \angle B = \angle Q, \angle C = \angle R$$

and $\dfrac{AB}{PQ} = \dfrac{BC}{QR} = \dfrac{AC}{PR}$.

Then, ΔABC is similar to ΔPQR.

Conversely If ΔABC is similar to ΔPQR, then

$$\angle A = \angle P, \ \angle B = \angle Q, \angle C = \angle R$$

and $\dfrac{AB}{PQ} = \dfrac{BC}{QR} = \dfrac{AC}{PR}$

Basic Proportionality Theorem (BPT)

Theorem 1 (Thales Theorem) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio.

Theorem 2 (Converse of Basic Proportionality Theorem) If a line divides any two sides of a triangle in the same ratio, then the line must be parallel to the third side.

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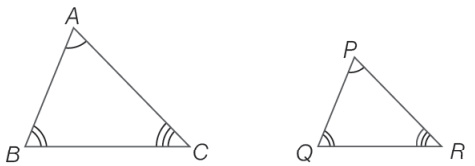
Criteria for Similarity of Triangles

We have some criteria for congruency of two triangles involving only three pairs of corresponding parts (elements) of two triangles. Similarly, we have some criteria for similarity of two triangles, which are given below:

(i) AAA Similarity Criterion

In two triangles, if corresponding angles are equal, then their corresponding sides are proportional and hence the two triangles are similar.



Here, $\angle A = \angle P, \angle B = \angle Q$

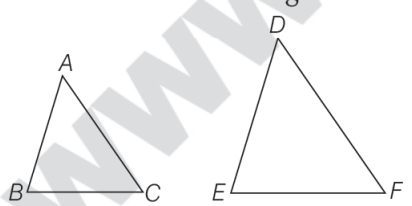
and $\angle C = \angle R$

$\therefore \quad \Delta ABC \sim \Delta PQR$

Note If two angles of one triangle are respectively equal to two angles of another triangle, then the two triangles are similar. AAA similarity criterion can be consider as **AA similarity criterion**.

(ii) SSS Similarity Criterion

If in two triangles, three sides of one triangle are proportional (i.e., in the same ratio) to the three sides of the other triangle, then their corresponding angles are equal and hence the two triangles are similar.

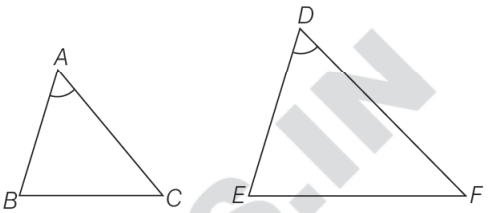


Here, $\dfrac{AB}{DE} = \dfrac{BC}{EF} = \dfrac{AC}{DF} (< 1)$

$\therefore \quad \Delta ABC \sim \Delta DEF$

(iii) SAS Similarity Criterion

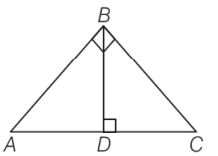
If one angle of a triangle is equal to one angle of the other triangle and the sides including these angles are proportional, then the two triangles are similar.



Here, $\dfrac{AB}{DE} = \dfrac{AC}{DF} (< 1)$ and $\angle A = \angle D$

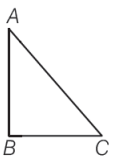
$\therefore \quad \Delta ABC \sim \Delta DEF$

Theorem 1 If a perpendicular is drawn from the vertex of the right angle of a right angled triangle to the hypotenuse, then triangles on both sides of the perpendicular are similar to the whole triangle and to each other.



i.e. $\Delta ADB \sim \Delta ABC$ and $\Delta BDC \sim \Delta ABC$

Theorem 2 (Pythagoras Theorem) In a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.



i.e. $AC^2 = AB^2 + BC^2$

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Objective Questions

Multiple Choice Questions

1. Two figures having the same shape but not necessarily the same size are called similar figures.

(a) True (b) False
(c) Cannot say (d) Partially True/False

2. Two triangles are similar. If their corresponding angles are proportional.

(a) True (b) False
(c) Cannot say (d) Partially True/False

3. All ..... triangles are similar.

(a) equilateral triangle (b) right triangle
(c) scalene triangle (d) None of these

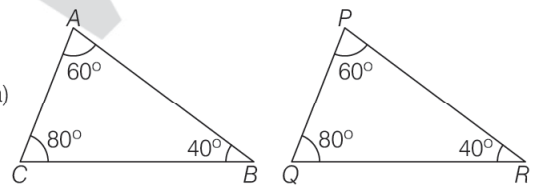
4. Two triangle are similar. If their corresponding sides are ..... .

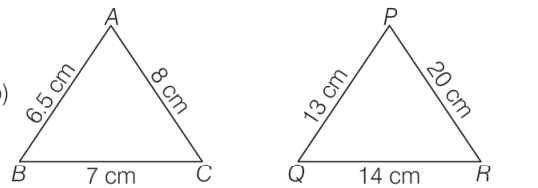
(a) equal
(b) proportional
(c) right angle
(d) None of the above

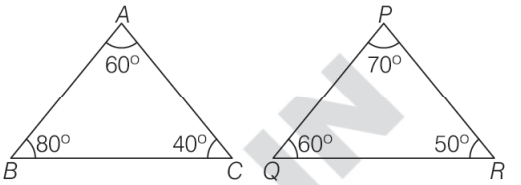
5. "Two quadrilaterals are similar, if their corresponding angles are equal".

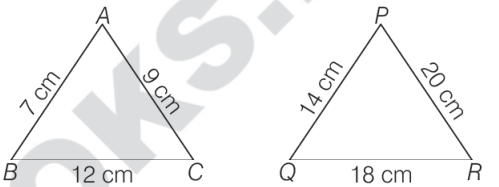
(a) True
(b) False
(c) Cannot say
(d) Partially true/false

6. Which pair of triangles are similar?

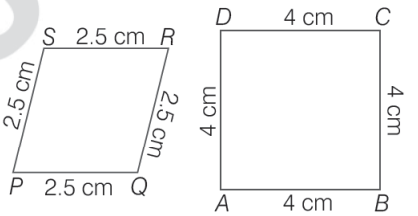
(a)


(b)


(c)


(d)


7. The given quadrilaterals are ..... .

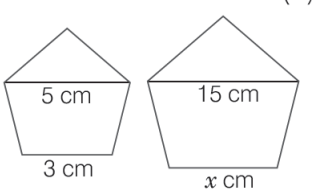


(a) similar
(b) not similar
(c) cannot say
(d) None of the above

8. Two sides and the perimeter of one triangle are respectively three times the corresponding sides and the perimeter of the other triangle then the two triangles are similar.

(a) True (b) False
(c) Cannot say (d) Partially true/false

9. The given shapes are mathematically similar. The unknown side (x) is



(a) 5 cm (b) 3 cm
(c) 9 cm (d) 15 cm

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10. If $\Delta ABC \sim \Delta PQR$, $AB = 6.5$ cm, $PQ = 10.4$ cm and perimeter of $\Delta ABC = 60$ cm, the perimeter of ΔPQR is

(a) 65 cm (b) 96 cm
(c) 60 cm (d) 104 cm

11. It is given that $\Delta ABC \sim \Delta EDF$ such that $AB = 5$ cm, $AC = 7$ cm, $DF = 15$ cm and $DE = 12$ cm. The lengths of the remaining sides of the triangles is

(a) 16.8 cm, 6.25 cm (b) 16.8 cm, 12 cm
(c) 12 cm, 6.25 cm (d) None of these

12. If in ΔABC and ΔDEF, $\frac{AB}{DE} = \frac{BC}{FD}$, then they will be similar, when

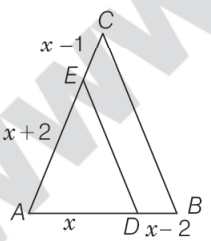
[NCERT Exemplar]

(a) $\angle B = \angle E$ (b) $\angle A = \angle D$
(c) $\angle B = \angle D$ (d) $\angle A = \angle F$

13. If a line divides any two sides of a triangle in the same ratio, then the line is …… to the third sides.

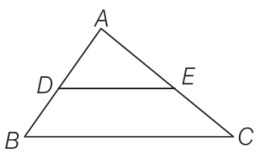
(a) perpendicular (b) parallel
(c) equal (d) None of these

14. In the given figure $DE \| BC$. If $AD = x$, $DB = x - 2$, $AE = x + 2$ and $EC = x - 1$, then the value of x is



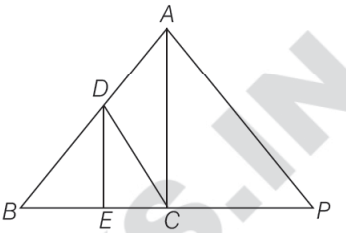
(a) 9 (b) 4 (c) 4.5 (d) 8

15. In the given figure, $DE \| BC$. If $AD = 3$ cm, $DB = 4$ cm and $AE = 6$ cm, then EC is



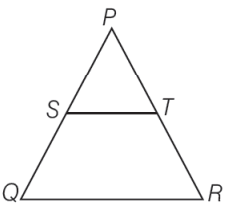
(a) 8 cm (b) 12 cm
(c) 6 cm (d) 4 cm

16. In the given figure of ΔABC, $DE \| AC$. If $DC \| AP$, where point P lies on BC produced, then $\frac{BE}{EC} =$



(a) $\frac{BD}{CP}$ (b) $\frac{BC}{CP}$
(c) $\frac{BC}{DA}$ (d) None of these

17. In ΔPQR, $ST \| QR$, $\frac{PS}{SQ} = \frac{3}{5}$ and $PR = 28$ cm, then the value of PT is

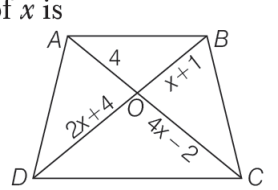


(a) 9.5 cm (b) 9 cm
(c) 10 cm (d) 10.5 cm

18. In ΔABC, D and E are points on the sides AB and AC respectively, such that $DE \| BC$. If $AD = 4x - 3$, $AE = 8x - 7$, $BD = 3x - 1$ and $CE = 5x - 3$, then the value of x is

(a) $\frac{1}{2}$ (b) 4
(c) 1 (d) $\frac{2}{3}$

19. In the given figure, if $AB \| CD$, then the value of x is



(a) 6 (b) 8
(c) 3 (d) 9

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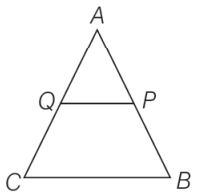
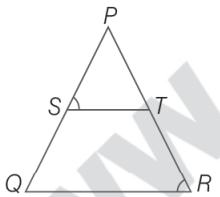
20. In the given figure P and Q are points on sides AB and AC respectively of ΔABC such that $AP = 3.5$ cm, $PB = 7$ cm, $AQ = 3$ cm and $QC = 6$ cm.
If $PQ = 4.5$ cm, then the value of BC is



(a) 13.5 cm (b) 3.4 cm
(c) 2.6 cm (d) 1.6 cm

21. The line joining the mid-points of two sides of a triangle is
(a) bisector of the third side
(b) perpendicular to the third side
(c) parallel to the third side
(d) None of the above

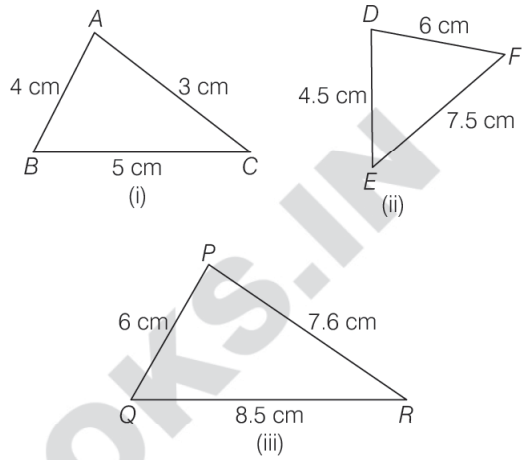
22. In the adjoining figure, $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle PST = \angle PRQ$. Then, ΔPQR is an



(a) equilateral triangle
(b) rightangle triangle
(c) isosceles triangle
(d) Cannot say

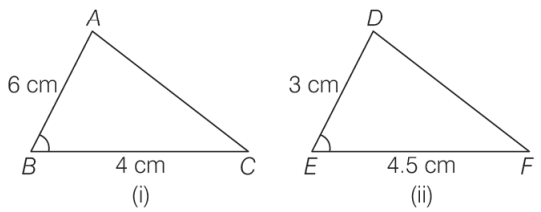
23. In ΔABC, points P and Q are on CA and CB, respectively such that $CA = 16$ cm, $CP = 10$ cm, $CB = 30$ cm and $CQ = 25$ cm. Then,
(a) $PQ \parallel AB$
(b) $PQ \nparallel AB$
(c) $\frac{QB}{CQ} = \frac{PA}{CP}$
(d) None of the above

24. Which pairs of triangles in the given figure are similar?



(a) (i) and (iii) (b) (ii) and (iii)
(c) (i) and (ii) (d) None of these

25. Two similar triangles are given in the figure the similarity criterion used is



(a) SAS (b) SSS
(c) AAA (d) None of these

26. In ΔABC and ΔDEF, $\angle B = \angle E$, $\angle F = \angle C$ and $AB = 3DE$. Then, the two triangles are **[NCERT Exemplar]**
(a) congruent but not similar
(b) similar but not congruent
(c) neither congruent nor similar
(d) congruent as well as similar

27. Diagonals AC and BD of a trapezium $ABCD$ with $AB \parallel DC$ intersect each other at the point O, then $\frac{OA}{OC} = \frac{OB}{OD}$
(a) True (b) False
(c) Cannot say (d) Partially True/False

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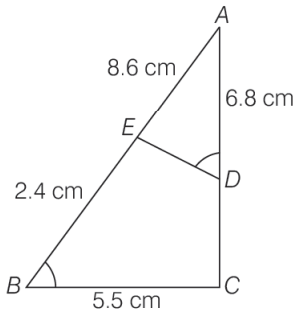
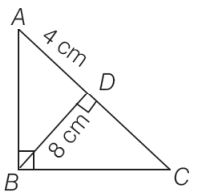
28. In the given figure, if $\angle ADE = \angle B$, and $AD = 6.8$ cm, $AE = 8.6$ cm, $BE = 2.4$ cm and $BC = 5.5$ cm, then the value of DE is



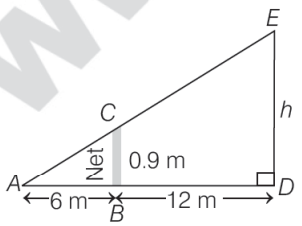
(a) 6.8 cm (b) 2.4 cm
(c) 3.4 cm (d) 4.8 cm

29. In the given figure, $\angle ABC = 90°$ and $BD \perp AC$. If $BD = 8$ cm and $AD = 4$ cm, then the value of CD is



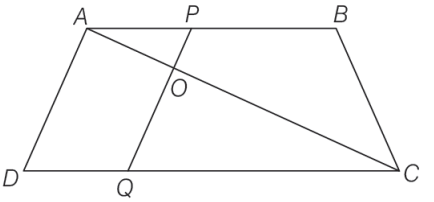
(a) 8 cm (b) 12 cm
(c) 14 cm (d) 16 cm

30. The value of the height 'h' in the adjoining figure is, at which the tennis ball must be hit, so that it will just pass over the net and land 6 m away from the base of the net.



(a) 3.6 m (b) 3 m
(c) 2.7 m (d) 0.27 m

31. In the figure given below, if $AB || DC$ and AC and PQ intersect each other at point O, then the value of $OA \cdot CQ$ is

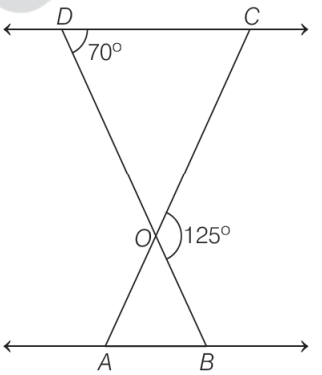


(a) $OC \cdot OQ$ (b) $OP \cdot OC$
(c) $OC \cdot AP$ (d) $OQ \cdot OP$

32. In ΔABC, $AD \perp BC$ and $AD^2 = BD \cdot CD$, then the value of $\angle BAC$ is

(a) 45° (b) 90°
(c) 180° (d) 60°

33. In the given figure, $\Delta ODC \sim \Delta OBA$. $\angle BOC = 125°$ and $\angle CDO = 70°$, then the value of $\angle OAB$ is



(a) 70° (b) 125°
(c) 65° (d) 55°

34. A vertical stick 20 m long casts a shadow 10 m long on the ground. At the same time, a tower casts a shadow 50 m long on the ground. The height of the tower is

(a) 100 m (b) 120 m
(c) 25 m (d) 200 m

35. A girl of height 90 cm is walking away from the base of a lamp-post at a speed of 1.2 m/s. If the lamp is 3.6 m above the ground, then the value of length of her shadow after 4s is

(a) 3.2 m (b) 4.8 m
(c) 1.6 m (d) 3.6 m

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36. $\Delta ABC \sim \Delta DEF$ and the perimeters of ΔABC and ΔDEF are 30 cm and 18 cm respectively. If $BC = 9$ cm, then $EF =$

(a) 6.3 cm (b) 5.4 cm
(c) 7.2 cm (d) 4.5 cm

37. ..... state that in a right angle triangle; the square of hypotenuse is equal to the sum of the square of the other two sides.

(a) BPT theorem
(b) Converse of Pythagoras theorem
(c) Converse of BPT theorem
(d) Pythagoras theorem

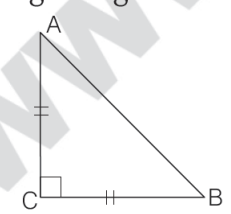
38. Right angle triangle whose hypotenuse is of length p cm, one side of length q cm and $p - q = 1$, then the length of third side of the triangle is

(a) $\sqrt{1+2q}$ cm (b) $\sqrt{p}+\sqrt{q}$ cm
(c) $\sqrt{p-q}$ cm (d) $\sqrt{p}-\sqrt{q}$ cm

39. If the lengths of the diagonals of rhombus are 16 cm and 12 cm. Then, the length of the sides of the rhombus is

(a) 9 cm (b) 10 cm
(c) 8 cm (d) 20 cm

40. In given figure, ABC is an isosceles triangle, right-angled at C. Therefore



[CBSE 2020]

(a) $AB^2 = 2AC^2$ (b) $BC^2 = 2AB^2$
(c) $AC^2 = 2AB^2$ (d) $AB^2 = 4AC^2$

41. In ΔPQR, $PD \perp QR$ such that D lies on QR, if $PQ = a$, $PR = b$, $QD = c$ and $DR = d$, then the value of $(a+b)(a-b)$ is

(a) $\frac{c+d}{c-d}$ (b) $\frac{c^2-d^2}{c-d}$
(c) $(c+d)(c-d)$ (d) $\frac{c^2+d^2}{c^2-d^2}$

42. The area of a right angled triangle is 40 sq cm and its perimeter is 40 cm. The length of its hypotenuse is

(a) 16 cm (b) 18 cm
(c) 17 cm (d) data insufficient

43. A flag pole 18 m high casts a shadow 9.6 m long. Then, the distance of the top of the pole from the far end of the shadow is ***[NCERT Exemplar]***

(a) 18 m (b) 26 m
(c) 21 m (d) 20.4 m

44.

	List I		List II
P.	In ΔABC and ΔPQR $\frac{AB}{PQ} = \frac{AC}{PR}$, $\angle A = \angle P$ $\Rightarrow \Delta ABC \sim \Delta PQR$	1.	AA similarity criterion
Q.	In ΔABC and ΔPQR $\angle A = \angle P$, $\angle B = \angle Q$ $\Rightarrow \Delta ABC \sim \Delta PQR$	2.	SAS similarity criterion
R.	In ΔABC and ΔPQR $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}$ $\Rightarrow \Delta ABC \sim \Delta PQR$	3.	SSS similarity criterion
S.	In ΔABC, $DE \parallel BC$ $\Rightarrow \frac{AD}{DB} = \frac{AE}{EC}$	4.	BPT

Codes

	P	Q	R	S
(a)	1	2	3	4
(b)	2	1	3	4
(c)	4	3	2	1
(d)	4	3	2	4

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45. If in a ΔABC, $DE \parallel BC$ and intersects AB at D and AC at E, then match the lists

	List I		List II
P.	$\frac{AD}{DB}$	1.	$\frac{AC}{AE}$
Q.	$\frac{AB}{AD}$	2.	$\frac{AE}{EC}$
R.	$\frac{DB}{AB}$	3.	$\frac{AB}{AC}$
S.	$\frac{AD}{AE}$	4.	$\frac{EC}{AC}$

Codes

	P	Q	R	S		P	Q	R	S
(a)	1	2	3	4	(b)	4	3	2	1
(c)	2	1	4	3	(d)	1	3	2	4

Assertion-Reasoning MCQs

Directions (Q. Nos. 46-55) Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) A is true, R is true; R is a correct explanation for A.
(b) A is true, R is true; R is not a correct explanation for A.
(c) A is true; R is False.
(d) A is false; R is true.

46. **Assertion (A)** All regular polygons of the same number of sides such as equilateral triangle, squares etc. are similar.

Reason (R) Two polygons are said to be similar, if their corresponding angles are equal and lengths of corresponding sides are proportional.

47. **Assertion (A)** If a line divides any two sides of a triangle in the same ratio, then the line is parallel to third side.

Reason (R) Line segment joining the mid-point of any two sides of a triangle is parallel to the third side.

48. **Assertion (A)** $ABCD$ is a trapezium with $DC \parallel AB$. E and F are points on AD and BC respectively such that $EF \parallel AB$.

Then, $\frac{AE}{ED} = \frac{BF}{FC}$.

Reason (R) Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.

49. **Assertion (A)** In a ΔABC, if D is a point on BC such that D divides BC in the ratio $AB : AC$, then AD is the bisector of $\angle A$.

Reason (R) The external bisector of an angle of a triangle divides the opposite sides internally in the ratio of the sides containing the angle.

50. **Assertion (A)** If in a ΔABC, a line $DE \parallel BC$, intersects AB at D and AC at E, then $\frac{AB}{AD} = \frac{AC}{AE}$.

Reason (R) If a line is drawn parallel to one side of a triangle intersecting the other two sides, then the other two sides are divided in the same ratio.

51. **Assertion (A)** In a rhombus of side 15 cm, one of the diagonals is 20 cm long. The length of the second diagonal is $10\sqrt{6}$ cm.

Reason (R) The sum of the squares of the sides of a rhombus is equal to the sum of the squares of its diagonals.

52. **Assertion (A)** In ΔABC, $\angle B = 90°$ and $BD \perp AC$. If $AD = 4$ cm and $CD = 5$ cm, then BD is $2\sqrt{5}$ cm.

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Reason (R) If a line divides any two sides of a triangle in the same ratio, then the line must not be parallel to the third side.

53. **Assertion (A)** ΔABC is an isosceles, right triangle, right angled at C. Then, $AB^2 = 2AC^2$.

Reason (R) In a right angled triangle, the cube of the hypotenuse is equal to the sum of the squares of the other two sides.

54. **Assertion (A)** ΔABC is a right triangle right angled at B. Let D and E be any points on AB and BC respectively. Then, $AE^2 + CD^2 = AC^2 + DE^2$.

Reason (R) In a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

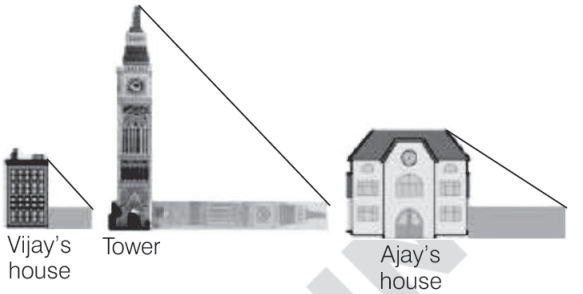
55. **Assertion (A)** In a ΔPQR, N is a point on PR such that $QN \perp PR$. If $PN \times NR = QN^2$, then $\angle PQR = 90°$.

Reason (R) In a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two.

Case Based MCQs

56. Vijay is trying to find the average height of a tower near his house. He is using the properties of similar triangles. The height of Vijay's house, if 20 m when Vijay's house casts a shadow 10m long on the ground.

At the same time, the tower casts a shadow 50 m long on the ground and the house of Ajay casts 20 m shadow on the ground.



Based on the above information, answer the following questions

(i) What is the height of the tower?
(a) 20 m (b) 50 m
(c) 100 m (d) 200 m

(ii) What will be the length of the shadow of the tower when Vijay's house casts a shadow of 12 m?
(a) 75 m (b) 50 m
(c) 45 m (d) 60 m

(iii) What is the height of Ajay's house?
(a) 30 m (b) 40 m
(c) 50 m (d) 20 m

(iv) When the tower casts a shadow of 40 m, same time what will be the length of the shadow of Ajay's house?
(a) 16 m (b) 32 m
(c) 20 m (d) 8 m

(v) When the tower casts a shadow of 40 m, same time what will be the length of the shadow of Vijay's house?
(a) 15 m (b) 32 m
(c) 16 m (d) 8 m

57. Aashi wants to make a toran for Home using some pieces of cardboard. She cuts some cardboard pieces as shown below. If perimeter of ΔADE and ΔBCE are in the ratio 4 : 3, then answer the following questions.

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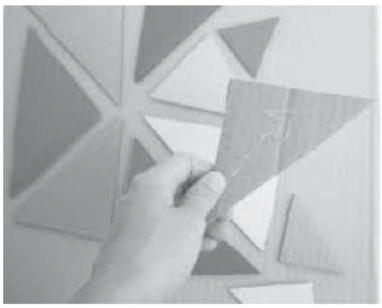
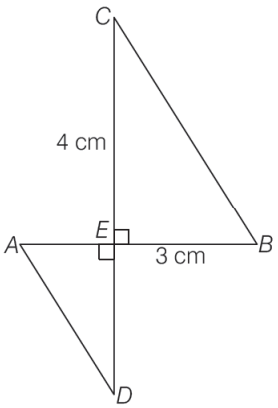




Based on the above information, answer the following questions

(i) If the two triangles here are similar by SAS similarity rule, then their corresponding proportional sides are

(a) $\frac{AE}{CE}=\frac{DE}{BE}$ (b) $\frac{BE}{AE}=\frac{CE}{DE}$

(c) $\frac{AD}{CE}=\frac{BE}{DE}$ (d) None of these

(ii) Length of BC =

(a) 20/3 cm (b) 4 cm

(c) 5 cm (d) None of these

(iii) Length of AD =

(a) 10/3 cm (b) 9/4 cm

(c) 5/3 cm (d) 20/3 cm

(iv) Length of ED =

(a) 4/3 cm (b) 8/3 cm

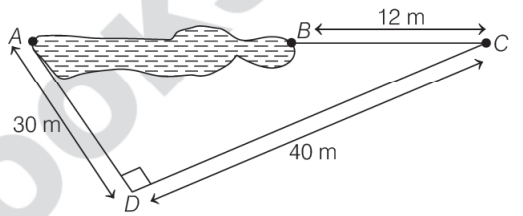
(c) 7/3 cm (d) 16/3 cm

(v) Length of AE =

(a) $\frac{2}{3}\times BE$ (b) $\sqrt{AD^2-DE^2}$

(c) $\frac{4}{3}\times\sqrt{BC^2-CE^2}$ (d) All of these

58. Rohan wants to measure the distance of a pond during the visit to his native. He marks points A and B on the opposite edges of a pond as shown in the figure below. To find the distance between the points, he makes a right-angled triangle using rope connecting B with another point C are a distance of 12 m, connecting C to point D at a distance of 40 m from point C and the connecting D to the point A which at distance of 30 m from D such that $\angle ADC = 90°$.



Based on the above information, answer the following questions

(i) Which property of geometry will be used to find the distance AC ?

(a) Similarity of triangles

(b) Thales Theorem

(c) Pythagoras Theorem

(d) Area of similar triangles

(ii) What is the distance AC ?

(a) 50 m (b) 12 m

(c) 100 m (d) 70 m

(iii) Which is the following does not form a Pythagoras triplet?

(a) (7,24,25)

(b) (15,8,17)

(c) (5,12,13)

(d) (21,20,28)

(iv) Find the length AB?

(a) 12 m (b) 38 m

(c) 50 m (d) 100 m

(v) Find the length of the rope used.

(a) 120 m (b) 70 m

(c) 82 m (d) 22 m

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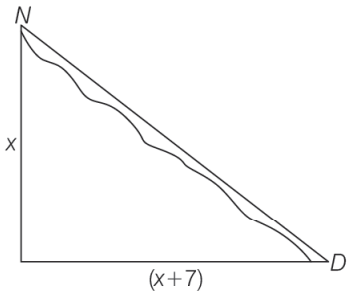
59. D.M of a district went to town Noida from city Delhi. There is a route via town Ghaziabad such that $NG \perp GD$, $NG = x$ km and $GD = (x + 7)$ km. He noticed that there is proposal to construct a 17 km highway which directly connects the two towns Noida and Delhi.



Based on the above information, answer the following questions.

(i) Which concept can be used to get the value of x

(a) Thales theorem
(b) Pythagoras theorem
(c) Converse of thales theorem
(d) Converse of Pythagoras theorem

(ii) The value of x is

(a) 4 (b) 6
(c) 5 (d) 8

(iii) The value of NG is

(a) 10 km (b) 20 km
(c) 8 km (d) 25 km

(iv) The value of GD is

(a) 12 km (b) 24 km
(c) 16 km (d) 15 km

(v) How much distance will be saved in reaching city Delhi after the construction of highway?

(a) 6 km (b) 9 km
(c) 4 km (d) 8 km

60. A scale drawing of an object is the same shape at the object but a different size. The scale of a drawing is a comparison of the length used on a drawing to the length it represents. The scale is written as a ratio. The ratio of two corresponding sides in similar figures is called the scale factor.

Scale factor = length in image/ corresponding length in object

If one shape can become another using revising, then the shapes are similar. Hence, two shapes are similar when one can become the other after a resize, flip, slide or turn. In the photograph below showing the side view of a train engine. Scale factor is 1 : 200.

This means that a length of 1 cm on the photograph above corresponds to a length of 200 cm or 2 m, of the actual engine. The scale can also be written as the ratio of two lengths.

Based on the above information, answer the following questions

(i) If the length of the model is 11cm, then the overall length of the engine in the photograph above, including the couplings(mechanism used to connect) is

(a) 22 cm
(b) 220 cm
(c) 220 m
(d) 22 m

(ii) What will affect the similarity of any two polygons?

(a) They are flipped horizontally
(b) They are dilated by a scale factor
(c) They are translated down
(d) They are not the mirror image of one another.

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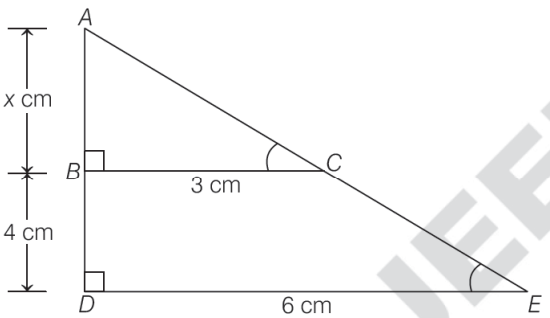
(iii) What is the actual width of the door, if the width of the door in photograph is 0.35 cm?

(a) 0.7 m
(b) 0.7 cm
(c) 0.07 cm
(d) 0.07 m

(iv) If two similar triangles have a scale factor 5 : 3 which statement regarding the two triangles is true?

(a) The ratio of their perimeters is 15 : 1
(b) Their altitudes have a ratio 25 :15
(c) Their medians have a ratio 10 : 4
(d) Their angle bisectors have a ratio 11 : 5

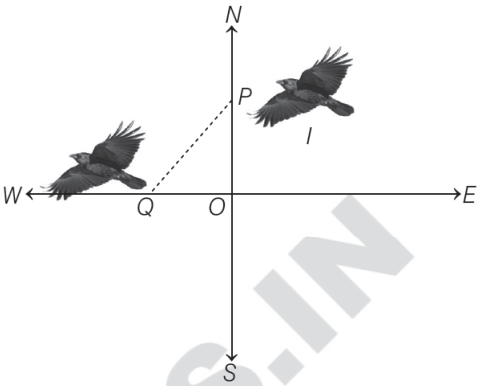
(v) The length of AB in the given figure



(a) 8 cm (b) 6 cm
(c) 4 cm (d) 10 cm

61. Application of Pythagoras Theorem

A crow leaves a tree and flies due north at a speed of 600 km/h. At the same time, another crow leaves the same place and flies due west at the speed 800 km/h as shown below. After $3\frac{1}{2}$ h both the crow reaches at point P and Q respectively.



Based on the above information, answer the following questions.

(i) Distance travelled by crow towards north after $3\frac{1}{2}$ h is

(a) 1800 km (b) 1500 km
(c) 1400 km (d) 2100 km

(ii) Distance travelled by crow towards west after $3\frac{1}{2}$ h is

(a) 1600 km (b) 2800 km
(c) 2250 km (d) 2625 km

(iii) In the given figure, $\angle POQ$ is

(a) 70° (b) 90°
(c) 80° (d) 100°

(iv) Distance between crow after $3\frac{1}{2}$ h is

(a) $450\sqrt{41}$ km (b) 3500 km
(c) $125\sqrt{12}$ km (d) $472\sqrt{41}$ km

(v) Area of ΔPOQ is

(a) 2940000 km^2 (b) 179000 km^2
(c) 186000 km^2 (d) 2025000 km^2

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ANSWERS

Multiple Choice Questions

1. (a)	2. (b)	3. (a)	4. (b)	5. (c)	6. (a)	7. (b)	8. (a)	9. (c)	10. (b)
11. (a)	12. (c)	13. (b)	14. (b)	15. (a)	16. (b)	17. (d)	18. (c)	19. (c)	20. (a)
21. (c)	22. (c)	23. (b)	24. (c)	25. (a)	26. (b)	27. (a)	28. (c)	29. (d)	30. (c)
31. (c)	32. (b)	33. (d)	34. (a)	35. (c)	36. (b)	37. (d)	38. (a)	39. (b)	40. (b)
41. (c)	42. (b)	43. (d)	44. (b)	45. (c)					

Assertion-Reasoning MCQs

46. (a)	47. (b)	48. (a)	49. (c)	50. (a)	51. (d)	52. (c)	53. (c)	54. (a)	55. (b)

Case Based MCQs

56. (i) - (c); (ii) - (d); (iii) - (b); (iv) - (a); (v) - (d)
57. (i) - (b); (ii) - (c); (iii) - (d); (iv) - (d); (v) - (c)
58. (i) - (c); (ii) - (a); (iii) - (d); (iv) - (b); (v) - (c)
59. (i) - (b); (ii) - (d); (iii) - (c); (iv) - (d); (v) - (a)
60. (i) - (d); (ii) - (d); (iii) - (a); (iv) - (b); (v) - (c)
61. (i) - (d); (ii) - (b); (iii) - (b); (iv) - (b); (v) - (a)

SOLUTIONS

1. All congruent figures are called similar but all similar figures are not congruent.
2. Two triangles are similar, if their corresponding angles are equal not proportional.
3. All equilateral triangles are similar because all equilateral triangle have same shape but size can vary.
4. Two triangles are similar. If their corresponding sides are proportional.
5. Two quadrilaterals are similar, if their corresponding angles are equal and corresponding sides must also be proportional.
6. When two triangles are said to be similar, then corresponding angles are equal and corresponding sides are proportional.

   Option (a) : Corresponding angles are equal

   $\angle A = \angle P$; $\angle B = \angle R$; $\angle C = \angle Q$

   Option (b) : Corresponding sides are not proportional.

   $$\frac{AB}{PQ} = \frac{BC}{QR} \neq \frac{AC}{PR} \quad \text{[not correct]}$$

   Option (c) : Corresponding angles are not equal.

   $$\angle A \neq \angle P \quad \text{[not correct]}$$

   Option (d) : Corresponding sides are not proportional.

   $$\frac{AB}{PQ} \neq \frac{BC}{QR} \neq \frac{AC}{PR} \quad \text{[not correct]}$$

7. Here, $\frac{PQ}{AB} = \frac{2.5}{4} = \frac{25}{10 \times 4} = \frac{5}{8}$

   and $\frac{RQ}{BC} = \frac{2.5}{4} = \frac{25}{10 \times 4} = \frac{5}{8}$

   Clearly, the corresponding sides of quadrilaterals $ABCD$ and $PQRS$ are proportional but their corresponding angles are not equal. Hence, quadrilaterals $ABCD$ and $PQRS$ are not similar.

8. Here, the corresponding two sides and the perimeters of two triangles are proportional, then third side of both triangles will also in proportion.
9. Given, both figures are similar.

   So, the ratio of corresponding sides will be equal.

   $$\therefore \quad \frac{3}{x} = \frac{5}{15}$$

   $$\Rightarrow \quad x = \frac{3 \times 15}{5} = 9 \text{ cm}$$

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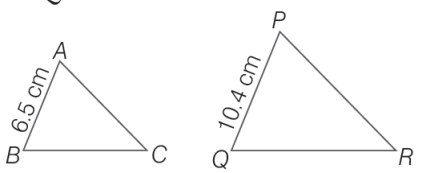
10. Given, $\Delta ABC \sim \Delta PQR$ with $AB = 6.5$ cm and $PQ = 10.4$ cm



Since, $\Delta ABC \sim \Delta PQR$

$\therefore \dfrac{AB}{PQ} = \dfrac{BC}{QR} = \dfrac{AC}{PR} = \dfrac{6.5}{10.4} = \dfrac{65}{104}$

[$\because$ corresponding sides of similar triangles are proportional]

$\Rightarrow AB = \dfrac{65}{104} PQ, BC = \dfrac{65}{104} QR, AC = \dfrac{65}{104} PR$

Also given, perimeter of $\Delta ABC = 60$

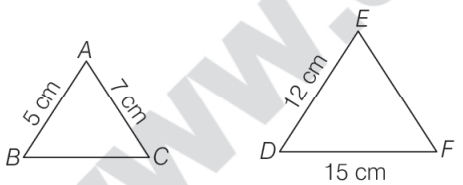
$\therefore \quad AB + BC + AC = 60$

$\Rightarrow \quad \dfrac{65}{104}(PQ + QR + PR) = 60$

$\Rightarrow \quad PQ + QR + PR = \dfrac{60 \times 104}{65} = 96$ cm

Hence, perimeter of ΔPQR is 96 cm.

11. Given, $\Delta ABC \sim \Delta EDF$ with $AB = 5$ cm, $AC = 7$ cm, $DF = 15$ cm and $DE = 12$ cm. ...(i)



Since, $\Delta ABC \sim \Delta EDF$,

$\therefore \quad \dfrac{AB}{ED} = \dfrac{AC}{EF} = \dfrac{BC}{DF}$

[$\because$ corresponding sides of similar triangles are proportional]

$\Rightarrow \quad \underset{\text{I}}{\dfrac{5}{12}} = \underset{\text{II}}{\dfrac{7}{EF}} = \underset{\text{III}}{\dfrac{BC}{15}}$ [from Eq. (i)]

On taking first I and II ratios, we get

$\dfrac{5}{12} = \dfrac{7}{EF}$

$\Rightarrow \quad EF = \dfrac{7 \times 12}{5} = 16.8$ cm

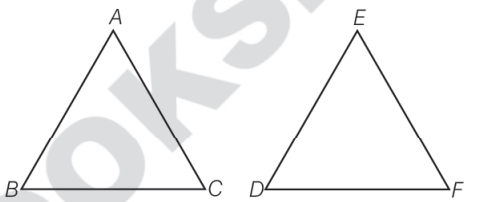
On taking first and third ratios, we get

$\dfrac{5}{12} = \dfrac{BC}{15}$

$\Rightarrow \quad BC = \dfrac{5 \times 15}{12} = 6.25$ cm

Hence, lengths of the remaining sides of the triangles are $EF = 16.8$ cm and $BC = 6.25$ cm.

12. Given, in ΔABC and ΔEDF, $\dfrac{AB}{DE} = \dfrac{BC}{FD}$



By converse of basic proportionality theorem,

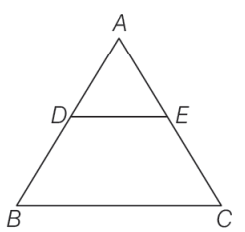
$\Delta ABC \sim \Delta EDF$

Then, $\angle B = \angle D$, $\angle A = \angle E$ and $\angle C = \angle F$

$\therefore \quad \angle B = \angle D$

13. (converse of BPT) If a line divides any two sides of a triangle in the same ratio, then the line must be parallel to the third side.

$\dfrac{AD}{DB} = \dfrac{AE}{EC}$ (given)



then, $DE \parallel BC$

14. Given in ΔABC $DE \parallel BC$,

Now, $\dfrac{AD}{DB} = \dfrac{AE}{EC}$ [by Thales theorem]

$\Rightarrow \quad \dfrac{x}{x-2} = \dfrac{x+2}{x-1}$

$\Rightarrow \quad x(x-1) = (x-2)(x+2)$

$\Rightarrow \quad x^2 - x = x^2 - 4$

$\therefore \quad x = 4$

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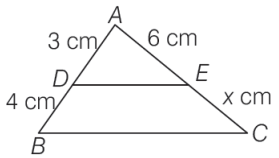
15. In ΔABC, $DE \parallel BC$



Let $EC = x$ cm, then $\frac{AD}{DB} = \frac{AE}{EC}$

[by basic proportionality theorem]

$\Rightarrow \quad \frac{3}{4} = \frac{6}{x}$

$\Rightarrow \quad x = \frac{4 \times 6}{3} = 8$ cm

$\therefore \quad EC = 8$ cm

16. Given, in ΔABC, $DE \parallel AC$

So, $\frac{BE}{EC} = \frac{BD}{DA}$ ...(i)

[by basic proportionality theorem]

Also, in ΔABP,

$DC \parallel AP$ [given]

So, $\frac{BC}{CP} = \frac{BD}{DA}$ ...(ii)

[by basic proportionality theorem]

From Eqs. (i) and (ii), we get

$$\frac{BE}{EC} = \frac{BC}{CP}$$

17. Given, $ST \parallel QR$, $PS / SQ = 3/5$ and $PR = 28$ cm

By using basic proportionality theorem, we get

$$\frac{PS}{SQ} = \frac{PT}{TR} \Rightarrow \frac{PS}{SQ} = \frac{PT}{PR - PT}$$

$\Rightarrow \quad \frac{3}{5} = \frac{PT}{28 - PT}$

$\Rightarrow \quad 3(28 - PT) = 5PT$

$\Rightarrow \quad 84 = 5PT + 3PT$

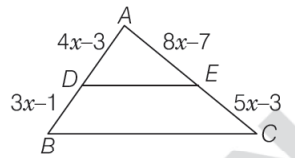
$\Rightarrow \quad PT = \frac{84}{8}$

$\Rightarrow \quad PT = 10.5$ cm

Hence, the length of PT is 10.5 cm.

18. Given, in ΔABC, $DE \parallel BC$

$\therefore$ By Thales theorem, we get



$$\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{4x-3}{3x-1} = \frac{8x-7}{5x-3}$$

[$\because AD = 4x - 3, DB = 3x - 1, AE = 8x - 7, EC = 5x - 3$]

$\Rightarrow \quad (4x-3)(5x-3) = (8x-7)(3x-1)$

$\Rightarrow \quad 20x^2 - 12x + 9 - 15x = 24x^2 - 21x - 8x + 7$

$\Rightarrow \quad 4x^2 - 2x - 2 = 0$

$\Rightarrow \quad 2x^2 - x - 1 = 0$

[dividing both sides by 2]

$\Rightarrow \quad 2x^2 - 2x + x - 1 = 0$

[by splitting the middle term]

$\Rightarrow 2x(x-1) + 1(x-1) = 0$

$\Rightarrow \quad (2x+1)(x-1) = 0$

$\Rightarrow \quad x = -\frac{1}{2}$ or $x = 1$

If $x = -\frac{1}{2}$, then $AD = 4 \times \left(-\frac{1}{2}\right) - 3 = -5 < 0$

[not possible; since, length cannot be negative]

Hence, $x = 1$ is the required value.

19. Given, $AB \parallel CD$

$\therefore$ Quadrilateral $ABCD$ is a trapezium

$\therefore \quad \frac{AO}{CO} = \frac{BO}{DO}$

[diagonals of trapezium divides each other proportionally]

$\Rightarrow \quad \frac{4}{4x-2} = \frac{x+1}{2x+4}$

$\Rightarrow \quad 4(2x+4) = (x+1)(4x-2)$

$\Rightarrow \quad 8x + 16 = 4x^2 - 2x + 4x - 2$

$\Rightarrow \quad 4x^2 - 6x - 18 = 0$

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$\Rightarrow \quad 2x^2 - 3x - 9 = 0$

$\Rightarrow \quad 2x^2 - 6x + 3x - 9 = 0$

$\Rightarrow \quad 2x(x-3) + 3(x-3) = 0$

$\Rightarrow \quad (2x+3)(x-3) = 0$

$\Rightarrow \quad x = 3$ and $x = -\frac{3}{2}$ (not possible)

Hence, the value of $x = 3$.

20. In the given figure, $\frac{AQ}{AC} = \frac{AP}{AB} = \frac{1}{3}$

Therefore, by converse of basic proportionality theorem, we have

$$QP \parallel CB$$

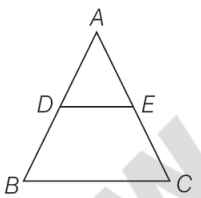
Hence, $\Delta AQP \sim \Delta ACB$

$$\frac{AQ}{AC} = \frac{AP}{AB} = \frac{QP}{CB}$$

$$\Rightarrow \quad \frac{1}{3} = \frac{4.5}{BC}$$

$$BC = 13.5 \text{ cm}$$

21. Let ΔABC and D and E be mid-points of AB and AC respectively.



$AD = DB$ and $AE = EC$

$\Rightarrow \quad \frac{AD}{DB} = 1$ and $\frac{AE}{EC} = 1$

$\Rightarrow \quad \frac{AD}{DB} = \frac{AE}{EC}$

$\Rightarrow \quad DE \parallel BC$

[by the converse of basic proportionality theorem]

22. Given, $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle PST = \angle PRQ$

Since, $\frac{PS}{SQ} = \frac{PT}{TR}$

$\therefore \quad ST \parallel QR$

[by converse of basic proportionality theorem]

Then, $\angle PST = \angle PQR$

[corresponding angles] ...(i)

Also, $\angle PST = \angle PRQ$ [given] ...(ii)

From Eqs. (i) and (ii), we get

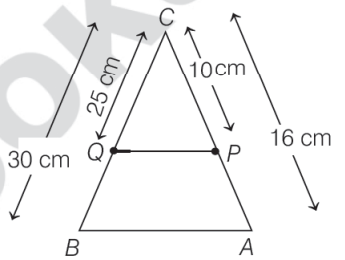
$$\angle PRQ = \angle PQR$$

$\Rightarrow \quad PQ = PR$

[since, sides opposite to equal angles of a triangle are also equal]

Hence, ΔPQR is an isosceles triangle.

23. Given, $CQ = 25$ cm, $CB = 30$ cm, $CP = 10$ cm and $CA = 16$ cm



Here, $\frac{CQ}{CB} = \frac{25}{30} = \frac{5}{6}$

and $\frac{CP}{CA} = \frac{10}{16} = \frac{5}{8} \Rightarrow \frac{CQ}{CB} \neq \frac{CP}{CA}$

$\Rightarrow \quad \frac{CB}{CQ} \neq \frac{CA}{CP} \Rightarrow \frac{CB}{CQ} - 1 \neq \frac{CA}{CP} - 1$

$\Rightarrow \frac{CB - CQ}{CQ} \neq \frac{CA - CP}{CP}$

$\Rightarrow \quad \frac{QB}{CQ} \neq \frac{PA}{CP}$ or $\frac{CQ}{QB} \neq \frac{CP}{PA}$

Hence, by converse of basic proportionality theorem, PQ is not parallel to AB.

24. Here, $\frac{AB}{DF} = \frac{4}{6} = \frac{2}{3}$, $\frac{BC}{EF} = \frac{5}{7.5} = \frac{2}{3}$,

$\frac{AC}{DE} = \frac{3}{4.5} = \frac{2}{3}$

As, $\frac{AB}{DF} = \frac{BC}{EF} = \frac{AC}{DE}$

So, $\Delta ABC \sim \Delta DFE$

[by SSS similarity criterion]

Hence, figures (i) and (ii) are similar triangles, but no other pairs of triangles in the given figure are similar.

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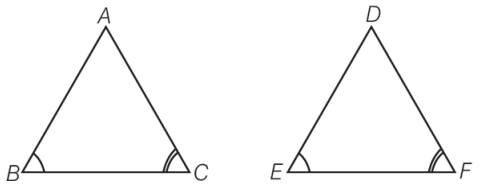
25. Here, $\frac{AB}{EF} = \frac{6}{4.5} = \frac{60}{45} = \frac{4}{3}$, $\frac{BC}{DE} = \frac{4}{3}$

$\Rightarrow \frac{AB}{EF} = \frac{BC}{DE}$ and $\angle ABC = \angle FED$ [given]

So, $\Delta ABC \sim \Delta FED$

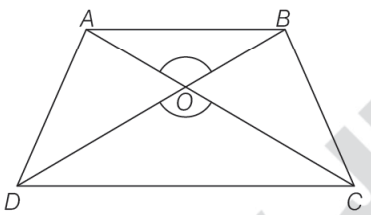
[by SAS similarity criterion]

26. In ΔABC and ΔDEF, $\angle B = \angle E$, $\angle F = \angle C$ and $AB = 3DE$



We know that, if in two triangles corresponding two angles are same, then they are similar by AAA similarity criterion. Also, ΔABC and ΔDEF do not satisfy any rule of congruency, (SAS, ASA, SSS), so both are not congruent.

27.



In ΔAOB and ΔOCD,

$\angle AOB = \angle COD$ [vertically opposite angle]

$\angle ABO = \angle CDO$ [$AB || CD$, alternate angle]

$\angle BAO = \angle OCD$ [$AB || CD$, alternate angle]

$\Delta OAB \sim \Delta OCD$ (AAA similarity)

Then, $\frac{OA}{OC} = \frac{OB}{OD}$

[corresponding sides are proportional].

28. In ΔADE and ΔABC,

$\angle ADE = \angle B$ [given]

and $\angle A = \angle A$ [common]

$\Delta ADE \sim \Delta ABC$ [by AA corollary]

$\therefore \frac{AD}{AB} = \frac{DE}{BC}$

[sides of similar triangles are proportional]

$\Rightarrow \frac{AD}{AE + EB} = \frac{DE}{BC}$

$\Rightarrow \frac{6.8}{8.6 + 2.4} = \frac{DE}{5.5}$

$\Rightarrow DE = \frac{6.8 \times 5.5}{8.6 + 2.4}$ cm = 3.4 cm

Hence, $DE = 3.4$ cm

29. Given, $BD = 8$ cm and $AD = 4$ cm

In ΔADB and ΔBDC,

$\angle BDA = \angle CDB$ [each 90°]

$\angle DBA = \angle DCB$ [each $(90° - \angle A)$]

$\therefore \Delta ADB \sim \Delta BDC$

[by AA similarity criterion]

$\Rightarrow \frac{BD}{CD} = \frac{AD}{BD}$

[since, corresponding sides of similar triangles are proportional]

$\Rightarrow CD = \frac{BD^2}{AD}$

$\therefore CD = \frac{8^2}{4} = \frac{64}{4} = 16$ cm

30. Since, the height h is measured vertically, so $\angle EDA$ is a right angle. We assume that the net (i.e. CB) is vertical.

Here, ΔADE and ΔABC are similar

[by AA similarity criterion]

$\therefore \frac{DE}{BC} = \frac{AD}{AB}$

[since, corresponding sides of similar triangles are proportional]

$\Rightarrow \frac{h}{0.9} = \frac{18}{6} \Rightarrow \frac{h}{0.9} = 3$

$\Rightarrow h = 0.9 \times 3 = 2.7$ m

Hence, the height at which the ball should be hit, is 2.7 m.

31. Given, $AB || DC$ and AC and PQ intersect each other at point O.

Now, in ΔAOP and ΔCOQ

$\angle AOP = \angle COQ$ [Vertical opposite angles]

$\angle APO = \angle CQO$

[$\because$ alternate angle, $AB || DC$ and PQ is a transversal]

$\therefore \Delta AOP \sim \Delta COQ$ [from AAA similarity]

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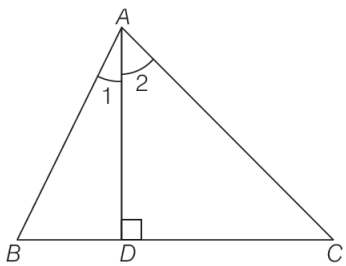
then, $\frac{OA}{OC} = \frac{AP}{CQ}$

[$\because$ corresponding sides are proportional]

$\Rightarrow OA \cdot CQ = OC \cdot AP$

32. Given, ΔABC in which $AD \perp BC$ and $AD^2 = BD \cdot CD$.



Now, in ΔDBA and ΔDAC, we have

$$\angle BDA = \angle ADC = 90°$$

$$\frac{BD}{AD} = \frac{AD}{CD}$$

$\Delta DBA \sim \Delta DAC$ [by SAS similarity]

$\angle B = \angle 2$ and $\angle 1 = \angle C$

$$\angle 1 + \angle 2 = \angle B + \angle C$$

$$\angle A = \angle B + \angle C$$

$$2\angle A = \angle A + \angle B + \angle C = 180°$$

$$\angle A = \frac{180°}{2} = 90°$$

33. $\angle DOC + \angle COB = 180°$ [linear pair]

$\Rightarrow \angle DOC + 125° = 180°$

Hence, $\angle DOC = 180° - 125° = 55°$

Again, $\angle DCO + \angle CDO + \angle DOC = 180°$

[angles of a triangle]

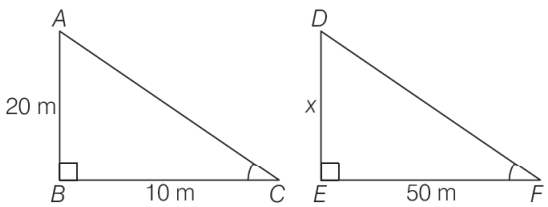
$\Rightarrow \angle DCO + 70° + 55° = 180°$

Hence, $\angle DCO = 180° - 125° = 55°$ ...(i)

$\because \Delta ODC \sim \Delta OBA$ [given]

$\therefore \angle OAB = \angle OCD = 55°$ [from Eq. (i)]

34. Let the height of the tower be x. As $\angle B = \angle E = 90°$ and angle of elevation of sun is same.



In ΔABC and ΔDEF,

$\angle B = \angle E$ [right angle]

$\angle C = \angle F$ [angle of elevation]

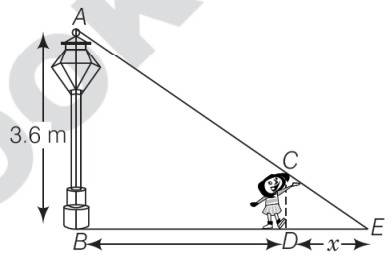
$\Delta ABC \sim \Delta DEF$ [from AA similarity]

$$\therefore \frac{AB}{DE} = \frac{BC}{EF} \Rightarrow \frac{20}{x} = \frac{10}{50}$$

$$\Rightarrow x = \frac{20 \times 50}{10} = 100 \text{ m}$$

35. Let AB be the lamp-post, CD be the girl and D be the position of girl after 4s.

Again, let $DE = x$ m be the length of shadow of the girl.



Given, $CD = 90$ cm $= 0.9$ m, $AB = 3.6$ m

and speed of the girl $= 1.2$ m/s

$\therefore$ Distance of the girl from lamp-post after 4s,

$$BD = 1.2 \times 4 = 4.8 \text{ m}$$

[$\because$ distance = speed $\times$ time]

In ΔABE and ΔCDE,

$\angle B = \angle D$ [each 90°]

$\angle E = \angle E$ [common angle]

$\therefore \Delta ABE \sim \Delta CDE$

[by AA similarity criterion]

$$\Rightarrow \frac{BE}{DE} = \frac{AB}{CD} \quad \text{...(i)}$$

[since, corresponding sides of similar triangles are proportional]

On substituting all the values in Eq. (i), we get

$$\frac{4.8 + x}{x} = \frac{3.6}{0.9}$$

[$\because BE = BD + DE = 4.8 + x$]

$$\Rightarrow \frac{4.8 + x}{x} = 4$$

$$\Rightarrow 4.8 + x = 4x$$

$$\Rightarrow 3x = 4.8$$

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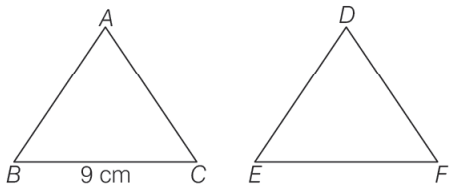
$\Rightarrow \quad x = \frac{4.8}{3} = 1.6$ m

Hence, the length of her shadow after 4s is 1.6 m.

36.



Given,

$$\Delta ABC \sim \Delta DEF$$

$$\therefore \quad \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF} \quad \ldots(i)$$

From eq. (i),

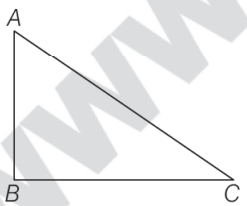
$$\frac{AB + BC + CA}{DE + EF + DF} = \frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta DEF} = \frac{30}{18} \quad \ldots(ii)$$

Therefore, $\frac{\text{Perimeter } (\Delta ABC)}{\text{Perimeter } (\Delta DEF)} = \frac{BC}{EF}$

$\Rightarrow \quad \frac{30}{18} = \frac{9}{EF}$

$\Rightarrow \quad EF = \frac{18 \times 9}{30} = 5.4$ cm

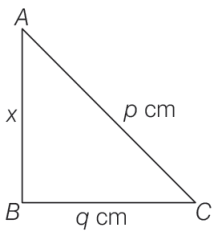
37.



$$AC^2 = AB^2 + BC^2$$

[by Pythagoras theorem]

38. Let the third side be x cm.



$p^2 = q^2 + x^2$ [by Pythagoras theorem]

$\Rightarrow \quad x^2 = p^2 - q^2$

$\Rightarrow \quad x^2 = (p - q)(p + q)$

$\Rightarrow \quad x = \sqrt{(p + q)}$ $[\because p - q = 1]$

$\Rightarrow \quad x = \sqrt{(1 + q) + q}$ $[p = 1 + q]$

$\Rightarrow \quad x = \sqrt{2q + 1}$ cm

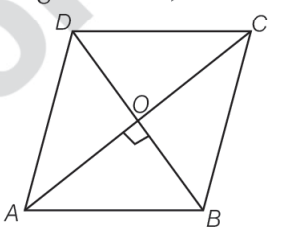
39. We know that, the diagonals of a rhombus are perpendicular bisector of each other.

Given, $AC = 16$ cm and $BD = 12$ cm [let]

$\therefore \quad AO = 8$ cm, $BO = 6$ cm

and $\angle AOB = 90°$

In right angled ΔAOB,



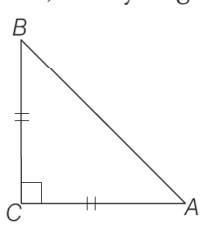
$$AB^2 = AO^2 + OB^2$$

[by Pythagoras theorem]

$\Rightarrow \quad AB^2 = 8^2 + 6^2 = 64 + 36 = 100$

$\therefore \quad AB = 10$ cm

40. In right ΔACB, use Pythagoras theorem



$AB^2 = AC^2 + BC^2$

$= AC^2 + (AC)^2$ $[\because BC = AC = \text{given}]$

$= 2AC^2$

41. Given, in ΔPQR, $PD \perp QR$, $PQ = a$, $PR = b$, $QD = c$ and $DR = d$

In right angled ΔPOQ,

$$PQ^2 = PD^2 + QD^2$$

[by Pythagoras theorem]

$\Rightarrow \quad a^2 = PD^2 + c^2$

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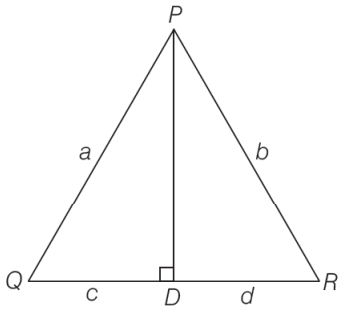
$\Rightarrow \quad PD^2 = a^2 - c^2 \quad \ldots(i)$



In right angled ΔPDR,

$$PR^2 = PD^2 + DR^2$$

[by Pythagoras theorem]

$\Rightarrow \quad b^2 = PD^2 + d^2$

$\Rightarrow \quad PD^2 = b^2 - d^2 \quad \ldots(ii)$

From Eqs. (i) and (ii),

$$a^2 - c^2 = b^2 - d^2$$

$\Rightarrow \quad a^2 - b^2 = c^2 - d^2$

$\Rightarrow \quad (a - b)(a + b) = (c - d)(c + d)$

42. Suppose hypotenuse of the triangle is c and other sides are a and b, obviously.

$$c = \sqrt{a^2 + b^2} \quad \ldots(i)$$

We have,

$$a + b + c = 40$$

and $\quad \frac{1}{2} ab = 40 \Rightarrow ab = 80$

or $\quad 40 - (a + b) = \sqrt{a^2 + b^2}$

$\Rightarrow \quad c = 40 - (a + b)$ and $ab = 80$

or $\quad 40 - (a + b) = \sqrt{a^2 + b^2}$ [from Eq. (i)]

By squaring the above equation both sides

$\Rightarrow (a + b)^2 - 2 \times 40(a + b) + 1600 = a^2 + b^2$

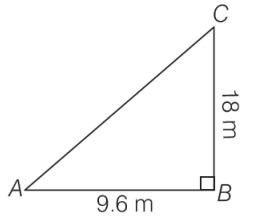
$\Rightarrow a^2 + b^2 + 2 \times 80 - 80(a + b) + 1600 = a^2 + b^2$

$\Rightarrow \quad 80[(a + b) - 2] = 1600$

$\Rightarrow \quad a + b = 20 + 2 = 22$

$\therefore \quad c = 40 - (a + b) = 40 - 22 = 18$ cm

43. Let $BC = 18$ m be the flag pole and its shadow be $AB = 9.6$ m. The distance of the top of the pole, C from the far end i.e. A of the shadow is AC.



In right angled ΔABC, $AC^2 = AB^2 + BC^2$

[by Pythagoras theorem]

$\Rightarrow \quad AC^2 = (9.6)^2 + (18)^2$

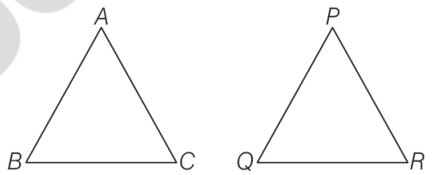
$AC^2 = 92.16 + 324$

$\Rightarrow \quad AC^2 = 416.16$

$\therefore \quad AC = \sqrt{416.16} = 20.4$ m

Hence, the required distance is 20.4 m.

44. (P)



Given, $\frac{AB}{PQ} = \frac{AC}{PR}$,

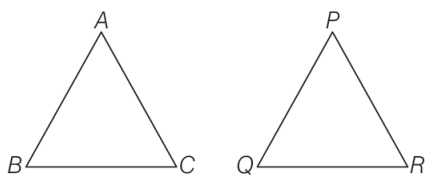
$\angle A = \angle P$

$\because$ $\angle A$ is containing the sides AB and AC and $\angle P$ is containing the sides PQ and PR.

$\therefore \quad \Delta ABC - \Delta PQR$

[by SAS criterion of similarity]

(Q)

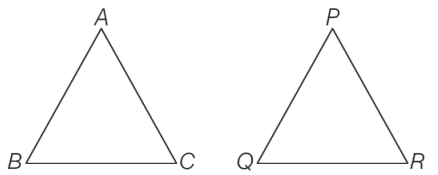


Given, $\angle A = \angle P$, $\angle B = \angle Q$

$\therefore \quad \Delta ABC - \angle PQR$

[by AA criterion of similarity]

(R)



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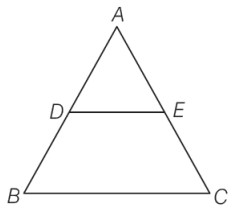
Given, $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}$

$\because$ Sides of the ΔABC and ΔPQR are in proportion

$\therefore$ $\Delta ABC - \Delta PQR$

[by SSS criterion of similarity]

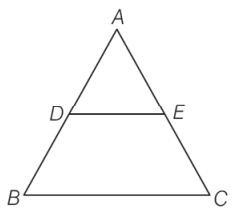
(S)



Given, $DE \parallel BC$

$\therefore$ $\frac{AD}{BD} = \frac{AE}{EC}$ [by BPT]

45. In ΔABC, $BC \parallel DE$



(P) $\frac{AD}{DB} = \frac{AE}{EC}$ (BPT)

(Q) $\frac{AD}{DB} = \frac{AE}{EC}$

$\Rightarrow \frac{DB}{AD} = \frac{EC}{AE} \Rightarrow \frac{DB}{AD} + 1 = \frac{EC}{AE} + 1$

$\Rightarrow \frac{BD + AD}{AD} = \frac{EC + AE}{AE} \Rightarrow \frac{AB}{AD} = \frac{AC}{AE}$

(R) Similarly, $\frac{DB}{AB} = \frac{EC}{AC}$

(S) $\frac{AD}{AB} = \frac{AE}{AC} \Rightarrow \frac{AD}{AE} = \frac{AB}{AC}$

46. Two polygons are similar, if their corresponding angles are equal and sides are proportional.

$\because$ In equilateral triangle and square, each angle are equal and sides are also equal therefore, regular polygons are similar.

Statement I is True and Statement II is True and Statement II is the correct explanation of Statement I.

47. Statement I is a basic proportionality theorem and Statement II is a mid-point theorem. But mid-point theorem is not the correct explanation of BPT.

Statement I is True and Statement II is True but statement II is not the correct explanation of Statement I.

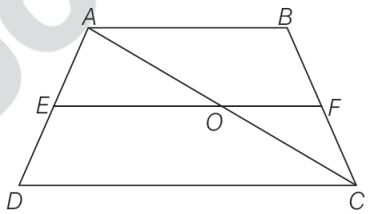
48. Given, $EF \parallel AB$

$\therefore$ $OE \parallel AB \parallel CD$ [$\because AB \parallel CD$]

In ΔACD, $\frac{AE}{ED} = \frac{AO}{OC}$ [by BPT] … (i)

Similarly in ΔABC, $\frac{AO}{OC} = \frac{BF}{FC}$ … (ii)

From Eqs. (i) and (ii), $\frac{AE}{ED} = \frac{BF}{FC}$



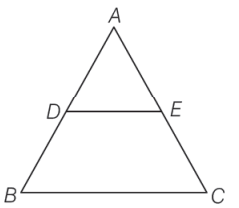
$\therefore$ Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.

Both Statement I and II are True and Statement II is the correct explanation of Statement I.

49. The internal bisector of an angle of a triangle divides the opposite sides internally in the ratio of sides containing the angle.

Statement I is True and Statement II is False.

50. Statement II is true.



For Assertion,

Since, $DE \parallel BC$

$\therefore$ By Thales Theorem

$$\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{DB}{AD} = \frac{EC}{AE}$$

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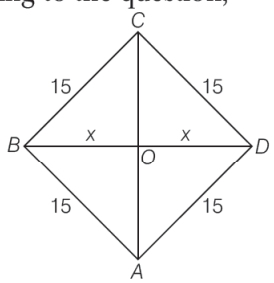
$$\Rightarrow \quad 1+\frac{DB}{AD}=1+\frac{EC}{AE}$$

$$\Rightarrow \quad \frac{AD+DB}{AD}=\frac{AE+EC}{AE}$$

$$\Rightarrow \quad \frac{AB}{AD}=\frac{AC}{AE}$$

$\therefore$ Both Statement I and II are true and Statement II is correct explanation of statement I.

51. According to the question,



Given, $AB = BC = CD = DA = 15$ cm

$AC = 20$ cm [let]

Let $BO = OD = x$ cm

$\therefore$ In ΔBOC, $x^2 + 10^2 = 15^2$

[by Pythagoras theorem]

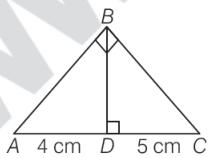
$$x^2 = 125$$

$$x = 5\sqrt{5}$$

$$BD = 2x = 10\sqrt{5} \text{ cm}$$

Hence, Statement I is false and Statement II is true.

52.



ΔABC is similar to ΔADB

$$\therefore \quad \frac{AB}{AD}=\frac{AC}{AB}$$

$$AB^2 = AD \times AC$$

$$AB^2 = 4 \times 9$$

$$AB = 6 \text{ cm}$$

In ΔADB, $AB^2 = AD^2 + BD^2$

$$36 = 16 + BD^2$$

$$BD^2 = 20$$

$$BD = 2\sqrt{5} \text{ cm}$$

Hence, Statement I is true and Statement II is false.

53. In right angled ΔABC,

$$AB^2 = AC^2 + BC^2$$

[by Pythagoras theorem]

$$= AC^2 + AC^2 \quad [\because BC = AC]$$

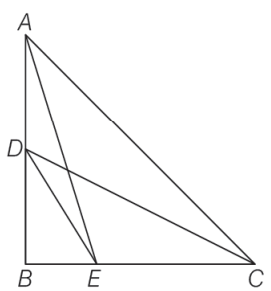
$$= 2AC^2$$

$$\therefore \quad AB^2 = 2AC^2$$

Hence, Statement I is true and Statement II is false.

54. Since, ΔABE is right triangle right-angled at B.

$$\therefore \quad AE^2 = AB^2 + BE^2 \quad \ldots(i)$$



Again, ΔDBC is right triangle right angled at B.

$$CD^2 = BD^2 + BC^2 \quad \ldots(ii)$$

Adding Eqs. (i) and (ii), we get

$$AE^2 + CD^2 = (AB^2 + BE^2) + (BD^2 + BC^2)$$

$$\Rightarrow AE^2 + CD^2 = (AB^2 + BC^2) + (BE^2 + BD^2)$$

Using Pythagoras theroem in ΔABC and ΔDBE, we have

$$AC^2 = AB^2 + BC^2$$

and $\quad DE^2 = BE^2 + BD^2$

$$\therefore AE^2 + CD^2 = AC^2 + DE^2$$

Hence, $AE^2 + CD^2 = AC^2 + DE^2$

Both Statement I and II are true and Statement II is the correct explanation of Statement I.

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55. In ΔPQR,

$QN \perp PR$ and $PN \times RN = QN^2$

$$\frac{PN}{QN} = \frac{QN}{NR}$$

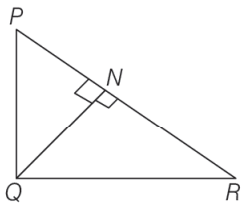
In ΔPQN and ΔRQN,

$$\angle QNP = \angle QNR$$

$$\Delta QPN \sim \Delta RQN$$

[by SAS similarity]

$\therefore \Delta QPN$ and ΔRQN are equiangular.



$$\angle 1 = \angle R \text{ and } \angle 2 = \angle P$$

$$\angle 1 + \angle 2 = \angle R + \angle P$$

$$\angle Q = \angle R + \angle P$$

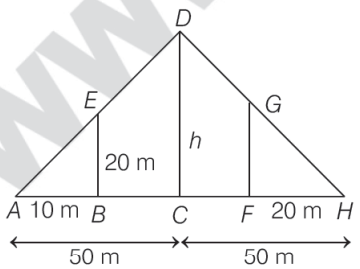
Now, $\angle Q + \angle R + \angle P = 180°$

$$2\angle Q = 180° \; [\angle Q = \angle R + \angle P]$$

$$\angle Q = 90°$$

Both Statements are true.

56. (i) Let $CD = h$ m be the height of the tower. Let $BE = 20$ m be the height of Vijay's house and GF be the height of Ajay's house.



$$\Delta ACD \sim ABE$$

$$\therefore \quad \frac{AC}{AB} = \frac{CD}{EB}$$

$$\Rightarrow \quad \frac{50}{10} = \frac{h}{20}$$

$$\Rightarrow \quad h = 100 \text{ m}$$

(ii) Given $AB = 12$ m, let $AC = h$

In similar ΔABE and ΔACD,

$$\frac{AB}{AC} = \frac{BE}{CD} \Rightarrow \frac{12}{h} = \frac{20}{100}$$

$$\Rightarrow \quad h = \frac{12 \times 100}{20} = 12 \times 5 = 60 \text{ m}$$

(iii) Let height of Ajay's house be $GF = h_1$

Since, $\Delta HFG \sim \Delta HCD$

$$\therefore \quad \frac{HF}{HC} = \frac{FG}{CD} \Rightarrow \frac{20}{50} = \frac{h_1}{100}$$

$$\Rightarrow \quad h_1 = \frac{20 \times 100}{50} = 40 \text{ m}$$

(iv) Given, $HC = 40$ cm

Let length of the shadow of Ajay's house be $HF = l$ m

Since, $\Delta HFG \sim \Delta HCD$

$$\therefore \quad \frac{HF}{HC} = \frac{FG}{CD}$$

$$\Rightarrow \quad \frac{l}{40} = \frac{40}{100}$$

$$\Rightarrow \quad l = \frac{40 \times 40}{100} = 16 \text{ m}$$

(v) Given, $AC = 40$ cm

Let length of the shadow of Vijay's house be $AB = l$ m

Since, $\Delta ABE \sim ACD$

$$\therefore \quad \frac{AB}{AC} = \frac{EB}{CD}$$

$$\Rightarrow \quad \frac{l}{40} = \frac{20}{100}$$

$$\Rightarrow \quad h = \frac{20 \times 40}{100} = 8 \text{ m}$$

57. (i) $\Delta AED \sim \Delta BEC$ [by SAS rule]

$$\frac{AD}{BC} = \frac{ED}{CE} = \frac{AE}{BE}$$

$$\Rightarrow \frac{BE}{AE} = \frac{CE}{ED}$$

(ii) $BC = \sqrt{BE^2 + CE^2}$

[Pythagoras theorem Apply]

$$= \sqrt{9 + 16} = \sqrt{25} = 5 \text{ cm}$$

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(iii) $\frac{AD}{BC} = \frac{\text{Perimeter of } \Delta ADE}{\text{Perimeter of } \Delta BCE}$

$\frac{AD}{5} = \frac{4}{3}$

$AD = 20/3$ cm

(iv) $\frac{ED}{CE} = \frac{4}{3}$ [similarly as (iii)]

$ED = \frac{4}{3} \times CE = \frac{4}{3} \times 4 = 16/3$ cm

(v) $\frac{AE}{BE} = \frac{4}{3}$

$AE = \frac{4}{3} \times BE = \frac{4}{3} \times 3 = 4$ cm

$\frac{4}{3}\sqrt{BC^2 - CE^2} = \frac{4}{3}\sqrt{25-16}$

$= \frac{4}{3} \times 3 = 4$cm

58. (i) To find the distance AC in the given figure, we use Pythagoras theorem.

(ii) In right ΔADC, use Pythagoras theorem,

$AC = \sqrt{AD^2 + CD^2}$

$= \sqrt{(30)^2 + (40)^2}$

$= \sqrt{900 + 1600} = \sqrt{2500} = 50$ m

(iii) (a) Now, $24^2 + 7^2 = 576 + 49$

$= 625 = 25^2$,

which forms a Pythagoras triplet

(b) $15^2 + 8^2 = 225 + 64 = 289 = 17^2$,

which forms a Pythagoras triplet

(c) $12^2 + 5^2 = 144 + 25 = 169 = 13^2$,

which form a Pythagoras triplet.

(d) $20^2 + 21^2 = 400 + 441 = 881 \neq 28^2$,

which does not form a Pythagoras triplet.

(iv) Since, $AC = 50$ m

$\therefore \quad AB = AC - BC = 50 - 12 = 38$ m

(v) The length of the rope used

$= BC + CD + DA$

$= 12 + 40 + 30 = 82$ m

59. (i) Pythagoras theorem concept can be used to get the value of x.

(ii) $NG^2 + GD^2 = ND^2$

[by Pythagoras theorem]

$\Rightarrow x^2 + (x+7)^2 = 17^2$

$\Rightarrow x^2 + x^2 + 49 + 14x = 289$

$\Rightarrow 2x^2 + 14x - 240 = 0$

$\Rightarrow x^2 + 7x - 120 = 0$

$\Rightarrow x^2 + 15x - 8x - 120 = 0$

$\Rightarrow x(x+15) - 8(x+15) = 0$

$\Rightarrow (x-8)(x+15) = 0$

$x = 8$

$x = -15$ (Not possible)

(iii) Value of $NG = 8$ km

(iv) Value of $GD = 8 + 7 = 15$ km

(v) Distance will be save after the construction $= (NG + GD) - ND$

$= (8 + 15) - 17 = 23 - 17 = 6$ km

60. Given, scale factors = 1 : 200

It means that length of 1 cm on the photograph above corresponds to a length of 200 cm (or 2 m) of the actual engine.

(i) Since, length of the model is 11 cm.

Therefore, the overall length of the engine $= 11 \times 200 = 2200$ cm $= 22$ m

(ii) The similarity of any two polygons will affect that they are not the mirror image of one another.

(iii) The actual width of the door

$= 0.35 \times 200$ cm $= 70$ cm $= 0.7$ m

(iv) If two similar triangles have a scale factor 5 : 3, then their altitudes have a ratio 25 : 15.

(v) In the given $BC \parallel DE$.

$\therefore \Delta ABC \sim ADE$,

$\Rightarrow \frac{AB}{AD} = \frac{BC}{DE} \Rightarrow \frac{x}{x+4} = \frac{3}{6}$

$\Rightarrow \frac{x}{x+4} = \frac{1}{2} \Rightarrow 2x = x + 4 \Rightarrow x = 4$ cm

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61. (i) Distance travelled by crow towards north after $3\frac{1}{2}$ h

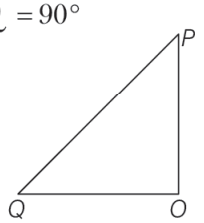
Distance = Speed × time

$= 600 \times \frac{7}{2} = 2100$ km

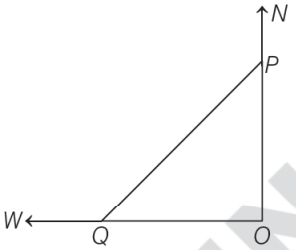
(ii) Distance travelled by crow towards west after $3\frac{1}{2}$ h

Distance $= 800 \times \frac{7}{2} = 2800$ km

(iii) $\angle POQ = 90°$



(iv) $OP = 2100$ km, $OQ = 2800$ km



$PQ = \sqrt{OP^2 + OQ^2}$

$= \sqrt{(2100)^2 + (2800)^2}$

$= 100\sqrt{441 + 784}$

$= 100\sqrt{1225}$

$= 100 \times 35 = 3500$ km

(v) Area of $\Delta POQ = \frac{1}{2} \times OP \times OQ$

$= \frac{1}{2} \times 2100 \times 2800 = 2940000$ km^2

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06

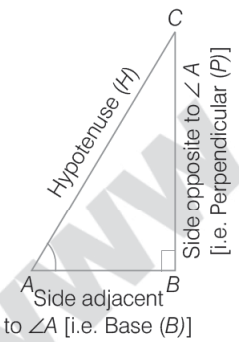
Introduction to Trigonometry

Quick Revision

Trigonometric Ratios

The ratios of the sides of a right angled triangle with respect to its acute angles, are called trigonometric ratios.

Trigonometric ratios are also called T-ratio. Trigonometric ratios of $\angle A$ in right angled ΔABC are defined below.



(i) sine A or sin $A = \dfrac{\text{Side opposite to } \angle A}{\text{Hypotenuse}} \left(\text{i.e. } \dfrac{P}{H}\right)$

$= \dfrac{BC}{AC}$

(ii) cosine A or cos A

$= \dfrac{\text{Side adjacent to } \angle A}{\text{Hypotenuse}} \left(\text{i.e. } \dfrac{B}{H}\right) = \dfrac{AB}{AC}$

(iii) tangent A or tan A

$= \dfrac{\text{Side opposite to } \angle A}{\text{Side adjacent to } \angle A} \left(\text{i.e. } \dfrac{P}{B}\right) = \dfrac{BC}{AB}$

(iv) cosecant A or cosec A

$= \dfrac{\text{Hypotenuse}}{\text{Side opposite to } \angle A} \left(\text{i.e. } \dfrac{H}{P}\right) = \dfrac{AC}{BC}$

(v) secant A or sec A

$= \dfrac{\text{Hypotenuse}}{\text{Side adjacent to } \angle A} \left(\text{i.e. } \dfrac{H}{B}\right) = \dfrac{AC}{AB}$

(vi) cotangent A or cot A

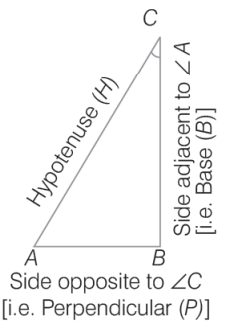
$= \dfrac{\text{Side adjacent to } \angle A}{\text{Side opposite to } \angle A} \left(\text{i.e. } \dfrac{B}{P}\right) = \dfrac{AB}{BC}$

Similarly trigonometric ratios of $\angle C$ are

(a) $\sin C = \dfrac{AB}{AC}$ (b) $\cos C = \dfrac{BC}{AC}$

(c) $\tan C = \dfrac{AB}{BC}$ (d) $\operatorname{cosec} C = \dfrac{AC}{AB}$

(e) $\sec C = \dfrac{AC}{BC}$ (f) $\cot C = \dfrac{BC}{AB}$



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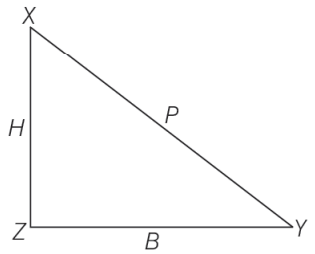
A Popular Technique to Remember T-ratios i.e. $\frac{PBP}{HHB}$

Pandit (P)	Badari (B)	Prasad (P)
Har (H)	Har (H)	Bholay (B)



Then, $\sin\theta = \frac{P}{H}$, $\cos\theta = \frac{B}{H}$, $\tan\theta = \frac{P}{B}$

$\Rightarrow$ $\operatorname{cosec}\theta = \frac{H}{P}$, $\sec\theta = \frac{H}{B}$, $\cot\theta = \frac{B}{P}$

where, P is perpendicular, B is base and H is hypotenuse.

Important Points

(i) In an isosceles right ΔABC, right angled at B, the trigonometric ratios obtained by taking either $\angle A$ or $\angle C$, both give the same value.

(ii) The value of each of the trigonometric ratios of an angle does not depend on the size of the triangle. It only depends on the angle.

(iii) It is clear that the values of the trigonometric ratios of an angle do not vary with the lengths of the sides of the triangle, if the angle remains the same.

(iv) If one of the trigonometric ratios of an acute angle is known, then remaining trigonometric ratios of that angle can be determined easily.

(v) Each trigonometric ratio is a real number and has no unit.

(vi) As, the hypotenuse is the longest side in a right angled triangle, the value of $\sin A$ or $\cos A$ is always less than 1 (or in particular equal to 1) whereas the value of $\sec A$ or $\operatorname{cosec} A$ is always greater than or equal to 1.

Relation Between Trigonometric Ratios

(i) $\sin A = \frac{1}{\operatorname{cosec} A}$, $\operatorname{cosec} A = \frac{1}{\sin A}$

(ii) $\cos A = \frac{1}{\sec A}$, $\sec A = \frac{1}{\cos A}$

(iii) $\tan A = \frac{1}{\cot A}$, $\cot A = \frac{1}{\tan A}$

(iv) $\tan A = \frac{\sin A}{\cos A}$

(v) $\cot A = \frac{\cos A}{\sin A}$

Values of Trigonometric Ratios for Some Specific Angles

Angles	**0°**	**30°**	**45°**	**60°**	**90°**
$\sin\theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos\theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan\theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞
$\operatorname{cosec}\theta$	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
$\sec\theta$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞
$\cot\theta$	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

Here, ∞ = undefined

Important Points

(i) The value of $\sin\theta$ increase from 0 to 1 and $\cos\theta$ decrease from 1 to 0, where $0 \le \theta \le 90°$.

(ii) In the case of $\tan\theta$, the values increase from 0 to ∞, where $0 \le \theta \le 90°$.

(iii) In the case of $\cot\theta$, the values decrease from ∞ to 0, where $0 \le \theta \le 90°$.

(iv) In the case of $\operatorname{cosec}\theta$, the values decrease from ∞ to 1, where $0 \le \theta \le 90°$.

(v) In the case of $\sec\theta$, the values increase from 1 to ∞, where $0 \le \theta \le 90°$.

(vi) Division by 0 is not allowed, since 1/0 is indeterminate (not defined).

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Trigonometric Identity

An equation is called an identity when it is true for all values of the variables involved. Similarly, an equation involving trigonometric ratios of an angle is called a trigonometric identity, if it is true for all values of the angle involved. For any acute angle θ, we have

(i) $\sin^2\theta + \cos^2\theta = 1$ or $\sin^2\theta = 1 - \cos^2\theta$

or $\cos^2\theta = 1 - \sin^2\theta$

(ii) $\sec^2\theta - \tan^2\theta = 1$ or $1 + \tan^2\theta = \sec^2\theta$

or $\sec^2\theta - 1 = \tan^2\theta$

(iii) $1 + \cot^2\theta = \text{cosec}^2\theta$ or $\text{cosec}^2\theta - \cot^2\theta = 1$

or $\cot^2\theta = \text{cosec}^2\theta - 1$

Note $\sin^2\theta = (\sin\theta)^2$ but $\sin\theta^2 \neq (\sin\theta)^2$. The same is true for all other trigonometric ratios.

Representation of a Trigonometric Ratio in Terms of Any Other Trigonometric Ratio

	sin θ	**cos θ**	**tan θ**	**cot θ**	**sec θ**	**cosec θ**
sin θ	$\sin\theta$	$\sqrt{(1-\cos^2\theta)}$	$\frac{\tan\theta}{\sqrt{(1+\tan^2\theta)}}$	$\frac{1}{\sqrt{(1+\cot^2\theta)}}$	$\frac{\sqrt{(\sec^2\theta-1)}}{\sec\theta}$	$\frac{1}{\text{cosec}\,\theta}$
cos θ	$\sqrt{(1-\sin^2\theta)}$	$\cos\theta$	$\frac{1}{\sqrt{(1+\tan^2\theta)}}$	$\frac{\cot\theta}{\sqrt{(1+\cot^2\theta)}}$	$\frac{1}{\sec\theta}$	$\frac{\sqrt{(\text{cosec}^2\theta-1)}}{\text{cosec}\,\theta}$
tan θ	$\frac{\sin\theta}{\sqrt{(1-\sin^2\theta)}}$	$\frac{\sqrt{(1-\cos^2\theta)}}{\cos\theta}$	$\tan\theta$	$\frac{1}{\cot\theta}$	$\sqrt{(\sec^2\theta-1)}$	$\frac{1}{\sqrt{(\text{cosec}^2\theta-1)}}$
cot θ	$\frac{\sqrt{(1-\sin^2\theta)}}{\sin\theta}$	$\frac{\cos\theta}{\sqrt{(1-\cos^2\theta)}}$	$\frac{1}{\tan\theta}$	$\cot\theta$	$\frac{1}{\sqrt{(\sec^2\theta-1)}}$	$\sqrt{\text{cosec}^2\theta-1}$
sec θ	$\frac{1}{\sqrt{(1-\sin^2\theta)}}$	$\frac{1}{\cos\theta}$	$\sqrt{(1+\tan^2\theta)}$	$\frac{\sqrt{(1+\cot^2\theta)}}{\cot\theta}$	$\sec\theta$	$\frac{\text{cosec}\theta}{\sqrt{(\text{cosec}^2\theta-1)}}$
cosec θ	$\frac{1}{\sin\theta}$	$\frac{1}{\sqrt{(1-\cos^2\theta)}}$	$\frac{\sqrt{(1+\tan^2\theta)}}{\tan\theta}$	$\sqrt{(1+\cot^2\theta)}$	$\frac{\sec\theta}{\sqrt{(\sec^2\theta-1)}}$	$\text{cosec}\,\theta$

Objective Questions

Multiple Choice Questions

1. Trigonometry is branch of Mathematics in which we deal with the relationship between angle and sides of a triangle.

(a) True (b) False
(c) Cannot say (d) Partially True/False

2. If $\cos A = \frac{4}{5}$, then the value of $\tan A$ is *[NCERT Exemplar]*

(a) 3/5 (b) 3/4
(c) 4/3 (d) 5/3

3. If $\sin\theta = \frac{a}{b}$, then $\cos\theta$ is equal to *[NCERT Exemplar]*

(a) $\frac{b}{\sqrt{b^2-a^2}}$ (b) $\frac{b}{a}$

(c) $\frac{\sqrt{b^2-a^2}}{b}$ (d) $\frac{a}{\sqrt{b^2-a^2}}$

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4. If $\cos\theta = \frac{2}{3}$, then the value of $2\sec^2\theta + 2\tan^2\theta - 9$ is

(a) 2 (b) −2
(c) 1 (d) 3

5. If $x \cos A = 8$ and $15\,\text{cosec}\,A = 8 \sec A$, then the value of x is

(a) 20 (b) 16
(c) 17 (d) 13

6. If $\alpha \sin A = 5$ and $7\,\text{cosec}\,A = 6 \sec A$, then the value of α is

(a) $\frac{46}{45}$ (b) $\frac{46}{7}$
(c) $\frac{49}{46}$ (d) None of these

7. If θ is an acute angle and $4 \sin\theta = 3$, then the value of $4\sin^2\theta - 3\cos^2\theta + 2$ is

(a) $\frac{45}{16}$ (b) $\frac{35}{18}$
(c) $\frac{32}{16}$ (d) $\frac{47}{16}$

8. If $\sin A = \frac{4}{5}$, then the value of $\frac{1 - \sin A}{1 + \cos A}$ is

(a) $\frac{1}{8}$ (b) $\frac{1}{2}$
(c) 2 (d) $\frac{3}{5}$

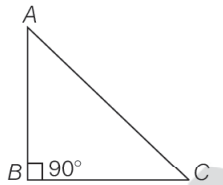
9. In a ΔPQR, $\angle Q = 90°$. If $PQ = 10$ cm and $PR = 15$ cm. Then, the value of $\tan^2 P + \sec^2 P + 1$ is

(a) $\frac{5}{2}$ (b) $\frac{3}{17}$
(c) $\frac{9}{2}$ (d) $\frac{4}{5}$

10. In ΔABC, if $AB = BC$, $\angle B = 90°$, then the value $\sin A$ is

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{\sqrt{3}}{2}$
(c) 0 (d) $\frac{1}{2}$

11. In ΔABC, if $AB = 2BC$, $\angle B = 90°$, then the value of $\sec A$ is



(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{\sqrt{3}}{2}$
(c) $\frac{\sqrt{5}}{2}$ (d) $\frac{1}{2}$

12. The value of $\cos\theta$ increase as θ increase.

(a) True (b) False
(c) Cannot say (d) Partially True/False

13. Is $\tan^2 30° + \cot^2 30° = \frac{10}{3}$?

(a) True (b) False
(c) Cannot say (d) Partially True/False

14. $\sin 2A = 2\sin A$ is true when A is equal to

(a) 0° (b) 30°
(c) 45° (d) 60°

15. $\cot^2 30° + \text{cosec}\,30° + 3\tan^2 30°$ is equal to

(a) 3 (b) 1
(c) 0 (d) 6

16. The value of $\frac{2\tan 30°}{1 - \tan^2 30°}$ will be

(a) $\cos 60°$ (b) $\sin 60°$
(c) $\tan 60°$ (d) $\cot 60°$

17. If $\tan\theta + \frac{1}{\tan\theta} = 2$, then the value of $\text{cosec}\,\theta$ is

(a) 1 (b) $\frac{1}{\sqrt{2}}$
(c) $\sqrt{2}$ (d) $\frac{\sqrt{3}}{2}$

18. If $x \tan 45° \cos 60° = \sin 60° \cot 60°$, then the value of x will be

(a) 1 (b) $\frac{1}{2}$
(c) $\frac{1}{\sqrt{2}}$ (d) $\frac{\sqrt{3}}{2}$

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19. $7\cos 30°+5\tan 30°+6\cot 60°$ is

(a) $\frac{43}{2\sqrt{3}}$ (b) $\frac{41\sqrt{3}}{2}$

(c) $\frac{47}{2\sqrt{3}}$ (d) $\frac{49\sqrt{3}}{2}$

20. If $\tan\theta - \frac{4}{\tan\theta} = 3$, then $\sin^2\theta$ is

(a) $\frac{4}{17}$ (b) $\frac{3}{17}$

(c) $\frac{16}{17}$ (d) $\frac{5}{17}$

21. If $\sin\alpha = \frac{1}{2}$ and $\cos\beta = \frac{1}{2}$, then the value of $(\alpha + \beta)$ is

(a) 60° (b) 90°

(c) 30° (d) 45°

22. If $\tan A = \frac{1}{\sqrt{3}}$ and $\tan B = \sqrt{3}$, then $\tan(A + B)$ is

(a) 0 (b) $\frac{1}{\sqrt{3}}$

(c) 1 (d) ∞

23. If $\sqrt{3}\tan\theta = 2\sin\theta$, then the value $\sin^2\theta - \cos^2\theta$ is

(a) $\frac{1}{2}$ (b) $-\frac{1}{2}$

(c) $\frac{3}{2}$ (d) $\frac{-3}{2}$

24. If $\sin\theta - \cos\theta = 0$, then the value of $\sin^4\theta + \cos^4\theta$ will be ***[NCERT Exemplar]***

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$

(c) $\frac{3}{4}$ (d) 1

25. If $m\tan 30°\cot 60° = \sin 45°\cos 45°$, then the value of m will be

(a) $\frac{1}{2}$ (b) $\frac{3}{2}$

(c) $\frac{1}{3}$ (d) $\frac{3}{4}$

26. The value of $\frac{2\tan 30°}{1+\tan^2 30°}$ is

(a) sin60° (b) cos 60°

(c) tan60° (d) sin30°

27. The value of $\frac{1-\tan^2 45°}{1+\tan^2 45°}$ is

(a) tan90° (b) 1

(c) sin45° (d) 0

28. The value of $\frac{\tan 30°}{\cot 60°}$ is

(a) 1 (b) –1

(c) 2 (d) $\frac{1}{2}$

29. If A, B, C are the angles of a ΔABC, then the value of $\tan\left(\frac{B+C}{2}\right)$ is

(a) $\cot\frac{B}{2}$ (b) $\tan\frac{A}{2}$

(c) $\cot\frac{C}{2}$ (d) $\cot\frac{A}{2}$

30. If $\cos A + \cos^2 A = 1$, then the value of $\sin^2 A + \sin^4 A$ is

(a) 0 (b) 1

(c) –1 (d) 2

31. Is $\sin(A + B) = \sin A + \sin B$?

(a) True

(b) False

(c) Cannot say

(d) Partially True/False

32. Is $\frac{1-\sin\theta}{1+\sin\theta} = \sec^2\theta - \tan^2\theta$?

(a) True

(b) False

(c) Cannot say

(d) Partially True/False

33. The value of $\frac{1+\tan^2 A}{1+\cot^2 A}$ is

(a) $\sec^2 A$

(b) –1

(c) $\cot^2 A$

(d) $\tan^2 A$

34. The value of $(1 + \tan\theta + \sec\theta)(1 + \cot\theta - \operatorname{cosec}\theta)$ is

(a) 0 (b) 1

(c) 2 (d) –1

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35. If $4x = \text{cosec}\,\theta$ and $\frac{4}{x} = \cot\theta$, then the value of $4\left[x^2 - \frac{1}{x^2}\right]$ is

(a) $\frac{1}{4}$ (b) 4

(c) 2 (d) $\frac{1}{2}$

36. The value of $\frac{\sin\theta\tan\theta}{1-\cos\theta} + \tan^2\theta - \sec^2\theta$ is

(a) $\sin\theta\cos\theta$ (b) $\sec\theta$

(c) $\tan\theta$ (d) $\text{cosec}\,\theta$

37. If $\sec\theta = x + \frac{1}{4x}$, then the value of $\sec\theta + \tan\theta$ is

(a) $4x$ (b) $2x$

(c) x (d) $\frac{x}{2}$

38. If $\sqrt{3}\cot^2\theta - 4\cot\theta + \sqrt{3} = 0$, then the value of $\tan^2\theta + \cot^2\theta$ is

(a) $\frac{3}{10}$ (b) $\frac{-10}{3}$

(c) $\frac{10}{3}$ (d) $\frac{-20}{3}$

39. If $\tan\theta + \sec\theta = l$, then the value of $\sec\theta$ is

(a) $\frac{l^2-1}{2l}$ (b) $\frac{l^2+1}{2l}$

(c) $\frac{l^2-1}{l}$ (d) $\frac{2(l^2-1)}{l}$

40. If $\tan A = a\tan B$ and $\sin A = b\sin B$, then the value of $\cos^2 A$ is

(a) $\frac{a^2-1}{b^2-1}$ (b) $\frac{a^2+1}{b^2-1}$

(c) $\frac{b^2-1}{a^2+1}$ (d) $\frac{b^2-1}{a^2-1}$

41. If $\text{cosec}\,A - \cot A = q$, then the value of $\frac{q^2-1}{q^2+1} + \cos A$ is

(a) 1 (b) 0

(c) -1 (d) 2

42. If $x = r\sin A\cos B$, $y = r\sin A\sin B$ and $z = r\cos A$, then the value of $x^2 + y^2 + z^2$ is

(a) $\frac{r^2}{2}$ (b) r^2

(c) $r^2 - 1$ (d) $r^2 + 1$

43. If $\sin^2 A = 1$, then the value of $\sin^2 A - \cos^2 A$ is

(a) 1 (b) 0

(c) 2 (d) None of these

44. Match the following.

	List I		List II
P.	$\frac{\sin 0°}{\cos 90°} + \sin 45°$	1.	$\left(\frac{1-\sqrt{3}}{2}\right)$
Q.	$\cos 60° - \sin 60°$	2.	$1 + \frac{\sqrt{2}}{3}$
R.	$\sec 30°\sin 60° + \cos 45°\,\text{cosec}\,60°$	3.	1
S.	$\frac{\cos^3 30° - \cos^3 60°}{\sin^3 60° - \sin^3 30°}$	4.	$\frac{1}{\sqrt{2}}$

	P	Q	R	S		P	Q	R	S
(a)	2	4	3	1	(b)	3	1	4	2
(c)	2	3	4	1	(d)	4	1	2	3

45. Match the following.

	List I		List II
P.	$1 + \frac{\cot^2\theta}{1+\text{cosec}\,\theta}$	1.	$2\tan\theta$
Q.	$\frac{\cos\theta}{\text{cosec}\,\theta + 1} + \frac{\cos\theta}{\text{cosec}\,\theta - 1}$	2.	$\left(\frac{\sin^2\theta - \cos^2\theta}{\cos\theta\sin\theta}\right)^2$
R.	$\tan^2\theta + \cot^2\theta - 2$	3.	$(\text{cosec}\,\theta - \cot\theta)^2$
S.	$\frac{1-\cos\theta}{1+\cos\theta}$	4.	$\sec\theta\cot\theta$

	P	Q	R	S		P	Q	R	S
(a)	3	4	2	1	(b)	3	1	4	2
(c)	2	3	4	1	(d)	4	1	2	3

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Assertion-Reasoning MCQs

Directions (Q. Nos. 46-55) Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) A is true, R is true; R is a correct explanation for A.
(b) A is true, R is true; R is not a correct explanation for A.
(c) A is true; R is false.
(d) A is false; R is true.

46. **Assertion** $2\cos\theta = a + \frac{1}{a}$, where $a > 0, a \neq 1$

Reason $-1 \leq \cos\theta \leq 1$ for all values of θ.

47. **Assertion** The value of each of the trigonometric ratios of an angle does not depend on the size of the triangle. It only depends on the angle.

Reason In right ΔABC, $\angle B = 90°$ and $\angle A = \theta°$ $\sin\theta = \frac{BC}{AC} < 1$ and $\cos\theta = \frac{AB}{AC} < 1$ as hypotenuse is the longest side.

48. **Assertion** The equation $\sec^2\theta = \frac{4xy}{(x+y)^2}$ is only possible when $x = y$.

Reason $\sec^2\theta > 1$ and therefore $(x-y)^2 < 0$.

49. **Assertion** In a right angled triangle, if $\tan\theta = \frac{3}{4}$, then greatest side of the triangle is 5 units.

Reason $(\text{greatest side})^2 = (\text{hypotenuse})^2 = (\text{perpendicular})^2 + (\text{base})^2$

50. **Assertion** $\sin 60° = \cos 30°$.

Reason $\sin 2\theta = \sin\theta + \sin\theta$, where θ is an acute angle.

51. **Assertion** $\cos 60° - \sin 60°$ is negative.

Reason $\sin^2\theta - \cos^2\theta$ is positive, where θ is an acute angle.

52. **Assertion** $\frac{(\sin\theta - \cos\theta)(\sin\theta + \cos\theta)}{(\cos\theta - \sin\theta)(\cos\theta + \sin\theta)} = -1$

Reason $\sin^2\theta + \cos^2\theta = -1$

53. **Assertion** $\cos^2 A - \sin^2 A = 1$, $\tan^2 A - \sec^2 A = 1$ are trigonometric identities.

Reason An equation involving trigonometric ratios of an angle is called a trigonometric identity. It is true for all values of the angles involved.

54. **Assertion** $(\cot\theta + 3)(3\cot\theta + 1) = 3\operatorname{cosec}^2\theta + 10\cot\theta$

Reason $1 + \cot^2\theta = \operatorname{cosec}^2\theta$

55. **Assertion** If $\sec\theta + \tan\theta = x$, then the value of $\sin\theta = \frac{x^2 - 1}{x^2 + 1}$

Reason $x + \frac{1}{x} = 2\tan\theta$ and $x - \frac{1}{x} = 2\sec\theta$.

Case Based MCQs

56. Two jet plane leave an airport, one after the other. After moving on runway, one flies due North and other flies due South. The speed of two aeroplanes is 400 km/h and 500 km/h respectively.

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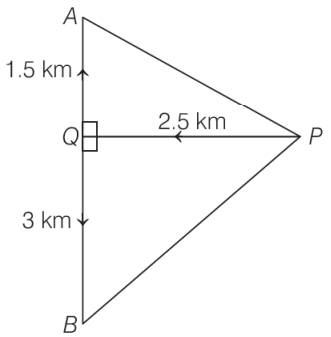
Considering PQ as runway and A and B are any two points in the path followed by two jet planes, then answer the following questions.



(i) Find $\tan\theta$; if $\angle APQ = \theta$.

(a) $\frac{1}{5}$ (b) $\frac{2}{3\sqrt{2}}$

(c) $\frac{\sqrt{3}}{2}$ (d) $\frac{3}{5}$

(ii) Find $\cot B$.

(a) $\frac{3}{4}$ (b) $\frac{6}{5}$

(c) $\frac{5}{6}$ (d) $\frac{15}{8}$

(iii) Find $\tan A$.

(a) 2/3 (b) $\sqrt{2}$

(c) $\frac{5}{3}$ (d) $\frac{2}{\sqrt{3}}$

(iv) Find $\sec A$.

(a) 1 (b) 2

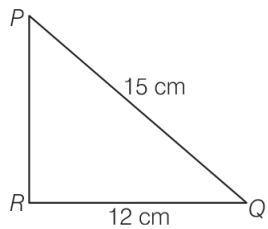
(c) $\frac{4}{3}$ (d) $\frac{5}{3}$

(v) Find $\operatorname{cosec} B$.

(a) $\frac{17}{8}$ (b) $\frac{8}{5}$

(c) $\frac{6}{5}$ (d) $\frac{8}{17}$

57. Kavita a student of class 10th, has to made a project on 'Introduction to Trigonometry'. She decides to make a Dog house which is triangular in shape. She uses cardboard to make the Dog house as shown in the figure.
Considering the front side of Dog house as right angled triangle PQR, right angled at R, answer the following questions.



(i) If $\angle PQR = \theta$, then $\cos\theta$ is equal to

(a) $\frac{4}{5}$ (b) $\frac{5}{12}$

(c) $\frac{3}{5}$ (d) $\frac{13}{12}$

(ii) The value of $\sec\theta$ is

(a) $\frac{5}{12}$ (b) $\frac{5}{4}$

(c) $\frac{13}{12}$ (d) $\frac{5}{3}$

(iii) The value of $\frac{\tan\theta}{1+\tan^2\theta}$ is

(a) $\frac{5}{12}$ (b) $\frac{12}{25}$

(c) $\frac{60}{169}$ (d) $\frac{169}{60}$

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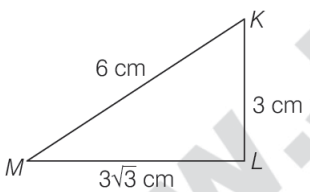
(iv) The value of $\cot^2\theta - \text{cosec}^2\theta$ is

(a) –1 (b) 0
(c) 1 (d) 2

(v) The value of $\sin^2\theta + \cos^2\theta$ is

(a) 0 (b) 1
(c) –1 (d) 2

58. Ritu's daughter is feeling so hungry and so thought to eat something. She looked into the bag and found some chips packed. She decided to eat. She open the chips packet and found that it forms a right angled triangle, with sides 3 cm, $3\sqrt{3}$ cm and 6 cm.



On the basis of above information, answer the following questions.

(i) The value of $\angle M$ =

(a) 30° (b) 60°
(c) 45° (d) None of these

(ii) The value of $\angle K$ =

(a) 45°
(b) 30°
(c) 60°
(d) None of the above

(iii) Find the value of $\tan M$.

(a) $\sqrt{3}$
(b) $\frac{1}{\sqrt{3}}$
(c) 1
(d) None of the above

(iv) $\sec^2 M - 1 =$

(a) tanM (b) tan2M
(c) $\tan^2 M$ (d) None of these

(v) The value of $\frac{\tan^2 45° - 1}{\tan^2 45° + 1}$ is

(a) 0 (b) 1
(c) 2 (d) –1

59. Janvi and her father go to meet her friend Sanvi for a candle light event. When they reached to church. Janvi saw the top of the church which is triangular in shape. If she imagined the dimensions of the top as given in the figure, then answer the following questions.

(i) If D is the mid point of AC, then BD is

(a) 2m (b) 3m
(c) 4 m (d) 6 m

(ii) Measure of $\angle A$ is

(a) 30° (b) 60°
(c) 45° (d) None of these

(iii) Measure of $\angle C$ is

(a) 30° (b) 60°
(c) 45° (d) None of these

(iv) The value of $\sin A + \cos C$.

(a) 0 (b) 1
(c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}$

(v) The value of $\tan^2 C + \tan^2 A$.

(a) 0 (b) 1
(c) 2 (d) $\frac{1}{2}$

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ANSWERS

Multiple Choice Questions

1. (a)	2. (b)	3. (c)	4. (b)	5. (c)	6. (b)	7. (d)	8. (a)	9. (c)	10. (a)
11. (c)	12. (b)	13. (a)	14. (a)	15. (d)	16. (c)	17. (c)	18. (a)	19. (a)	20. (c)
21. (b)	22. (d)	23. (b)	24. (b)	25. (b)	26. (a)	27. (d)	28. (a)	29. (d)	30. (b)
31. (b)	32. (b)	33. (d)	34. (c)	35. (a)	36. (b)	37. (b)	38. (c)	39. (b)	40. (d)
41. (b)	42. (b)	43. (a)	44. (d)	45. (d)					

Assertion and Reason

46. (d)	47. (b)	48. (a)	49. (a)	50. (c)	51. (c)	52. (c)	53. (d)	54. (a)	55. (c)

Case Study Based

56. (i) - (d); (ii) - (b); (iii) - (c); (iv) - (b); (v) - (b)
57. (i) - (a); (ii) - (b); (iii) - (b); (iv) - (a); (v) - (b)
58. (i) - (a); (ii) - (c); (iii) - (b); (iv) - (c); (v) - (a)
59. (i) - (c); (ii) - (c); (iii) - (c); (iv) - (d); (v) - (c)

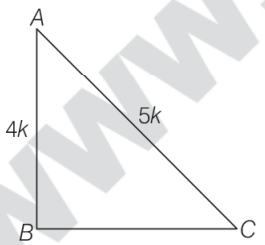
SOLUTIONS

1. (True) Trigonometry is branch of Mathematics in which we deal with the relationship between angle and sides of a triangle.

$\therefore \quad \sin\theta = \frac{p}{h} \qquad \tan\theta = \frac{p}{b}$

$\operatorname{cosec}\theta = \frac{h}{p} \quad \sec\theta = \frac{h}{b} \quad \cot\theta = \frac{b}{p}$

2. Given,



$\cos A = \frac{4}{5}$

$\therefore$ Let $AB = 4k$ and $AC = 5k$

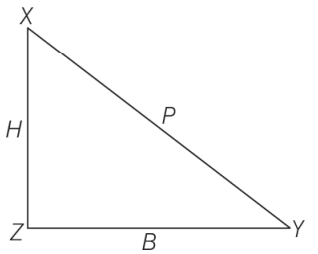
Apply Pythagoras Theorem

$AB^2 + BC^2 = AC^2$

$BC = \sqrt{25k^2 - 16k^2} = 3k$

Now, $\tan A = \frac{BC}{AB} = \frac{3k}{4k} = \frac{3}{4}$

3. Given, $\sin\theta = \frac{a}{b} = \frac{AB}{AC}$



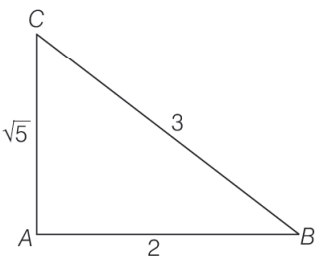
Let $AB = ak$, $AC = bk$

$AB^2 + BC^2 = AC^2$

[from Pythagoras theorem]

$BC = \sqrt{b^2 - a^2} \Rightarrow \cos\theta = \frac{\sqrt{b^2 - a^2}}{b}$

4. Given, $\cos\theta = \frac{2}{3} = \frac{\text{Base}}{\text{Hypotenuse}}$



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Let $AB = 2k$ and $BC = 3k$

Apply Pythagoras theorem,

$$AB^2 + AC^2 = BC^2$$

$$\Rightarrow \quad (2k)^2 = AC^2 + (3k)^2$$

$$\Rightarrow \quad AC^2 = 9k^2 - 4k^2$$

$$\Rightarrow \quad AC = \sqrt{5}k$$

$$\sec\theta = \frac{\text{Hypotenuse}}{\text{Base}} = \frac{3}{2}, \tan\theta = \frac{p}{b} = \frac{\sqrt{5}}{2}$$

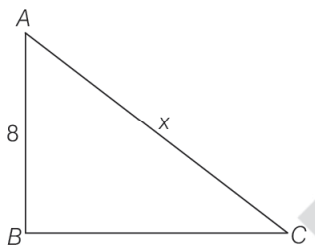
$2\sec^2\theta + 2\tan^2\theta - 9$

$$= 2 \times \left(\frac{3}{2}\right)^2 + 2 \times \left(\frac{\sqrt{5}}{2}\right)^2 - 9$$

$$= 2 \times \frac{9}{4} + \frac{2 \times 5}{4} - 9 = \frac{18 + 10 - 36}{4}$$

$$= \frac{28 - 36}{4} = -\frac{8}{4} = -2$$

5. Given, $x \cos A = 8$



$$\cos A = \frac{8}{x}$$

and $15\,\text{cosec}\ A = 8 \sec A$

$$\cos A = \frac{8}{x}$$

$$= \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC}$$

Let $AB = 8k$, $AC = xk$

Apply Pythagoras theorem,

$$AB^2 + BC^2 = AC^2$$

$$\Rightarrow \quad (8k)^2 + BC^2 = (xk)^2$$

$$\Rightarrow \quad BC = (\sqrt{x^2 - 8^2})\,k$$

$$\Rightarrow \quad 15\,\text{cosec}\ A = 8 \sec A$$

$$\Rightarrow \quad \frac{15 \times xk}{k\sqrt{x^2 - 8^2}} = \frac{8xk}{8k}$$

$$\Rightarrow \quad \sqrt{x^2 - 8^2} = 15$$

On squaring both side, we get

$$x^2 - 8^2 = (15)^2$$

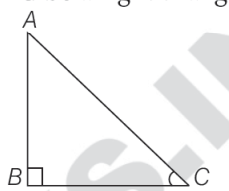
$$\Rightarrow \quad x^2 = 225 + 64$$

$$\Rightarrow \quad x^2 = 289$$

$$\Rightarrow \quad x = 17$$

6. $\sin A = \frac{5}{\alpha}$ and $7\text{cosec}A = 6 \sec A$

Let the ΔABC be a right triangle.



$$\angle B = 90°$$

$$\sin A = \frac{5}{\alpha}$$

$$BC = 5k,\ AC = \alpha k$$

$$7\text{cosec}A = 6 \sec A$$

$$7 \times \frac{AC}{BC} = 6\,\frac{AC}{AB}$$

$$\frac{7}{5k} = \frac{6}{AB}$$

$$AB = \frac{30k}{7}$$

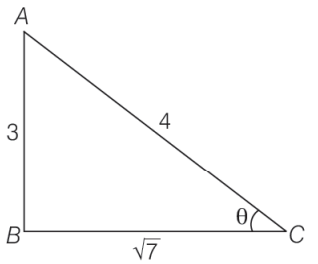
$$AB^2 + BC^2 = AC^2$$

$$\left(\frac{30}{7}k\right)^2 + (5k)^2 = \alpha^2 k^2$$

$$\sqrt{\frac{900 + 49 \times 25}{49}} = \alpha$$

$$\Rightarrow \quad \alpha = \sqrt{\frac{2125}{49}} = \frac{46}{7} \text{ (approx)}$$

7. Given, $4 \sin\theta = 3$



$$\Rightarrow \quad \sin\theta = \frac{3}{4} = \frac{\text{Opposite side}}{\text{Hypotenuse}}$$

Let $AB = 3k$ and $AC = 4k$

Apply Pythagoras theorem,

$$AB^2 + BC^2 = AC^2$$

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$\Rightarrow \quad (3k)^2 + BC^2 = (4k)^2$

$\Rightarrow \quad BC = (\sqrt{16-9})\,k$

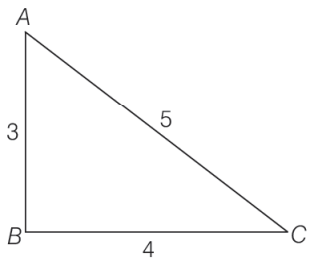
$= \sqrt{7}\,k$

$\Rightarrow \quad \cos\theta = \dfrac{\sqrt{7}\,k}{4k} = \dfrac{\sqrt{7}}{4}$

$\Rightarrow 4\sin^2\theta - 3\cos^2\theta + 2 = 4 \times \dfrac{9}{16} - 3 \times \dfrac{7}{16} + 2$

$= \dfrac{36 - 21 + 32}{16} = \dfrac{47}{16}$

8. Given, $\sin A = \dfrac{4}{5} = \dfrac{BC}{AC}$



Let $BC = 4k$, $AC = 5k$

Apply Pythagoras theorem,

$AB^2 + BC^2 = AC^2$

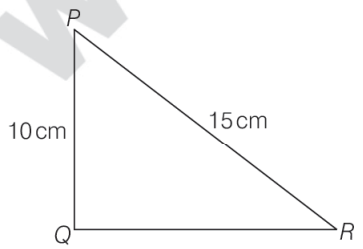
$\Rightarrow \quad AB^2 + (4k)^2 = (5k)^2$

$\Rightarrow \quad AB = \sqrt{25-16} = 3$

$\Rightarrow \quad \dfrac{1-\sin A}{1+\cos A} = \dfrac{1-\frac{4}{5}}{1+\frac{3}{5}}$

$= \dfrac{(5-4)}{5} \times \dfrac{5}{(5+3)} = \dfrac{1}{8}$

9. Given, $PQ = 10$ cm, $PR = 15$ cm



Apply Pythagoras theorem,

$PQ^2 + QR^2 = PR^2$

$\Rightarrow \quad 10^2 + QR^2 = 15^2$

$\Rightarrow \quad QR = \sqrt{225-100}$

$= \sqrt{125}$

$\therefore \quad \tan^2 p + \sec^2 p + 1$

$= \left(\dfrac{QR}{PQ}\right)^2 + \left(\dfrac{PR}{PQ}\right)^2 + 1$

$= \dfrac{125}{100} + \dfrac{225}{100} + 1$

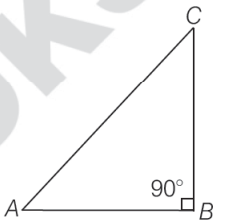
$= \dfrac{125 + 225 + 100}{100} = \dfrac{450}{100} = \dfrac{9}{2}$

10. Given, in ΔABC, $\angle B = 90°$ and $AB = BC$

$\therefore \quad \angle ACB = \angle BAC$

[$\because$ angles opposite to two equal sides are equal]

In ΔABC, $\angle ABC + \angle ACB + \angle BAC = 180°$



Let $\angle ACB = \angle BAC = x$

$\therefore \quad 90° + x + x = 180°$

[$\because$ sum of all angles of a triangle is 180°]

$\Rightarrow \quad 2x = 90° \Rightarrow x = 45°$

$\therefore \quad \angle ACB = \angle BAC = 45°$

(i) $\sin A = \sin 45° = \dfrac{1}{\sqrt{2}} \quad \left[\because \sin 45° = \dfrac{1}{\sqrt{2}}\right]$

(ii) $\cos A = \cos 45° = \dfrac{1}{\sqrt{2}} \quad \left[\because \cos 45° = \dfrac{1}{\sqrt{2}}\right]$

11. Given, $AB = 2BC$

$\dfrac{AB}{BC} = 2$

$\tan A = \dfrac{BC}{AB} = \dfrac{1}{2}$

Let $AB = 2k$ and $BC = k$

$AC = \sqrt{4k^2 + k^2} = \sqrt{5}k$

$\sec A = \dfrac{AC}{AB} = \dfrac{\sqrt{5}k}{2k} = \dfrac{\sqrt{5}}{2}$

12. (False) Since, the value of $\cos\theta$ decrease from 1 to 0 as θ increase from 0° to 90°.

13. (True) We know that,

$\tan 30° = \dfrac{1}{\sqrt{3}}$ and $\cot 30 = \sqrt{3}$

We have, $\tan^2 30° + \cot^2 30°$

$= \left(\dfrac{1}{\sqrt{3}}\right)^2 + (\sqrt{3})^2 = \dfrac{1}{3} + 3 = \dfrac{1+9}{3} = \dfrac{10}{3}$

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14. Given, $\sin 2A = 2\sin A$

when, $A = 0°$, then

$\sin(2\times 0°) = 2\sin 0°$

$\Rightarrow \quad \sin(0°) = 2\times 0$

$\Rightarrow \quad 0 = 0$

So, for $A = 0°$, given statement is true.

15. We have,

$\cot^2 30° + \text{cosec } 30° + 3\tan^2 30°$

$$= (\sqrt{3})^2 + (2) + 3\left(\frac{1}{\sqrt{3}}\right)^2$$

$$= 3 + 2 + 3\times\frac{1}{3} = 6$$

16. Given, $\dfrac{2\tan 30°}{1-\tan^2 30°}$

$$= \frac{2\times\frac{1}{\sqrt{3}}}{1-\left(\frac{1}{\sqrt{3}}\right)^2} \quad \left[\because \tan 30° = \frac{1}{\sqrt{3}}\right]$$

$$\Rightarrow \quad \frac{\frac{2}{\sqrt{3}}}{1-\frac{1}{3}} = \frac{2}{\sqrt{3}}\left[\frac{1}{3-1}\right]\times 3$$

$$= \frac{1}{\sqrt{3}}\times 3 = \sqrt{3} = \tan 60°$$

17. Given, $\tan\theta + \dfrac{1}{\tan\theta} = 2$

$\Rightarrow \quad \tan^2\theta + 1 = 2\tan\theta$

$\Rightarrow \quad \tan^2\theta - 2\tan\theta + 1 = 0$

$\Rightarrow \quad (\tan\theta - 1)^2 = 0$

$\Rightarrow \quad \tan\theta = 1$

$\Rightarrow \quad \tan\theta = \tan 45°$

$\Rightarrow \quad \theta = 45°$

$\Rightarrow \quad \text{cosec } 45° = \sqrt{2}$

18. Given,

$x\tan 45°\cos 60° = \sin 60°\cot 60°$

We know that,

$$\tan 45° = 1, \cos 60° = \frac{1}{2}, \sin 60° = \frac{\sqrt{3}}{2}$$

$\Rightarrow \quad \cot 60° = \dfrac{1}{\sqrt{3}}$

$\Rightarrow \quad x\times 1\times\dfrac{1}{2} = \dfrac{\sqrt{3}}{2}\times\dfrac{1}{\sqrt{3}}$

$\Rightarrow \quad x = 1$

19. $7\times\dfrac{\sqrt{3}}{2} + 5\times\dfrac{1}{\sqrt{3}} + 6\times\dfrac{1}{\sqrt{3}}$

$$\left[\cos 30° = \frac{\sqrt{3}}{2}, \tan 30° = \frac{1}{\sqrt{3}}, \cot 60° = \frac{1}{\sqrt{3}}\right]$$

$$= \frac{7\times 3 + 10 + 12}{2\sqrt{3}} = \frac{43}{2\sqrt{3}}$$

20. $\tan^2\theta - 4 = 3\tan\theta$

$\tan^2\theta - 3\tan\theta - 4 = 0$

$\tan^2\theta - 4\tan\theta + \tan\theta - 4 = 0$

$\tan\theta(\tan\theta - 4) + 1(\tan\theta - 4) = 0$

$(\tan\theta + 1)(\tan\theta - 4) = 0$

$\tan\theta = -1$ [Not Applicable]

$\tan\theta = 4 \quad \left[\because \sin\theta = \dfrac{\tan\theta}{\sqrt{1+\tan^2\theta}}\right]$

$\sin\theta = \dfrac{4}{\sqrt{17}} \Rightarrow \sin^2\theta = \dfrac{16}{17}$

21. Given, $\sin\alpha = \dfrac{1}{2}$ and $\cos\beta = \dfrac{1}{2}$

$\Rightarrow \quad \sin\alpha = \sin 30° \quad \left[\because \sin 30° = \dfrac{1}{2}\right]$

and $\quad \cos\beta = \cos 60° \quad \left[\because \cos 60° = \dfrac{1}{2}\right]$

$\Rightarrow \quad \alpha = 30°$ and $\beta = 60°$

$\therefore \quad \alpha + \beta = 30° + 60° = 90°$

22. Given, $\tan A = \dfrac{1}{\sqrt{3}} = \tan 30° \Rightarrow A = 30°$

$$\left[\because \tan 30° = \frac{1}{\sqrt{3}}\right]$$

and $\quad \tan B = \sqrt{3} = \tan 60° \Rightarrow B = 60°$

$[\because \tan 60° = \sqrt{3}]$

Now, $\quad A + B = 30° + 60° = 90°$

$\therefore \quad \tan(A+B) = \tan 90° = \infty$

23. Given, $\sqrt{3}\tan\theta = 2\sin\theta$

$\sqrt{3}\dfrac{\sin\theta}{\cos\theta} = 2\sin\theta$

$\therefore \quad \cos\theta = \dfrac{\sqrt{3}}{2}$

$\Rightarrow \quad \cos\theta = \cos 30° \Rightarrow \theta = 30°$

$= \sin^2\theta - \cos^2\theta$

$= \sin^2 30° - \cos^2 30°$

$= \left(\dfrac{1}{2}\right)^2 - \left(\dfrac{\sqrt{3}}{2}\right)^2$

$= \dfrac{1-3}{4} = -\dfrac{2}{4} = -\dfrac{1}{2}$

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24. Given, $\sin\theta - \cos\theta = 0$

$\Rightarrow \quad \sin\theta = \cos\theta$

$\Rightarrow \quad \tan\theta = 1 = \tan 45° \Rightarrow \theta = 45°$

$\therefore \sin^4\theta + \cos^4\theta = \sin^4 45° + \cos^4 45°$

$$= \left(\frac{1}{\sqrt{2}}\right)^4 + \left(\frac{1}{\sqrt{2}}\right)^4 = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$$

25. $m \tan 30° \cot 60° = \sin 45° \cos 45°$

$$m \times \frac{1}{\sqrt{3}} \times \frac{1}{\sqrt{3}} = \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$$

$$\frac{m}{3} = \frac{1}{2}$$

$$\therefore \quad m = \frac{3}{2}$$

26. We have, $\dfrac{2\tan 30°}{1 + \tan^2 30°}$

$$= \frac{2 \times \left(\frac{1}{\sqrt{3}}\right)}{1 + \left(\frac{1}{\sqrt{3}}\right)^2} \quad \left[\because \tan 30° = \frac{1}{\sqrt{3}}\right]$$

$$= \frac{\frac{2}{\sqrt{3}}}{1 + \frac{1}{3}} = \frac{\frac{2}{\sqrt{3}}}{\frac{3+1}{3}}$$

$$= \frac{2}{\sqrt{3}} \times \frac{3}{4} = \frac{3}{\sqrt{3}} \times \frac{1}{2} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{3 \times \sqrt{3}}{3 \times 2} = \frac{\sqrt{3}}{2} = \sin 60°$$

27. Given, $\dfrac{1 - \tan^2 45°}{1 + \tan^2 45°}$

$$\frac{1 - (1)^2}{1 + (1)^2} = \frac{0}{2} = 0 \qquad [\because \tan 45° = 1]$$

28. Given, $\dfrac{\tan 30°}{\cot 60°} = \dfrac{1 \times \sqrt{3}}{\sqrt{3} \times 1} = 1$

29. We know that, $A + B + C = 180°$

$\Rightarrow A = 180° - (B + C) \Rightarrow \dfrac{A}{2} = \dfrac{1}{2}[180° - (B + C)]$

$\Rightarrow \quad \dfrac{B + C}{2} = 90° - \dfrac{A}{2}$

$\Rightarrow \quad \tan\left(\dfrac{B + C}{2}\right) = \tan\left[90° - \dfrac{A}{2}\right]$

[take both sides tan]

$\Rightarrow \quad \tan\left(\dfrac{B + C}{2}\right) = \cot\dfrac{A}{2}$

30. Given, $\cos A + \cos^2 A = 1$

$\Rightarrow \quad \cos A = 1 - \cos^2 A$

$\Rightarrow \quad \cos A = \sin^2 A$

$[\because 1 - \cos^2 A = \sin^2 A] \ldots$(i)

We have to find the value of $\sin^2 A + \sin^4 A$

$\Rightarrow \quad \sin^2 A + \sin^4 A$

$\Rightarrow \quad \cos A + \cos^2 A \qquad$ [from Eq (i)]

$\Rightarrow \quad 1$

31. (False) Let us take $A = 30°$ and $B = 60°$,

then $\text{LHS} = \sin(30° + 60°) = \sin 90° = 1$

$\text{RHS} = \sin 30° + \sin 60°$

$$= \frac{1}{2} + \frac{\sqrt{3}}{2} = \frac{1 + \sqrt{3}}{2}$$

$\text{LHS} \neq \text{RHS}$

32. (False) We have,

$$\frac{1 - \sin\theta}{1 + \sin\theta} = \frac{(1 - \sin\theta)(1 - \sin\theta)}{(1 + \sin\theta)(1 - \sin\theta)}$$

[$\because$ rationalise]

$$\Rightarrow \frac{(1 - \sin\theta)^2}{1 - \sin^2\theta} = \left(\frac{1 - \sin\theta}{\cos\theta}\right)^2$$

$[\because \sin^2\theta + \cos^2\theta = 1]$

$$= (\sec\theta - \tan\theta)^2$$

$\text{LHS} \neq \text{RHS}$

33. We have, $\dfrac{1 + \tan^2 A}{1 + \cot^2 A} = \dfrac{1 + \tan^2 A}{1 + \dfrac{1}{\tan^2 A}}$

$$= \frac{1 + \tan^2 A}{\frac{\tan^2 A + 1}{\tan^2 A}}$$

$$= (1 + \tan^2 A)\frac{(\tan^2 A)}{(1 + \tan^2 A)}$$

$$= \tan^2 A$$

34. We have,

$(1 + \tan\theta + \sec\theta)(1 + \cot\theta - \operatorname{cosec}\theta)$

$$= (1 + \tan\theta + \sec\theta)\left[1 + \frac{1}{\tan\theta} - \operatorname{cosec}\theta\right]$$

$$= (1 + \tan\theta + \sec\theta)\left[\frac{\tan\theta + 1 - \tan\theta \cdot \operatorname{cosec}\theta}{\tan\theta}\right]$$

$$= \frac{(1 + \tan\theta + \sec\theta)[\tan\theta + 1 - \sec\theta]}{\tan\theta}$$

$$\left[\because \tan\theta \cdot \operatorname{cosec}\theta = \frac{\sin\theta}{\cos\theta} \times \frac{1}{\sin\theta} = \frac{1}{\cos\theta} = \sec\theta\right]$$

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$$= \frac{(1+\tan\theta)^2 - \sec^2\theta}{\tan\theta}$$
$$= \frac{1+\tan^2\theta + 2\tan\theta - \sec^2\theta}{\tan\theta}$$
$$= \frac{1+2\tan\theta - 1}{\tan\theta}$$
$$= \frac{2\tan\theta}{\tan\theta} = 2$$

35. Given, $4x = \text{cosec}\,\theta$ and $\frac{4}{x} = \cot\theta$

$$x = \frac{\text{cosec}\,\theta}{4} \text{ and } \frac{1}{x} = \frac{\cot\theta}{4}$$

We have find the value of $4\left[x^2 - \frac{1}{x^2}\right]$

$$= 4\left[\left(\frac{\text{cosec}\,\theta}{4}\right)^2 - \left(\frac{\cot\theta}{4}\right)^2\right]$$
$$= 4\left[\frac{\text{cosec}^2\theta}{16} - \frac{\cot^2\theta}{16}\right]$$
$$= \frac{4}{16}[\text{cosec}^2\theta - \cot^2\theta] = \frac{1}{4}$$

36. $\frac{\sin\theta\tan\theta}{1-\cos\theta} + \tan^2\theta - \sec^2\theta$

$$= \frac{\sin\theta\tan\theta(1+\cos\theta)}{(1-\cos\theta)(1+\cos\theta)} - 1$$
$$[\because \sec^2\theta - \tan^2\theta = 1]$$
$$= \frac{\sin\theta\cdot\tan\theta(1+\cos\theta)}{1-\cos^2\theta} - 1$$
$$= \frac{\sin^2\theta}{\cos\theta\times\sin^2\theta}(1+\cos\theta) - 1$$
$$= \frac{1}{\cos\theta} + 1 - 1$$
$$= \sec\theta$$

37. Given, $\sec\theta = x + \frac{1}{4x}$

Squaring both sides, we get

$$\sec^2\theta = \left(x + \frac{1}{4x}\right)^2$$
$$= x^2 + \frac{1}{16x^2} + \frac{1}{2}$$
$$\sec^2\theta - 1 = x^2 + \frac{1}{16x^2} - \frac{1}{2}$$
$$\sec^2\theta - 1 = \left(x - \frac{1}{4x}\right)^2$$
$$\tan^2\theta = \left(x - \frac{1}{4x}\right)^2$$
$$[\because \sec^2\theta - 1 = \tan^2\theta]$$
$$\tan\theta = \pm\left(x - \frac{1}{4x}\right)$$
$$\sec\theta + \tan\theta$$
$$x + \frac{1}{4x} + x - \frac{1}{4x} = 2x$$

38. Let $\cot\theta = x$

and $\sqrt{3}x^2 - 4x + \sqrt{3} = 0$

Here, $a = \sqrt{3}$, $b = -4$ and $c = \sqrt{3}$

$$X = \frac{-b \pm \sqrt{D}}{2a}$$
[using quadratic formula]

$$\Rightarrow \quad x = \frac{-(-4) \pm \sqrt{16 - 4\cdot\sqrt{3}\cdot\sqrt{3}}}{2\times\sqrt{3}} = \frac{4\pm\sqrt{4}}{2\sqrt{3}}$$
$$\Rightarrow \quad x = \frac{4+2}{2\sqrt{3}}, \frac{4-2}{2\sqrt{3}}$$
$$\Rightarrow \cot\theta = \frac{6}{2\sqrt{3}}, \frac{2}{2\sqrt{3}} \Leftrightarrow \cot\theta = \sqrt{3}, \frac{1}{\sqrt{3}}$$
$$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}, \sqrt{3}$$
$$\Rightarrow \cot^2\theta + \tan^2\theta = (\sqrt{3})^2 + \left(\frac{1}{\sqrt{3}}\right)^2$$
$$= 3 + \frac{1}{3} = \frac{10}{3}$$

39. Given, $\tan\theta + \sec\theta = I$ ...(i)

$$\Rightarrow \frac{(\tan\theta + \sec\theta)(\sec\theta - \tan\theta)}{(\sec\theta - \tan\theta)} = I$$
$$\Rightarrow \frac{(\sec^2\theta - \tan^2\theta)}{(\sec\theta - \tan\theta)} = I$$
$$\Rightarrow \frac{1}{\sec\theta - \tan\theta} = I$$
$$[\because \sec^2\theta - \tan^2\theta = 1]$$
$$\Rightarrow \sec\theta - \tan\theta = \frac{1}{I} \quad \text{...(ii)}$$

On adding Eqs. (i) and (ii), we get

$$2\sec\theta = I + \frac{1}{I}$$
$$\Rightarrow \sec\theta = \frac{I^2+1}{2I}$$

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40. Given, $\tan A = a \tan B$ and $\sin A = b \sin B$

$$\cot B = \frac{a}{\tan A} \text{ and } \operatorname{cosec} B = \frac{b}{\sin A}$$

We know that,

$$\operatorname{cosec}^2 B - \cot^2 B = 1$$

$$\left(\frac{b}{\sin A}\right)^2 - \left(\frac{a}{\tan A}\right)^2 = 1$$

$$\frac{b^2}{\sin^2 A} - \frac{a^2}{\tan^2 A} = 1$$

$$\frac{1}{\sin^2 A}[b^2 - a^2 \cos^2 A] = 1$$

$$b^2 - a^2 \cos^2 A = \sin^2 A$$

$$b^2 = 1 - \cos^2 A + a^2 \cos^2 A$$

$$\cos^2 A(a^2 - 1) = (b^2 - 1)$$

$$\Leftrightarrow \quad \cos^2 A = \frac{b^2 - 1}{a^2 - 1}$$

41. Given, $\operatorname{cosec} A - \cot A = q$

$$= (\operatorname{cosec} A - \cot A)^2 = q^2$$

$$= \operatorname{cosec}^2 A + \cot^2 A - 2\operatorname{cosec} A \cdot \cot A = q^2$$

$\therefore$ Put the value of q^2 in $\dfrac{q^2 - 1}{q^2 + 1} + \cos A$.

$$= \frac{\operatorname{cosec}^2 A + \cot^2 A - 2\operatorname{cosec} A \cdot \cot A - 1}{\operatorname{cosec}^2 A + \cot^2 A - 2\operatorname{cosec} A \cdot \cot A + 1} + \cos A$$

$$= \frac{2\cot^2 A - 2\operatorname{cosec} A \cdot \cot A}{2\operatorname{cosec}^2 A - 2\operatorname{cosec} A \cdot \cot A} + \cos A$$

$$= \frac{2\cot A}{2\operatorname{cosec} A}\left[\frac{\cot A - \operatorname{cosec} A}{\operatorname{cosec} A - \cot A}\right] + \cos A$$

$$= \cos A(-1) + \cos A = 0$$

42. Given, $x = r \sin A \cos B$ ...(i)

$$y = r \sin A \sin B$$

$$\Leftrightarrow \quad y^2 = r^2 \sin^2 A \cdot \sin^2 B \quad \text{...(ii)}$$

$$z = r \cos A$$

$$\Leftrightarrow \quad z^2 = r^2 \cos^2 A \quad \text{...(iii)}$$

On adding Eqs. (i), (ii) and (iii), we get

$$x^2 + y^2 + z^2 = r^2 \sin^2 A \cos^2 B + r^2 \sin^2 A \cdot \sin^2 B + r^2 \cos^2 A$$

$$x^2 + y^2 + z^2 = r^2 \sin^2 A(\cos^2 B + \sin^2 B) + r^2 \cos^2 A$$

$$x^2 + y^2 + z^2 = r^2 \sin^2 A + r^2 \cos^2 A$$

$$= r^2[\sin^2 A + \cos^2 A]$$

$$= r^2$$

43. We know that,

$$\sin^2 A + \cos^2 A = 1$$

$$1 + \cos^2 A = 1$$

$$\cos^2 A = 0$$

$$\sin^2 A - \cos^2 A = 1 - 0 = 1$$

44. P $\to$ 4; Q $\to$ 1; R $\to$ 2; S $\to$ 3

(P) $\dfrac{\sin 0°}{\cos 90°} + \sin 45° = 0 + \dfrac{1}{\sqrt{2}} = \dfrac{1}{\sqrt{2}}$

(Q) $\cos 60° - \sin 60° = \dfrac{1}{2} - \dfrac{\sqrt{3}}{2} = \dfrac{1 - \sqrt{3}}{2}$

(R) $\sec 30° \sin 60° + \cos 45° \operatorname{cosec} 60°$

$$= \frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \times \frac{2}{\sqrt{3}} = 1 + \frac{\sqrt{2}}{\sqrt{3}}$$

(S) $\dfrac{\cos^3 30° - \cos^3 60°}{\sin^3 60° - \sin^3 30°} = \dfrac{\left(\dfrac{\sqrt{3}}{2}\right)^3 - \left(\dfrac{1}{2}\right)^3}{\left(\dfrac{\sqrt{3}}{2}\right)^3 - \left(\dfrac{1}{2}\right)^3} = 1$

45. P $\to$ 4; Q $\to$ 1; R $\to$ 2; S $\to$ 3

(P) $1 + \dfrac{\cot^2 \theta}{1 + \operatorname{cosec} \theta}$

$$= 1 + \frac{\operatorname{cosec}^2 \theta - 1}{1 + \operatorname{cosec} \theta}$$

$$= 1 + \frac{(\operatorname{cosec} \theta + 1)(\operatorname{cosec} \theta - 1)}{(\operatorname{cosec} \theta + 1)}$$

$$= 1 + \operatorname{cosec} \theta - 1$$

$$= \operatorname{cosec} \theta = \sec \theta \cot \theta$$

(Q) $\dfrac{\cos \theta}{\operatorname{cosec} \theta + 1} + \dfrac{\cos \theta}{\operatorname{cosec} \theta - 1}$

$$= \cos \theta \left(\frac{1}{\operatorname{cosec} \theta + 1} + \frac{1}{\operatorname{cosec} \theta - 1}\right)$$

$$= \cos \theta \left(\frac{\operatorname{cosec} \theta - 1 + \operatorname{cosec} \theta + 1}{\operatorname{cosec}^2 \theta - 1}\right)$$

$$= \frac{\cos \theta (2\operatorname{cosec} \theta)}{\cot^2 \theta}$$

$$= 2\frac{\cot \theta}{\cot^2 \theta}$$

$$= 2 \tan \theta$$

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(R) $\tan^2\theta + \cot^2\theta - 2 = (\tan\theta - \cot\theta)^2$

$$= \left(\frac{\sin\theta}{\cos\theta} - \frac{\cos\theta}{\sin\theta}\right)^2$$

$$= \left(\frac{\sin^2\theta - \cos^2\theta}{\cos\theta\sin\theta}\right)^2$$

(S) $\frac{1-\cos\theta}{1+\cos\theta} = \frac{(1-\cos\theta)(1-\cos\theta)}{(1+\cos\theta)(1-\cos\theta)}$

$$= \frac{(1-\cos\theta)^2}{1-\cos^2\theta}$$

$$= \frac{(1-\cos\theta)^2}{\sin^2\theta}$$

$$= \left(\frac{1-\cos\theta}{\sin\theta}\right)^2$$

$$= \left(\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta}\right)^2$$

$$= (\operatorname{cosec}\theta - \cot\theta)^2$$

46. Assertion

We have,

$$2\cos\theta = a + \frac{1}{a}$$

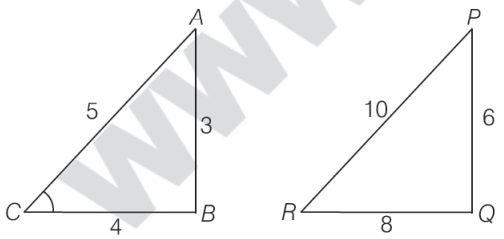
It is not possible because $a > 0$.

$\therefore \quad \cos\theta \le 1$

and Reason is true.

Assertion is false but reason is true.

47.



In ΔABC and in ΔPQR

$$\sin C = \frac{AB}{AC}$$

and $\quad \sin R = \frac{6}{10}$

$\Rightarrow \quad \sin C = \frac{3}{5}$

$\Rightarrow \quad \sin R = \frac{3}{5}$

$\therefore$ Trigonometric ratio does not depend on the size of the triangle.

Assertion is True and Reason is True but Reason is not the correct explanation of Assertion.

48. We know that,

$$\cos^2\theta \le 1$$

$$\sec^2\theta = \frac{4xy}{(x+y)^2} \ge 1$$

$\Rightarrow \quad 4xy \ge (x+y)^2$

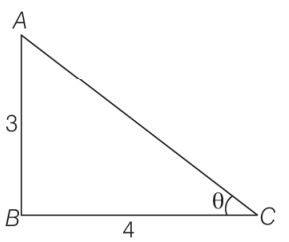
$\Rightarrow \quad (x-y)^2 \le 0$

Assertion is true and Reason is true and is the correct explanation of assertion.

49. Assertion

Given, $\quad \tan\theta = \frac{3}{4}$

$$\tan\theta = \frac{p}{b}$$



Perpendicular = 3 units base = 4 units

Apply Pythagoras theorem,

$$AC^2 = AB^2 + BC^2$$

$\Rightarrow \quad AC^2 = 3^2 + 4^2$

$\Rightarrow \quad AC = \sqrt{9+16} = 5$ units

Reason is true and correct explanation of the assertion.

50. Assertion

$\cos 30° = \frac{\sqrt{3}}{2}$ and $\sin 60° = \frac{\sqrt{3}}{2}$

Assertion is true

Reason $\sin 2\theta = \sin\theta + \sin\theta$

This statement is false for an acute angle.

$\theta = 30° \Leftrightarrow \sin 2\times 30° = \sin 30° + \sin 30°$

$$\frac{\sqrt{3}}{2} = \frac{1}{2} + \frac{1}{2} \qquad \text{[False]}$$

Assertion is true but Reason is false.

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51. **Assertion** $\cos 60° - \sin 60°$

$$\frac{1}{2} - \frac{\sqrt{3}}{2} = \frac{1-\sqrt{3}}{2} \quad \text{[It is negative]}$$

Assertion is true and Reason is false.

52. **Assertion** $\dfrac{\sin^2\theta - \cos^2\theta}{\cos^2\theta - \sin^2\theta} = -1$

Assertion is true and Reason is false.

53. We have, $\cos^2 A - \sin^2 A = 1$

Put $A = 45°$, we get

$$\cos^2 45° - \sin^2 45° = 0$$

and $\tan^2 A - \sec^2 A = 1$

Put $A = 45°$, $\tan^2 45° - \sec^2 45° = -1$

These are not trigonometric but identities.

Assertion is false but Reason is true.

54. **Assertion**

$$(\cot\theta + 3)(3\cot\theta + 1)$$
$$= 3\cot^2\theta + 3 + 9\cot\theta + \cot\theta$$
$$= 3(1 + \cot^2\theta) + \cot\theta(9 + 1)$$
$$= 3\operatorname{cosec}^2\theta + 10\cot\theta$$

Reason True

Hence, Assertion and Reason are true and correct explanation for Assertion.

55. We have,

$$(\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$$
$$\Rightarrow \quad x(\sec\theta - \tan\theta) = 1$$
$$\Rightarrow \quad \sec\theta - \tan\theta = \frac{1}{x}$$

Thus, we have

$$\sec\theta + \tan\theta = x$$

and $\sec\theta - \tan\theta = \dfrac{1}{x}$

Adding and subtracting these two equations, we get

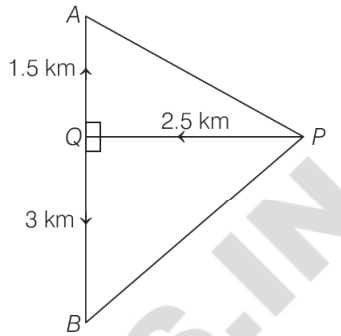
$$2\sec\theta = x + \frac{1}{x} \text{ and } 2\tan\theta = x - \frac{1}{x}$$
$$\Rightarrow \sec\theta = \frac{1}{2}\left(x + \frac{1}{x}\right) \text{ and } \tan\theta = \frac{1}{2}\left(x - \frac{1}{x}\right)$$

Now, $\sin\theta = \dfrac{\tan\theta}{\sec\theta}$

$$\Rightarrow \quad \sin\theta = \frac{\frac{1}{2}\left(x - \frac{1}{x}\right)}{\frac{1}{2}\left(x + \frac{1}{x}\right)} = \frac{x^2 - 1}{x^2 + 1}$$

Assertion is true but Reason is false.

56. (i) In ΔAPQ, $\angle APQ = \theta$



$$\tan\theta = \frac{AQ}{QP} \Rightarrow \tan\theta = \frac{1.5}{2.5} = \frac{3}{5}$$

(ii) $\cot B = \dfrac{BQ}{PQ}$

$$\cot B = \frac{3}{25} \times 10 = \frac{3 \times 2}{5} = \frac{6}{5}$$

(iii) $\tan A = \dfrac{PQ}{AQ} = \dfrac{2.5}{1.5} = \dfrac{5}{3}$

(iv) $\sec A = \dfrac{AP}{AQ} = \dfrac{\sqrt{AQ^2 + PQ^2}}{AQ}$

$$= \frac{\sqrt{(1.5)^2 + (2.5)^2}}{1.5}$$

$$\sec A = \frac{\sqrt{2.25 + 6.25}}{1.5} = \frac{\sqrt{8.5}}{1.5} = \frac{3}{1.5} \text{ (approx)}$$

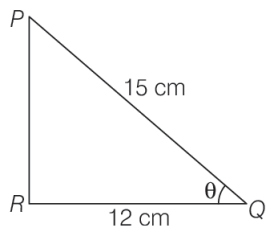
$$\sec A = \frac{3}{15} \times 10 = 2$$

(v) $\operatorname{cosec} B = \dfrac{BP}{PQ} = \dfrac{\sqrt{(3)^2 + (2.5)^2}}{2.5}$

$$\frac{\sqrt{9 + 6.25}}{25} = \frac{4}{25} \times 10 \text{ (approx)}$$

$$\operatorname{cosec} B = \frac{8}{5}$$

57. (i) Given, $\angle PQR = \theta$ and $\angle R = 90°$



$$\cos\theta = \frac{QR}{PQ} = \frac{12}{15} = \frac{4}{5}$$

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(ii) $\sec\theta = \frac{PQ}{RQ} = \frac{15}{12} = \frac{5}{4}$

(iii) $\frac{\tan\theta}{1+\tan^2\theta} = \frac{\tan\theta}{\sec^2\theta}$

$= \frac{\sin\theta}{\cos\theta} \times \cos^2\theta$ $\left[\because \tan\theta = \frac{\sin\theta}{\cos\theta}\right]$

$[\because 1 + \tan^2\theta = \sec^2\theta]$

$= \sin\theta \times \cos\theta$

$= \frac{PR}{PQ} \times \frac{RQ}{PQ} = \frac{9}{15} \times \frac{12}{15}$

$[PR = \sqrt{225-144} = \sqrt{81} = 9]$

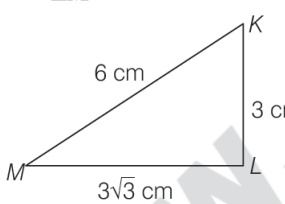
$= \frac{12}{25}$

(iv) $\cot^2\theta - \text{cosec}^2\theta = -1$ $[\because \text{cosec}^2\theta - \cot^2\theta = 1]$

(v) $\sin^2\theta + \cos^2\theta = \left(\frac{PR}{PQ}\right)^2 + \left(\frac{QR}{PQ}\right)^2$

$= \left(\frac{9}{15}\right)^2 + \left(\frac{18}{15}\right)^2 = \frac{81+144}{225} = \frac{225}{225} = 1$

58. (i) $\tan M = \frac{KL}{LM}$



$\tan M = \frac{3}{3\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\tan M = \tan 30°$

$\angle M = 30°$

(ii) $\tan K = \frac{3\sqrt{3}}{3}$

$\tan K = \sqrt{3}$

$\tan K = \tan 60°$

$\therefore \angle K = 60°$

(iii) $\tan M = \frac{3}{3\sqrt{3}} = \frac{1}{\sqrt{3}}$

(iv) $\sec^2 M - 1 = \left(\frac{KM}{LM}\right)^2 - 1$

$\sec^2 M - 1 = \frac{36}{27} - 1 = \frac{36-27}{27} = \frac{9}{27}$

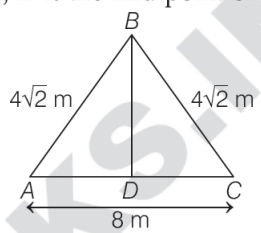
$\sec^2 M - 1 = \frac{1}{3}$

$\tan M = \frac{1}{\sqrt{3}}$

$\tan^2 M = \frac{1}{3} \Rightarrow \sec^2 M - 1 = \tan^2 M$

(v) $\frac{\tan^2 45° - 1}{\tan^2 45° + 1} = \frac{1-1}{1+1} = 0$

59. (i) Given, D is the mid-point of AC.



$AD = DC = \frac{AC}{2} = \frac{8}{2} = 4$ m

$BD = \sqrt{(BC)^2 - (DC)^2}$

[Apply Pythagoras theorem in ΔACD]

$BD = \sqrt{(4\sqrt{2})^2 - (4)^2}$

$= \sqrt{32-16}$

$= \sqrt{16}$ m $= 4$ m

(ii) In ΔABD, $\angle D = 90°$

$\tan A = \frac{BD}{AD}$

$\tan A = \frac{4}{4} = 1$

$\angle A = 45°$ $[\because \tan 45° = 1]$

(iii) $\tan C = \frac{BD}{DC}$

$\tan C = \frac{4}{4} = 1$

$\angle C = 45°$

(iv) $\sin A + \cos C = \frac{BD}{BA} + \frac{CD}{BC}$

$= \frac{4}{4\sqrt{2}} + \frac{4}{4\sqrt{2}}$

$= \frac{8}{4\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$

(v) $\tan^2 C + \tan^2 A$

$= \left(\frac{BD}{CD}\right)^2 + \left(\frac{BD}{AD}\right)^2$

$= \left(\frac{4}{4}\right)^2 + \left(\frac{4}{4}\right)^2 = 1 + 1 = 2$

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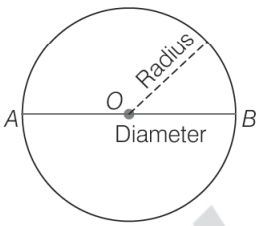
07

Areas Related to Circles

Quick Revision

Circle

A circle is the locus of a point which moves in a plane such a way that its distance from a fixed point remains the same. The fixed point is called the **centre** and the given constant distance is known as **radius** of the circle.



Circumference (Perimeter) of a Circle

The distance covered by travelling once around a circle is called the circumference or the length of boundary of a circle.

$\therefore$ Circumference $= \pi \times$ Diameter $= \pi \times 2r$ units

where, r is the radius of circle.

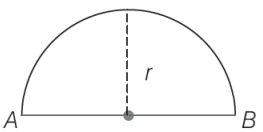
Area of a Circle

The space occupied in a circular region is called area of a circle.

$\therefore$ Area of a circle $= \pi r^2$ sq units

Semi-circle

A diameter divides the circle into two parts, each part is called semi-circle.



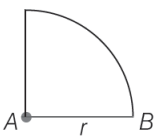
(i) Perimeter of semi-circle $= \dfrac{2\pi r}{2} + 2r$

$= (\pi r + 2r)$ units

(ii) Area of semi-circle $= \dfrac{1}{2}(\pi r^2)$ sq units

Quadrant of a Circle

If a circle is divided into four equal parts, then each part of a circle is said to be quadrant of a circle.



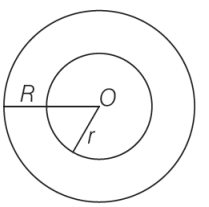
(i) Perimeter of a quadrant $= \dfrac{2\pi r}{4} + 2r$

$= \left(\dfrac{\pi r}{2} + 2r\right)$ units

(ii) Area of a quadrant $= \left(\dfrac{\pi r^2}{4}\right)$ sq units

Circular Ring

It is a plane figure bounded by the circumference of two concentric circles of two different radii.



Area of ring $= \pi(R^2 - r^2)$ sq units.

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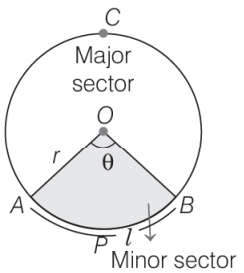
Sector of a Circle

The region enclosed by two radii and the corresponding arc of a circle is called the sector of circle.

In the figure, unshaded region *OACBO* is called the **major sector** and shaded region *OAPBO* is called the **minor sector** of a circle.

Length of an Arc of a Sector

The arc corresponding to a sector is called the arc of the sector.



Length of an arc of a sector, $l = \frac{\theta}{360°} \times 2\pi r$

Area of Sector of a Circle

(i) Area of the sector $= \frac{\theta}{360°} \times \pi r^2$

(ii) Area of sector in terms of length of arc $= \frac{1}{2} lr$

(iii) Area of the major sector $= \pi r^2 -$ Area of minor sector

(iv) Area of minor sector $= \pi r^2 -$ Area of major sector

Note

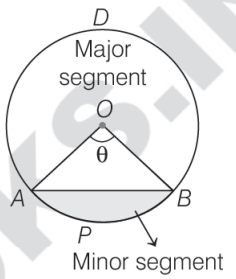
(i) If $\theta = 180°$, then sector becomes a semi-circular region and its area $= \frac{1}{2}\pi r^2$.

(ii) If $\theta = 90°$, then sector becomes a quadrant of a circle and its area $= \frac{1}{4}\pi r^2$.

Segment of a Circle

The region bounded by a chord and the corresponding arc of the circle is called the segment of the circle.

The segment containing the minor arc is called the **minor segment** and the segment containing the major arc is called the **major segment.**



(i) Area of a segment = Area of corresponding sector – Area of triangle formed by chord and the radii of the circle.

(ii) Area of major segment $= \pi r^2 -$ Area of minor segment

(iii) Area of minor segment $= \pi r^2 -$ Area of major segment

Areas of Combinations of Plane Figures

We have already known some combination of plane figure which are combination of two or more plane figures such as window designs, flower beds, circular paths etc. To calculate these types of figures we have to use some formulae, which are given below

(i) Area of triangle $= \frac{1}{2} \times$ Base $\times$ Height

(ii) Area of equilateral triangle $= \frac{\sqrt{3}}{4} \times (\text{Side})^2$

(iii) Area of rectangle = Length $\times$ Breadth

(iv) Area of square $= (\text{Side})^2$

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Objective Questions

Multiple Choice Questions

1. If the sum of the circumferences of two circles with radii R_1 and R_2 is equal to the circumference of a circle of radius R, then ***[NCERT Exemplar]***

(a) $R_1 + R_2 = R$
(b) $R_1 + R_2 > R$
(c) $R_1 + R_2 < R$
(d) Nothing definite can be said about the relation among R_1, R_2 and R.

2. In covering a distance s m, a circular wheel of radius r m makes ..... revolution.

(a) $\frac{2s}{\pi r}$ (b) $\frac{s}{2\pi r}$
(c) $\frac{s}{\pi r}$ (d) None of these

3. The distance travelled by a circular wheel of diameter d cm in one revolution is equal to ..... cm.

(a) $\frac{\pi d}{2}$ (b) $2\pi d$
(c) $\frac{\pi d}{4}$ (d) πd

4. The perimeter of a square circumscribing a circle of radius a cm is equal to ..... cm.

(a) $8a$ (b) $4a$
(c) $2a$ (d) $\frac{a}{2}$

5. The radii of two circles are 13 cm and 6 cm, respectively. Then, the radius of the circle which has circumference equal to sum of the circumferences of the two circles is

(a) 17 cm (b) 19 cm
(c) 7 cm (d) 11 cm

6. The circumference of a circle exceeds the diameter by 25.8 cm, then the radius of the circle is

(a) 6.02 cm (b) 5.02 cm
(c) 4.02 cm (d) 5.58 cm

7. If the perimeter of a protractor is 72 cm, then its area is

(a) 12 cm^2 (b) 13 cm^2
(c) 14 cm^2 (d) None of these

8. The short and long hands of a clock are 6 cm and 8 cm long, respectively. Then, the sum of the distance travelled by their tips in 1 day is [take $\pi = 22/7$]

(a) 1282.29 cm (b) 1228.30 cm
(c) 1382.30 cm (d) 1198.20 cm

9. The radius of the wheel of a bus is 25 cm. If the speed of the bus is 33 km/h, then how many revolutions will the wheel make in 1 min?

(a) 250 (b) 520
(c) 420 (d) 350

10. Areas of two circles are equal. Is it necessary that their circumferences are equal?

(a) True (b) False
(c) Cannot say (d) Partially True/False

11. Circumference of two circles are equal. Is it necessary that their areas be equal?

(a) True (b) False
(c) Cannot say (d) Partially True/False

12. The numerical value of the area of a circle is greater than the numerical value of its circumference.

(a) True (b) False
(c) Cannot say (d) Partially True/False

13. Area of the largest triangle that can be inscribed in a semi-circle of radius r units is ***[NCERT Exemplar]***

(a) r^2 sq units (b) $\frac{1}{2} r^2$ sq units
(c) $2r^2$ sq units (d) $\sqrt{2}\, r^2$ sq units

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14. If the perimeter of a circle is equal to that of a square, then the ratio of their areas is ***[NCERT Exemplar]***

(a) 22 : 7 (b) 14 : 11
(c) 7 : 22 (d) 11 : 14

15. If the area of a circle is $2464\ cm^2$, then the diameter of circle is

(a) 57 cm (b) 56 cm
(c) 54 cm (d) None of these

16. If the area of a semi-circular field is $30800\ m^2$, then the perimeter of the field is

(a) 420 cm (b) 720 m
(c) 580 m (d) None of these

17. The cost of fencing a circular field at the rate of ₹ 36 per m is ₹ 11880. The field is to be ploughed at the rate of ₹ 0.60 per m^2. Then, the cost of ploughing the field is [take $\pi = 22/7$]

(a) ₹ 5197.5 (b) ₹ 866.25
(c) ₹ 10395 (d) None of these

18. A circular park is surrounded by a road 21 m wide. If the radius of the park is 105 m, then the area of the road is

(a) $1524.62\ cm^2$ (b) $15246\ cm^2$
(c) $15640.20\ cm^2$ (d) None of these

19. Circular footpath of width 2 m is constructed at the rate of ₹ 20 per m^2 around a circular park of radius 1500 m. Then, the total cost of construction of the footpath is [take, $\pi = 3.14$]

(a) ₹ 37705.12 (b) ₹ 18852.56
(c) ₹ 377051.2 (d) None of these

20. Area of segment of a circle is less than the area of its corresponding sector?

(a) True (b) False
(c) Cannot say (d) Partially True/False

21. The areas of two sectors of two different circles are equal. Is it necessary that their corresponding arc lengths are equal?

(a) True (b) False
(c) Cannot say (d) Partially True/False

22. Tick the correct answer in the following question. Area of a sector of angle p (in degrees) of a circle with radius R is

(a) $\frac{p}{180°} \times 2\pi R$ (b) $\frac{p}{180°} \times \pi R^2$
(c) $\frac{p}{360°} \times 2\pi R$ (d) $\frac{p}{720°} \times 2\pi R^2$

23. Find the area of sector of central angle $x°$ of a circle with radius $4r$.

(a) $\frac{\pi x r^2}{45°}$ (b) $\frac{2\pi x r^2}{360°}$
(c) $\frac{2\pi x r^2}{45°}$ (d) $\frac{4\pi x r^2}{180°}$

24. The area of a sector of a circle with radius 6 cm, if angle of the sector 60° is

(a) $\frac{132}{14} cm^2$ (b) $\frac{36}{7} cm^2$
(c) $\frac{132}{7} cm^2$ (d) None of these

25. An arc of a circle is of length 5π cm and the sector it bounds has an area of $20\pi\ cm^2$, then radius of the circle is ***[NCERT Exemplar]***

(a) 4 cm (b) 8 cm
(c) 12 cm (d) 16 cm

26. The length of minute hand of a clock is 14 cm. Then, the area swept by the minute hand in one minute is

$$\left[\text{take } \pi = \frac{22}{7}\right]$$

(a) $28\ cm^2$ (b) $10.27\ cm^2$
(c) $14.7\ cm^2$ (d) $12.8\ cm^2$

27. A pendulum swings through an angle 60° and describes an arc 8.8 cm in length.
Then, the length of pendulum is

$$\left[\text{use } \pi = \frac{22}{7}\right]$$

(a) 8.40 cm (b) 16.8 cm
(c) 4.20 cm (d) 8.90 cm

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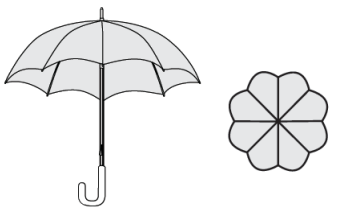
28. A car has two wipers which do not overlap each other. Each wiper has a blade of length r cm sweeping through an angle of 60°. The area cleaned at each sweep of blades is

(a) $\frac{1}{3}\pi r$ cm^2 (b) $\frac{2}{3}\pi r$ cm^2
(c) $\frac{1}{3}\pi r^2$ cm^2 (d) $\frac{2}{3}\pi r^2$ cm^2

29. An umbrella has 8 ribs which are equally spaced (see the figure). Assuming umbrella to be a flat circle of radius 45 cm, then the area between the two consecutive ribs of the umbrella is



(a) $\frac{22275}{56}$ cm^2 (b) $\frac{22275}{28}$ cm^2
(c) $\frac{22285}{28}$ cm^2 (d) None of these

30. To warn ships for underwater rocks, a light house spreads a red coloured light over a sector of angle 80° to a distance of 16.5 km. Then, the area of the sea over which the ships are warned is

[take $\pi = 3.14$]

(a) 189.97 km^2 (b) 1899.7 km^2
(c) 1709.73 km^2 (d) None of these

31. In a circle of radius 42 cm, an arc subtends an angle of 60° at the centre. Then, the length of the arc is

(a) 44 cm (b) 24 cm
(c) 48 cm (d) 46 cm

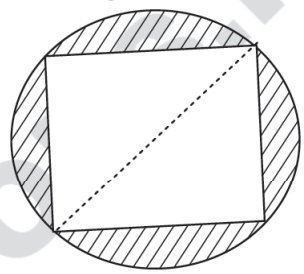
32. In a circle of radius 28 cm, an arc subtends an angle of 45° at the centre. Then, the length of the arc and the area of the sector is

(a) 44 cm, 154 cm^2 (b) 22 cm, 154 cm^2
(c) 22 cm, 308 cm^2 (d) None of these

33. Is the area of the circle inscribed in a square of side a cm is ..... .

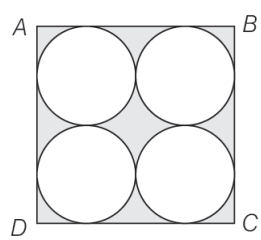
(a) πa^2 cm^2 (b) $\frac{\pi a^2}{2}$ cm^2
(c) $\frac{\pi a^2}{4}$ cm^2 (d) $2\pi a^2$ cm^2

34. In figure, a square of diagonal 8 cm is inscribed in a circle, then the area of the shaded region is ***[NCERT Exemplar]***



(a) $(32\pi - 16)$ cm^2 (b) $(16\pi - 32)$ cm^2
(c) $(11\pi - 32)$ cm^2 (d) $(16\pi - 64)$ cm^2

35. The area of the shaded region in figure as shown below where $ABCD$ is a square of side 12 cm is equal to ***[NCERT Exemplar]***



(a) 15.43 cm^2 (b) 198 cm^2
(c) 31.72 cm^2 (d) 30.86 cm^2

36. A cow is tied with a rope of length 14 m at the corner of a rectangular field of dimensions 20 m × 16 m. Then, the area of the field in which the cow can graze is ***[NCERT Exemplar]***

(a) 154 m^2 (b) 196 m^2
(c) 228 m^2 (d) 144 m^2

37. In the given figure, a square is inscribed in a circle of diameter d and another square is circumscribing the circle. Then, the ratio between area of inner square to outer square.

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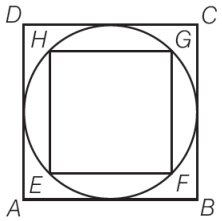
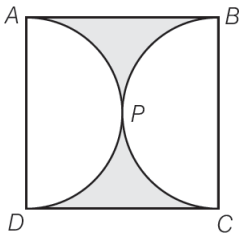


(a) 2 : 1 (b) 1 : 4
(c) 1 : 3 (d) 1 : 2

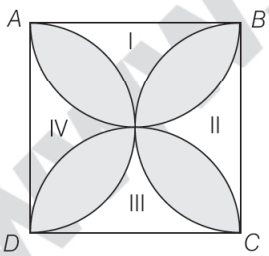
38. The area of the shaded region in figure, if *ABCD* is a square of side 14 cm and *APD* and *BPC* are semi circles is



(a) 196 cm^2 (b) 84 cm^2
(c) 21 cm^2 (d) 42 cm^2

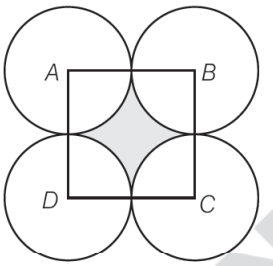
39. The area of shaded design in the given figure is (where *ABCD* is a square of side 10 cm and semi-circles are drawn with each of the side as diameter.)

[take $\pi = 3.14$]



(a) 57 cm^2 (b) 67 cm^2
(c) 86 cm^2 (d) 52 cm^2

40. In the given figure, *ABCD* is a square of side 14 cm. With centres *A*, *B*, *C* and *D*, four circles are drawn such that each circle touch externally two of the remaining three circles, then the area of the shaded region is

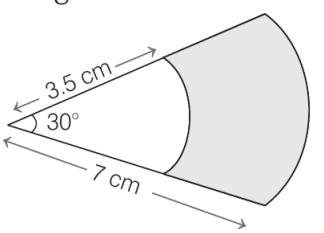


(a) 154 cm^2 (b) 21 cm^2
(c) 42 cm^2 (d) 184 cm^2

41. Is the area of the largest circle that can be drawn inside a rectangle of length *a* cm and breadth *b* cm $(a > b)$ is …… cm^2.

(a) $\frac{\pi b^2}{4}$ (b) $\frac{\pi \alpha^2}{4}$
(c) $\frac{\pi(b^2 - a^2)}{4}$ (d) $\frac{\pi(b - a)^2}{4}$

42. In the given figure, sectors of two concentric circles of radii 7 cm and 3.5 cm are shown, then the area of the shaded region is



(a) 96.25 cm^2 (b) 88.2 cm^2
(c) 9.625 cm^2 (d) 8.42 cm^2

43. In figure, *AOB* is a flower bed in the shape of a sector of a circle of radius 40 m and $\angle AOB = 60°$. Also, a 15 m wide concrete track is made as shown in the figure. Flower bed is made at the rate of ₹ 2.40 per m^2 and rate of making the concrete track is ₹ 20 per m^2, then the total amount spent for the job is

[take $\pi = 3.14$]

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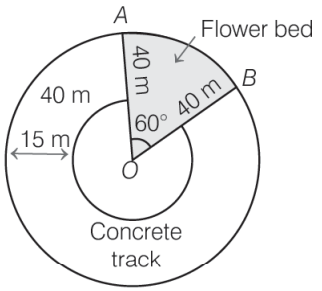
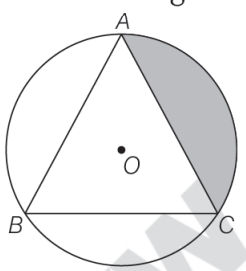


(a) ₹ 2009
(b) ₹ 53034.60
(c) ₹ 5303.460
(d) None of the above

44. A chord of a circle of radius 10 cm subtends a right angle at the centre. Then, the area of the minor segment is

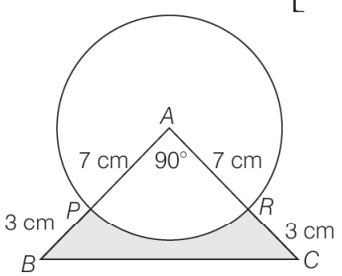
(a) 78.5 cm^2 (b) 28.5 cm^2
(c) 50 cm^2 (d) 128.5 cm^2

45. In the given figure, *ABC* is an equilateral triangle inscribed in a circle of radius 4 cm with centre *O*, then the area of the shaded region is



(a) $\frac{5}{3}(5\pi - 3\sqrt{3})\,cm^2$ (b) $\frac{4}{3}(4\pi - 3\sqrt{3})\,cm^2$
(c) $\frac{2}{3}(2\pi - \sqrt{3})\,cm^2$ (d) $\frac{7}{3}(7\pi - 3\sqrt{3})\,cm^2$

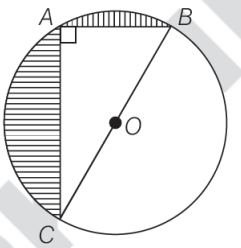
46. A memento is made as shown in the figure. Its base *PBCR* is silver plated from the front side at the rate of ₹ 20 per cm^2. Then, the total cost of the silver plating is $\left[\text{take } \pi = \frac{22}{7}\right]$



(a) ₹ 460 (b) ₹ 115
(c) ₹ 230 (d) None of these

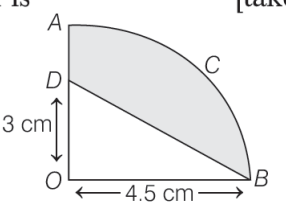
47. Find the area of the shaded region in figure, if $AC = 20$ cm, $AB = 15$ cm and *O* is the centre of the circle.

$\left[\text{take } \pi = \frac{22}{7}\right]$



(a) 95.54 cm^2
(b) 95.45 cm^2
(c) 59.54 cm^2
(d) None of the above

48. In the given figure, *OACBO* represents a quadrant of a circle of radius 4.5 cm with centre *O*. Then, the area of shaded portion is [take $\pi = 22/7$]



(a) 15.91 cm^2
(b) 9.16 cm^2
(c) 6.75 cm^2
(d) 22.66 cm^2

49. In this section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (a), (b), (c) and (d) out of which one is correct.

Figure depicts an archery target marked with its five scoring areas from the centres outwards as Gold, Red, Blue, Black and White. The diameter of the region representing Gold score is 14 cm and each of the other bands is 7 cm wide. Then match the following.

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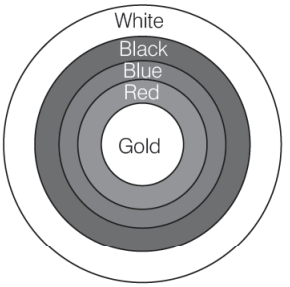
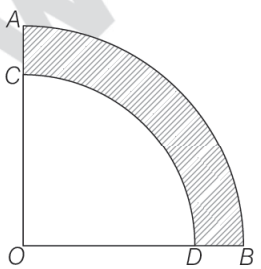
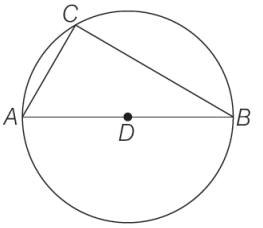
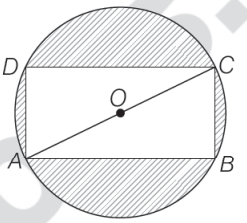
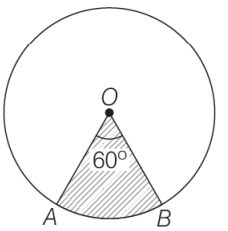


	List I		List II
P.	Area of Gold score	1.	$462\ cm^2$
Q.	Area of Red score	2.	$770\ cm^2$
R.	Area of Blue score	3.	$154\ cm^2$
S.	Area of Black score	4.	$1078\ cm^2$

Codes

(a) P → 2, Q → 1, R → 4, S → 3
(b) P → 3, Q → 1, R → 2, S → 4
(c) P → 1, Q → 4, R → 2, S → 3
(d) P → 1, Q → 3, R → 4, S → 2

50. Following question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s, t) in Column-II. Any given statement in Column-I can have correct matching with one or more statement(s) given in Column-II.

	Column I		Column II
A.	 $OA = 26$ cm, $OC = 23$ m Area of shaded region = ?	(p)	$30\ cm^2$
B.	 $AD = 6.5$ cm, $CA = 5$ cm Area of ΔABC = ?	(q)	$115\ m^2$
C.	 $BC = 6$ m, $AB = 8$ cm Area of the shaded region = ?	(r)	$35\ cm^2$
D.	 $OB = 14.8$ m Area of the shaded region = ?	(s)	$0.003\ m^2$
		(t)	$30\ m^2$

Codes

(a) (A) → p, s; (B) → q; (C) → q; (D) → r, s
(b) (A) → q; (B) → p, s; (C) → p, s; (D) → q
(c) (A) → p, s; (B) → q; (C) → p, s; (D) → r, s
(d) None of the above

Assertion-Reasoning MCQs

Directions (Q. Nos. 51-60) Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

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(a) A is true, R is true; R is a correct explanation for A.
(b) A is true, R is true; R is not a correct explanation for A.
(c) A is true; R is false.
(d) A is false; R is true.

51. **Assertion** If the circumference of a circle is 176 cm, then its radius is 28 cm.

Reason Circumference = $2\pi \times$ radius

52. **Assertion** If a wire of length 22 cm is bent is the shape of a circle, then area of the circle so formed is 40 cm^2.

Reason Circumference of the circle = length of the wire.

53. **Assertion** The diameter of a wheel is 4.2 m. It makes 75 revolutions in one minute. The speed of the wheel is 59.4 km/h.

Reason Distance travelled in one minute = Circumference × Number of revolutions in one minute.

54. **Assertion** If the circumference of two circles are in the ratio 2 : 3, then ratio of their areas is 4 : 9.

Reason The circumference of a circle of radius r is $2\pi r$ and its area is πr^2.

55. **Assertion** The area of a circular playground is 22176 m^2, the cost of fencing this ground at the rate of ₹ 50 per m is ₹ 26400.

Reason If R and r be the radius of outer and inner circular path, then area of the ring will be $\pi(R^2 - r^2)$.

56. **Assertion** If the outer and inner diameter of a circular path is 10 m and 6 m, then area of the path is $16\pi\ m^2$.

Reason If R and r be the radius of outer and inner circular path respectively, then

area of path = $\pi(R^2 - r^2)$.

57. **Assertion** In the figure, O is the centre of a circle. The area of sector $OAPB$ is $\frac{5}{18}$ of the area of the circle, then the value of x is 100°

Reason Length of an arc of a circle with radius r and central angle θ is given by $l = \frac{\theta}{360°} \times \pi r^2$.

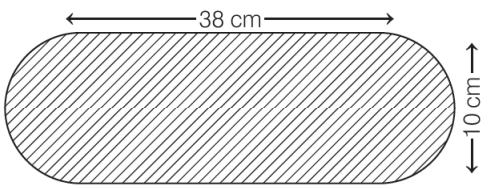
58. **Assertion** The area of the sector of a circle of radius 5 cm is 9.75 cm^2, if the corresponding arc length is 3.5 cm.

Reason Area of a sector of a circle of radius r and central angle θ is $\frac{\theta}{360°}\pi r^2$.

59. **Assertion** Area of the square inscribed in a circle of radius r is $2r^2$ sq units.

Reason Area of the major segment of a circle = Area of the circle – Area of minor segment.

60. **Assertion** The area of the flower bed (with semi-circular ends) shown in figure.



is $(380 + 50\pi)\ cm^2$

Reason Area of the semi-circle is $\frac{\pi r^2}{2}$ and area of rectangle is length × breadth.

Case Based MCQs

61. A farmer has a rectangular field of length 60 m and breadth 30 m. By the farmer a pit of diameter 14 m is dug 12 m deep to make a well. The earth taken out is spread in the field.

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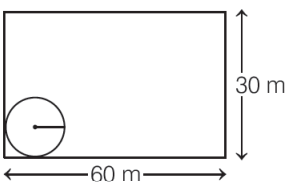


Based on the above information, answer the following questions.

(i) Find the volume of the earth taken out.
(a) 1460 m^3 (b) 1462 m^3
(c) 1848 m^3 (d) 1850 m^3

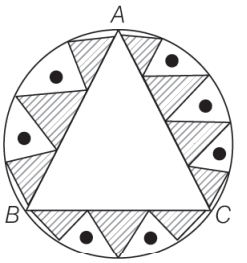
(ii) The area of the rectangular field is
(a) 1420 m^2 (b) 1430 m^2
(c) 1840 m^2 (d) 1800 m^2

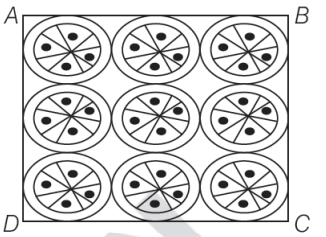
(iii) Find the area of the top of the pit.
(a) 38.5 m^2 (b) 40.5 m^2
(c) 41.5 m^2 (d) None of these

(iv) The area of the remaining field is
(a) 1402.3 m^2 (b) 1184 m^2
(c) 1646 m^2 (d) 411.5 m^2

(v) Find the level rise in the field.
(a) 0.5 m (b) 3 m
(c) 1.12 m (d) 2.12 m

62. Pookalam is the flower bed or flower pattern designed during Onam in Kerala. It is similar as Rangoli in North India and Kolam in Tamil Nadu. During the festival of Onam , your school is planning to conduct a Pookalam competition. Your friend who is a partner in competition , suggests two designs given below. Observe these carefully.





Design I This design is made with a circle of radius 32 cm leaving equilateral triangle *ABC* in the middle as shown in the given figure.

Design II This Pookalam is made with 9 circular design each of radius 7 cm.

[CBSE Question Bank]

Refer Design I

(i) The side of equilateral triangle is
(a) $12\sqrt{3}$ cm (b) $32\sqrt{3}$ cm
(c) 48 cm (d) 64 cm

(ii) The altitude of the equilateral triangle is
(a) 8 cm (b) 12 cm
(c) 48 cm (d) 52 cm

Refer Design II

(iii) The area of square is
(a) 1264 cm^2 (b) 1764 cm^2
(c) 1830 cm^2 (d) 1944 cm^2

(iv) Area of each circular design is
(a) 124 cm^2 (b) 132 cm^2
(c) 144 cm^2 (d) 154 cm^2

(v) Area of the remaining portion of the square *ABCD* is
(a) 378 cm^2 (b) 260 cm^2
(c) 340 cm^2 (d) 278 cm^2

63. There is a race competition between all participants of a sports club, so that the sports committee can choose better person for a marathon. The race track in the club is in the form of a ring whose inner most circumference 176 m and the outer most circumference is 352 m.

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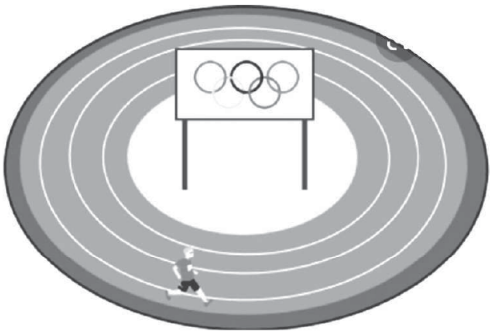


Based on the above information, answer the following questions.

(i) Find the radius of the outer most circle.
(a) 48 m (b) 49 m
(c) 50 m (d) 56 m

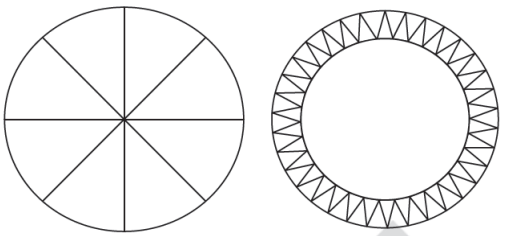
(ii) Find the radius of the inner most circle.
(a) 28 m
(b) 40 m
(c) 42 m
(d) 44 m

(iii) Find the width of the track.
(a) 17 m
(b) 28 m
(c) 19 m
(d) 10 m

(iv) Find the area of the race track.
(a) 7010 m^2
(b) 7392 m^2
(c) 8000 m^2
(d) 9002 m^2

(v) If the cost of painting on the race track is ₹5 per m^2, find the total cost for painting the whole race track.
(a) ₹36960
(b) ₹36430
(c) ₹3580
(d) None of the above

64. A brooch is a small piece of jewellery which has a pin at the back so it can be fastened on a dress, blouse or coat. Designs of some brooch are shown below. Observe them carefully.



Design A Brooch A is made with silver wire in the form of a circle with diameter 28 mm. The wire used for making 4 diameters which divide the circle into 8 equal parts.

Design B Brooch b is made two colours_ Gold and silver. Outer part is made with Gold. The circumference of silver part is 44 mm and the gold part is 3mm wide everywhere.

[CBSE Question Bank]

Refer to Design A

(i) The total length of silver wire required is
(a) 180 mm (b) 200 mm
(c) 250 mm (d) 280 mm

(ii) The area of each sector of the brooch is
(a) 44 mm^2 (b) 52 mm^2
(c) 77 mm^2 (d) 68 mm^2

Refer to Design B

(iii) The circumference of outer part (golden) is
(a) 48.49 mm (b) 82.2 mm
(c) 72.50 mm (d) 62.86 mm

(iv) The difference of areas of golden and silver parts is
(a) 18π mm^2 (b) 44π mm^2
(c) 51π mm^2 (d) 64π mm^2

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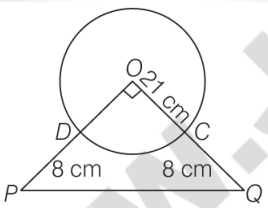
(v) A boy is playing with brooch B. He makes revolution with it along its edge. How many complete revolutions must it take to cover 80 π mm ?

(a) 2 (b) 3
(c) 4 (d) 5

65. Committee of a club select a round glass trophy for awarding best director in film festival. Design of each trophy is made as shown in the figure, where its base *PQRS* is golden plated from the front side and painted at the rate of ₹5 per cm^2.



(i) Find the area of sector *OSRO*.

(a) 254 cm^2 (b) 348 cm^2
(c) 344.5 cm^2 (d) 346.5 cm^2

(ii) Find the area of ΔPOQ.

(a) 210 cm^2 (b) 420.5 cm^2
(c) 418.2 cm^2 (d) 300 cm^2

(iii) Find the total cost of golden plating.

(a) ₹276 (b) ₹280
(c) ₹284 (d) ₹370

(iv) Find the area of major sector formed in the given figure.

(a) 1400 cm^2 (b) 1039.5 cm^2
(c) 1462 cm^2 (d) 1472 cm^2

(v) Find the length of arc *SR*.

(a) 16 cm (b) 18 cm
(c) 20 cm (d) 33 cm

66. Heena hold a Japanese fan in her hand as shown in the figure. It is shaped like a sector of a circle and made of a thin material such as paper or feather. The inner and outer radii are 6 cm and 10 cm respectively. The fan has three colours i.e. Pink, Blue and Black.

Based on the above information, answer the following questions.

(i) If the region containing blue colour makes an angle of 80° at the centre, then find the area of the region having blue colour.

(a) 49.17 cm^2 (b) 44.69 cm^2
(c) 41.17 cm^2 (d) 43.17 cm^2

(ii) If the region containing black colour makes an angle of 40° at the centre, then find the area of the region having green colour.

(a) 22.34 cm^2 (b) 18.38 cm^2
(c) 19.9 cm^2 (d) 21.12 cm^2

(iii) If the region containing pink colour makes an angle of 30° at the centre, then find the perimeter of the region containing pink colour.

(a) 12.9 cm (b) 14.2 cm
(c) 15.4 cm (d) 16.38 cm

(iv) Find the area of the region having radius 6 cm.

(a) 42.57 cm^2 (b) 47.14 cm^2
(c) 42 cm^2 (d) 26.57 cm^2

(v) The region given in the figure represents.

(a) minor sector (b) major sector
(c) minor segment (d) major segment

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ANSWERS

Multiple Choice Questions

1. (a)	2. (b)	3. (d)	4. (a)	5. (b)	6. (a)	7. (d)	8. (a)	9. (d)	10. (a)
11. (a)	12. (b)	13. (a)	14. (b)	15. (b)	16. (b)	17. (a)	18. (b)	19. (c)	20. (c)
21. (a)	22. (d)	23. (c)	24. (c)	25. (b)	26. (b)	27. (a)	28. (c)	29. (b)	30. (a)
31. (a)	32. (c)	33. (c)	34. (b)	35. (d)	36. (a)	37. (d)	38. (d)	39. (a)	40. (c)
41. (a)	42. (c)	43. (b)	44. (b)	45. (b)	46. (c)	47. (a)	48. (b)	49. (b)	50. (d)

Assertion and Reason

51. (a)	52. (d)	53. (a)	54. (a)	55. (b)	56. (a)	57. (c)	58. (d)	59. (d)	60. (d)

Case Based

61. (i) - (c); (ii) - (d); (iii) - (d); (iv) - (c); (v) - (c)
62. (i) - (b); (ii) - (c); (iii) - (b); (iv) - (d); (v) - (a)
63. (i) - (d); (ii) - (a); (iii) - (b); (iv) - (b); (v) - (a)
64. (i) - (b); (ii) - (c); (iii) - (d); (iv) - (c); (v) - (c)
65. (i) - (d); (ii) - (b); (iii) - (d); (iv) - (b); (v) - (d)
66. (i) - (b); (ii) - (a); (iii) - (d); (iv) - (b); (v) - (a)

SOLUTIONS

1. According to the given condition,
Circumference of circle
= Circumference of first circle
+ Circumference of second circle

$\therefore \quad 2\pi R = 2\pi R_1 + 2\pi R_2$

$\Rightarrow \quad R = R_1 + R_2$

2. The distance covered in one revolution is $2\pi r$ [its circumference]

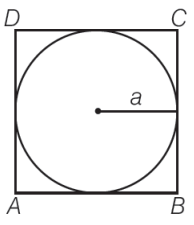
$\because$ Number of revolution

$$= \frac{\text{Total distance travelled}}{\text{Circumference}}$$

$$= \frac{s}{2\pi r}$$

3. Because the distance travelled by the wheel in one revolution is equal to its circumference i.e. πd.

4. Given, radius of circle, $r = a$ cm



$\therefore$ Diameter of circle, $d = 2 \times$ Radius $= 2a$ cm

$\therefore$ Side of a square = Diameter of circle
$= 2a$ cm

$\therefore$ Perimeter of a square $= 4 \times$ (Side) $= 4 \times 2a$
$= 8a$ cm

5. Let r cm be the radius of the required circle.
According to the question, we have
Circumference of the required circle having radius r cm
= Circumference of the circle having radius 13 cm
+ Circumference of the circle having radius 6 cm

$\therefore \quad 2\pi r = 2\pi(13) + 2\pi(6)$
[$\because$ circumference of circle $= 2\pi r$]

$\Rightarrow \quad 2\pi r = 2\pi(13+6)$

$\Rightarrow \quad r = 19$ cm

Hence, the radius of the required circle is 19 cm.

6. Given, circumference of a circle
= Diameter of a circle + 25.8

$\Rightarrow \quad 2\pi r = 2r + 25.8$

$\Rightarrow \quad 2r(\pi - 1) = 25.8 \Rightarrow (\pi - 1)r = 12.9$

$\Rightarrow \quad r = 12.9 \times \frac{7}{15} \Rightarrow r = 6.02$ cm

7. Given, perimeter of a protractor = 72 cm

$\therefore \quad \pi r + 2r = 72$ [$\because$ perimeter of a protractor = perimeter of semi-circle]

where, r is the radius of circle.

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$\Rightarrow \quad r\left(\frac{22}{7}+2\right)=72 \Rightarrow r\times\frac{36}{7}=72$

$\Rightarrow \quad r=2\times 7 \Rightarrow r=14$ cm

$\therefore$ Area of protractor $=\frac{\pi r^2}{2}=\frac{22}{7}\times\frac{(14)^2}{2}$

$=308\text{ cm}^2$

8. In 1 day, i.e. 24 h, short (hour) hand of the clock make 2 revolutions and long (minute) hand make 24 revolutions.

In 1 revolution, distance travelled by tip of hour hand = Circumference of circle of radius 6 cm $=2\times\frac{22}{7}\times 6$

In 1 revolution distance travelled by tip of minute hand = Circumference of circle of radius 8 cm $=2\times\frac{22}{7}\times 8$

$\therefore$ Sum of distances travelled by tips of both hand in 1 day

$=2\times 2\times\frac{22}{7}\times 6+24\times 2\times\frac{22}{7}\times 8$

$=2\times\frac{22}{7}(12+192)=2\times\frac{22}{7}\times 204$

$=1282.29$ cm (approx).

9. In 1 h, distance covered by wheel = 33 km

In 1 min, distance covered by wheel

$=\frac{33\times 1000}{60}\text{ m}=550\text{ m}$

Now, number of revolutions made in 1 min

$=\frac{\text{Distance covered by wheel}}{\text{Circumference of the wheel}}$

$=\frac{550}{2\times\frac{22}{7}\times\frac{25}{100}}\quad\left[\because 25\text{ cm}=\frac{25}{100}\text{ m}\right]$

$=\frac{550\times 7\times 100}{2\times 22\times 25}=350$

10. If areas of two circles are equal, then their corresponding radii are equal. So, their circumference will be equal.

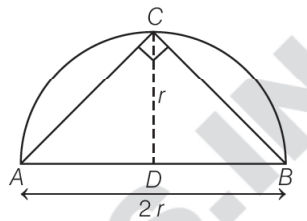
11. If circumference of two circles are equal, then their corresponding radii are equal. So, their areas will be equal.

12. If $0<r<2$, then numerical value of circumference is greater than numerical value of area of circle and if $r>2$, area is greater than circumference.

13. Take a point C on the circumference of the semi-circle and join it by the end points of diameter A and B.

$\therefore \quad \angle C=90°$ [by property of circle]

[angle in a semi-circle are right angle]



So, ΔABC is right angled triangle.

$\therefore$ Area of largest $\Delta ABC=\frac{1}{2}\times AB\times CD$

$=\frac{1}{2}\times 2r\times r$

$=r^2$ sq units

14. Let radius of circle be r and side of a square be a.

According to the given condition,

Perimeter of a circle = Perimeter of a square

$\therefore \quad 2\pi r=4a\Rightarrow a=\frac{\pi r}{2}$ ...(i)

Now, $\frac{\text{Area of circle}}{\text{Area of square}}=\frac{\pi r^2}{(a)^2}=\frac{\pi r^2}{\left(\frac{\pi r}{2}\right)^2}$

[from Eq. (i)]

$=\frac{\pi r^2}{\pi^2 r^2/4}=\frac{4}{\pi}=\frac{4}{22/7}=\frac{28}{22}=\frac{14}{11}$

15. Given, area of circle $=2464\text{ cm}^2$

$\pi r^2=2464\Rightarrow r^2=\frac{2464\times 7}{22}$

$\Rightarrow \quad r^2=784\Rightarrow r=28$ [taking square root]

$\therefore$ Diameter of a circle $=2r=2\times 28=56$ cm

16. Let the radius of the field be r.

Then, $\frac{1}{2}\pi r^2=30800\Rightarrow\frac{1}{2}\times\frac{22}{7}\times r^2=30800$

$\Rightarrow \quad r^2=30800\times 2\times\frac{7}{22}=19600\Rightarrow r=140$ m

[taking positive square root]

Thus, perimeter of the field $=\pi r+2r$

$=\frac{22}{7}\times 140+2\times 140$

$=440+280=720$ m

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17. Length of the fence of a circular field

$$= \frac{\text{Total cost}}{\text{Rate}} = \frac{11880}{36}$$

$= 330$ m

So, the circumference of the field is 330 m.

Let r be the radius of the field, then

$\therefore \quad 2\pi r = 330$

[$\because$ circumference of circular field $= 2\pi r$]

$\Rightarrow \quad 2 \times \frac{22}{7} \times r = 330$

$\Rightarrow \quad r = \frac{330 \times 7}{2 \times 22} = 52.5$ m

So, the radius of the field is 52.5 m.

Now, area of the field $= \pi r^2$

$= \frac{22}{7} \times 52.5 \times 52.5$

$= 22 \times 7.5 \times 52.5 \text{ m}^2$

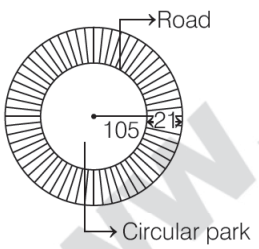
Given, cost of ploughing 1 m^2 of the field

= ₹ 0.60

So, total cost of ploughing the field

$= 0.6 \times 22 \times 7.5 \times 52.5 =$ ₹ 5197.5

18. Given that, a circular park is surrounded by a road.



Width of the road = 21 m

Radius of the park $(r_i) = 105$ m

$\therefore$ Radius of whole circular portion (park + road),

$r_e = 105 + 21 = 126$ m

Now, area of road

= Area of whole circular portion – Area of circular park

$= \pi r_e^2 - \pi r_i^2$ [$\because$ area of circle $= \pi r^2$]

$= \pi(r_e^2 - r_i^2)$

$= \pi\{(126^2 - (105)^2\}$

$= \frac{22}{7} \times (126 + 105)(126 - 105)$

$= \frac{22}{7} \times 231 \times 21$

[$\because (a^2 - b^2) = (a - b)(a + b)$]

$= 66 \times 231 = 15246 \text{ cm}^2$

Hence, the required area of the road is 15246 cm^2.

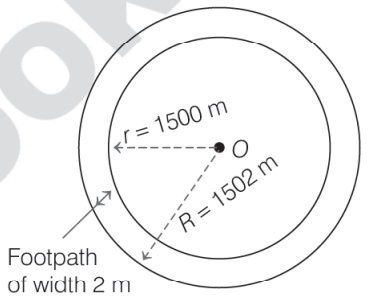
19. Radius of the park, i.e. inner radius of the park, $r = 1500$ m

Width of the footpath around the park

= 2 m

Let R be the outer radius of the park including the footpath.

Then, $R = (1500 + 2)$ m $= 1502$ m



Now, area of the footpath

$= \pi R^2 - \pi r^2$

$= \pi\{R^2 - r^2\}$

$= 3.14\{(1502)^2 - (1500)^2\}$

$= 3.14\{(1502 + 1500)(1502 - 1500)\}$

$= 3.14 \times 6004 = 18852.56 \text{ m}^2$

$\therefore$ Total cost of construction of the footpath at the rate of ₹ 20 per m^2

$= 20 \times 18852.56$

= ₹ 377051.2

20. It is true only in the case of minor segment. But in case of major segment area is always greater than the area of sector.

21. It is true for arcs of the same circle. But in different circle, it is not possible.

22. Given, sector angle $= p$ and radius of circle $= R$

$\therefore \quad$ Area of sector $= \frac{\theta}{360°} \times \pi r^2$

$= \frac{p}{360°} \times \pi R^2$

$= \frac{p}{720°} \times 2\pi R^2$

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23. Area of the sector with central angle θ and radius r is $\frac{\theta}{360°} \times \pi r^2$

Here, radius is $4r$ and angle $x°$.

$\therefore$ Area of sector $= \frac{x°}{360°} \times \pi(4r)^2$

$= \frac{16\pi x r^2}{360°}$

$= \frac{2\pi x r^2}{45°}$

24. We know that, area of sector of a circle

$= \frac{\theta}{360°} \times \pi r^2$

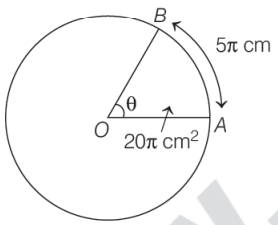
Given, radius of circle, $r = 6$ cm

and angle of sector, $\theta = 60°$

$\therefore$ Area of sector of a circle

$= \frac{60°}{360°} \times \frac{22}{7} \times (6)^2 = \frac{132}{7}$ cm^2

25. Let the radius of the circle be r cm and the arc AB of length 5π cm subtends angle θ at the centre O of the circle.



Then, arc $AB = 5\pi$ cm and area of the sector $OAB = 20\pi$ cm^2

$\Rightarrow \quad \frac{\theta}{360°} \times 2\pi r = 5\pi$

and $\quad \frac{\theta}{360°} \times \pi r^2 = 20\pi$

$\Rightarrow \quad \frac{\frac{\theta}{360°} \times \pi r^2}{\frac{\theta}{360°} \times 2\pi r} = \frac{20\pi}{5\pi}$

$\Rightarrow \quad \frac{r}{2} = 4 \quad \Rightarrow \quad r = 8$ cm

26. The minute hand of a clock describes a circle of radius equal to its length, i.e. 14 cm in 1 h. So, the angle described by minute hand in 60 min = 360°.

$\therefore$ Angle described by minute hand in 1 min $= \frac{360°}{60} = 6°$

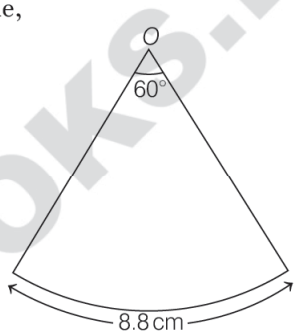
So, the area swept by the minute hand in 1 min is the area of a sector of angle 6° in a circle of radius 14 cm.

$\therefore$ Required area $= \frac{\theta}{360°} \times \pi r^2$

$= \frac{6°}{360°} \times \frac{22}{7} \times (14)^2$

$= \frac{1}{60} \times \frac{22}{7} \times 14 \times 14 = 10.27$ cm^2

27. As per question, length of an arc of a sector of angle,



$\theta = 60°$

$l = \frac{\theta}{360°} \times 2\pi r$

$\Rightarrow \quad 8.8 = \frac{60}{360°} \times 2 \times \frac{22}{7} \times r$

$\Rightarrow \quad 8.8 = \frac{1}{3} \times \frac{22}{7} \times r \Rightarrow r = \frac{8.8 \times 21}{22}$

$\therefore \quad r = 8.40$ cm

28. Given, central angle $(\theta) = 60°$

Area of sector $= \frac{60°}{360°} \times \pi r^2$

For both the area we have to multiply by 2.

Then, area $= 2 \times \frac{60°}{360°} \times \pi r^2 = \frac{1}{3}\pi r^2$ cm^2

29. Given, umbrella to be a flat circle.
So, the central angle of an umbrella is 360°.
Since, umbrella has 8 ribs.

$\therefore$ Angle between two ribs $= \frac{360°}{8} = 45°$

Area between two ribs

= Area of one sector of the umbrella

$= \frac{\theta}{360°} \times \pi r^2 = \frac{45°}{360°} \times \frac{22}{7} \times (45)^2$

[$\because r = 45$, given]

$= \frac{22}{7 \times 8} \times 45 \times 45 = \frac{22275}{28}$ cm^2

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30. Given, sector angle,

$$\theta = 80°$$

and distance or radius,

$$r = 16.5 \text{ km}$$

$$\therefore \text{ Area of sector} = \frac{\theta}{360°} \times \pi r^2$$

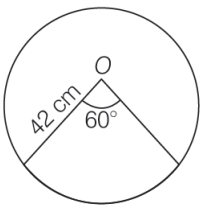
$$= \frac{80°}{360°} \times 3.14 \times (16.5)^2$$

$$= \frac{2 \times 3.14 \times 272.25}{9}$$

$$= \frac{1709.73}{9} = 189.97 \text{ km}^2$$

which is the required area of the sea over which the ships are warned.

31. Given, $r = 42$ cm and $\theta = 60°$

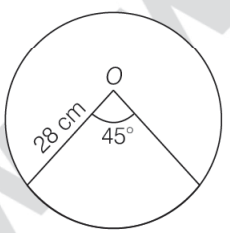


$$\therefore \text{ Arc length} = \frac{\theta}{360°} \times 2\pi r$$

$$= \frac{60°}{360°} \times 2 \times \frac{22}{7} \times 42$$

$$= \frac{1}{6} \times 2 \times 22 \times 6 = 44 \text{ cm}$$

32. Given, $r = 28$ cm and $\theta = 45°$



$$\therefore \text{ Arc length} = \frac{\theta}{360°} \times 2\pi r$$

$$= \frac{45°}{360°} \times 2 \times \frac{22}{7} \times 28$$

$$= \frac{1}{8} \times 2 \times 22 \times 4 = 22 \text{ cm}$$

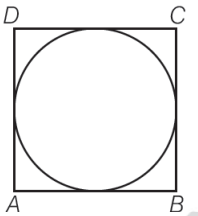
$$\text{Now, area of sector} = \frac{1}{2} \times l \times r$$

[where, l = arc length]

$$= \frac{1}{2} \times 22 \times 28$$

$$= 22 \times 14 = 308 \text{ cm}^2$$

33. Let $ABCD$ be a square of side a.



$\therefore$ Diameter of circle = Side of square = a

$$\therefore \text{ Radius of circle} = \frac{a}{2}$$

$$\therefore \text{ Area of circle} = \pi\,(\text{Radius})^2$$

$$= \pi \left(\frac{a}{2}\right)^2 = \frac{\pi a^2}{4}$$

Hence, area of the circle is $\frac{\pi a^2}{4}$ cm^2

34. Let the side of a square be a and the radius of circle be r.

Given that, length of diagonal of square

$$= 8 \text{ cm}$$

$$\Rightarrow \quad a\sqrt{2} = 8$$

$$\Rightarrow \quad a = 4\sqrt{2} \text{ cm}$$

Now, Diagonal of a square

= Diameter of a circle

$\Rightarrow$ Diameter of circle = 8

$$\Rightarrow \quad \text{Radius of circle} = r = \frac{\text{Diameter}}{2}$$

$$\Rightarrow \quad r = \frac{8}{2} = 4 \text{ cm}$$

$\therefore$ Area of circle $= \pi r^2 = \pi(4)^2 = 16\pi$ cm^2

and Area of square $= a^2 = (4\sqrt{2})^2 = 32$ cm^2

So, the area of the shaded region

= Area of circle – Area of square

$= (16\pi - 32)$ cm^2

Hence, the required area of the shaded region is $(16\pi - 32)$ cm^2.

35. $\because$ Area of square = (Side)^2

$\therefore$ Area of square $ABCD = 12 \times 12$

$= 144$ cm^2

$$\because \text{ Diameter of each circle} = \frac{12}{2} = 6 \text{ cm}$$

[here, length = 12 cm]

$$\therefore \text{ Radius of each circle } (r) = \frac{6}{2} = 3 \text{ cm}$$

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Area of one circle $= \pi r^2$

$$= \frac{22}{7} \times 3 \times 3 = \frac{198}{7} \text{ cm}^2$$

Therefore, area of four circles $= 4 \times \frac{198}{7}$

$$= \frac{792}{7} \text{ cm}^2$$

Hence, area of the shaded region

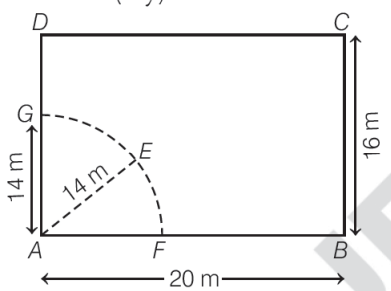
= Area of square

– Area of four circles

$$= 144 - \frac{792}{7} = \frac{1008 - 792}{7}$$

$$= \frac{216}{7} = 30.86 \text{ cm}^2$$

36. Let *ABCD* be a rectangular field of dimensions 20 m × 16 m. Suppose, a cow is tied at a point *A*. Let length of rope be $AE = 14$ m $= r$ (say).



∴ Area of the field in which the cow graze

= Area of sector *AFEG*

$$= \frac{\theta}{360°} \times \pi r^2$$

$$= \frac{90°}{360°} \times \pi \times (14)^2$$

[so, the angle between two adjacent sides of a rectangle is 90°]

$$= \frac{1}{4} \times \frac{22}{7} \times 196 = 154 \text{ m}^2$$

37. Given diameter of a circle is *d*.

∴ Diagonal of a inner square

= Diameter of a circle = *d*

Let side of a inner square *EFGH* be *x*.

In right angled Δ*EFG*,

$$EG^2 = EF^2 + FG^2$$

[by Pythagoras theorem]

$$\Rightarrow \quad d^2 = x^2 + x^2$$

$$\Rightarrow \quad d^2 = 2x^2 \Rightarrow x^2 = \frac{d^2}{2}$$

∴ Area of a inner square

$$EFGH = (\text{Side})^2 = x^2 = \frac{d^2}{2}$$

But side of a outer square *ABCD*

= Diameter of a circle = *d*

∴ Area of outer square $= d^2$

$$\text{Ratio} = \frac{\text{Area of inner square}}{\text{Area of outer square}} = \frac{d^2}{2 \times d^2} = 1 : 2$$

38. Given, side of square = 14 cm

Also, *APD* and *BPC* are semi-circles, therefore

Their radius, $r = \frac{14}{2} = 7$ cm.

Now, area of semi-circle *APD*

$$= \text{Area of semi-circle } BPC = \frac{\pi r^2}{2}$$

$$= \frac{22}{7 \times 2} \times (7)^2 = 77 \text{ cm}^2$$

and area of square $ABCD = (\text{Side})^2 = (14)^2$

$$= 196 \text{ cm}^2$$

Hence, area of shaded region

= Area of square – (Area of semi-circle *APD*

+ Area of semi-circle *BPC*)

$$= 196 - (77 + 77) = 42 \text{ cm}^2$$

39. Let the four unshaded regions be denoted by I, II, III and IV as shown in the figure.

Given, side of square = 10 cm

Diameter of each semi-circle = 10 cm

∴ Radius of each semi-circle $= \frac{10}{2} = 5$ cm

Now, area of I region + area of III region

= Area of *ABCD*

– Area of two semi-circles each of radius 5 cm

$$= \left(10 \times 10 - 2 \times \frac{1}{2} \pi \times 5^2\right)$$

$$= (100 - 3.14 \times 25)$$

$$= (100 - 78.5) = 21.5 \text{ cm}^2$$

Similarly, area of II region

+ area of IV region $= 21.5 \text{ cm}^2$

∴ Area of the shaded design

= Area of *ABCD*

– Area of (I + II + III + IV) region

$$= (100 - 2 \times 21.5) = (100 - 43) = 57 \text{ cm}^2$$

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40. Given, side of square = 14 cm

i.e. $AB = BC = CD = DA = 14$ cm

$\therefore$ Radius of circle $= \frac{1}{2}$ (Side of a square)

$= \frac{14}{2} = 7$ cm

Area of quadrant of one circle $= \frac{\pi r^2}{4}$

$= \frac{22}{7 \times 4} \times (7)^2 = \frac{154}{4}$ cm^2

$\therefore$ Area of four quadrants of four circles

$= 4\left(\frac{154}{4}\right) = 154$ cm^2

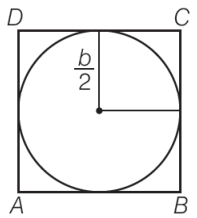
Now, area of square $= (\text{Side})^2 = (14)^2 = 196$ cm^2

Hence, area of shaded region

= Area of square – Area of four quadrants

$= 196 - 154 = 42$ cm^2

41. Given, $a > b$



Radius of the circle, $r = \frac{b}{2}$ cm

$\therefore$ Area of circle $= \pi\left(\frac{b}{2}\right)^2 = \frac{\pi b^2}{4}$ cm^2

42. Area of shaded region

= (Area of sector having $r = 7$ cm, $\theta = 30°$)

– (Area of sector having $r = 3.5 = \frac{7}{2}$ cm, $\theta = 30°$)

$= \left[\frac{22}{7} \times (7)^2 \times \frac{30°}{360°}\right] - \left[\frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times \frac{30°}{360°}\right]$

$\left[\because \text{area of a sector} = \frac{\theta}{360°} \times \pi r^2\right]$

$= \left(\frac{77}{6} - \frac{77}{24}\right) = \frac{308 - 77}{24}$

$= \frac{231}{24} = \frac{77}{8} = 9.625$ cm^2

43. Given, radius of circle = 40 m and angle of sector = 60°

Area of the sector

$AOB = \frac{60°}{360°} \times 3.14 \times (40)^2$

$= \frac{1}{6} \times 3.14 \times 1600 = \frac{2512}{3}$ m^2

Amount spent for making the flower bed at the rate of ₹2.40 per m^2

$= ₹\ 2.40 \times \frac{2512}{3} = ₹\ 2009.60$

Angles for the major sectors of both the circle at O is same, i.e. 300°.

Radius of inner circle = 40 – 15 = 25 m

Area of concrete track

$= \left\{\frac{300°}{360°} \times \pi \times (40)^2 - \frac{300°}{360°} \times \pi \times (25^2)\right\}$

[$\because$ area of track = area of outer sector – area of inner sector]

$= \frac{5}{6} \times \pi \times (1600 - 625) = \frac{5}{6} \times 3.14 \times 975$

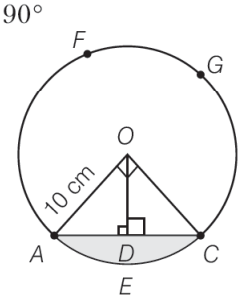
$= 2551.25$ m^2

Amount spent for making the concrete track at the rate of ₹ 20 per m^2

$= 20 \times 2551.25 = ₹\ 51025$

Thus, the total amount spent for both the jobs = ₹ 2009.60 + ₹ 51025 = ₹ 53034.60

44. Given, radius of a circle, $AO = 10$ cm and $\angle AOC = 90°$



Area of $\Delta AOC = \frac{1}{2} \times OA \times OC$

$= \frac{1}{2} \times 10 \times 10 = 50$ cm^2

Area of sector OAECO $= \frac{\theta}{360°} \times \pi r^2$

$= \frac{90°}{360°} \times 3.14 \times (10)^2 = \frac{314}{4} = 78.5$ cm^2

Area of minor segment $AECDA$

= Area of sector $OAECO$ – Area of $\Delta\ AOC$

$= 78.5 - 50 = 28.5$ cm^2

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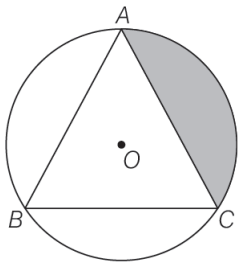
45. We have, $R = 4$ cm

$\therefore \quad AB = BC = CA = R\sqrt{3} = 4\sqrt{3}$ cm

$$\left[\because R = \frac{2}{3}h \text{ and } h = \frac{\sqrt{3}}{2}a;\ \therefore R = \frac{a}{\sqrt{3}}\right]$$

$\therefore$ Required area $= \frac{1}{3}$ (Area of the circle – Area of ΔABC)



$$\therefore \text{ Required area} = \frac{1}{3}\left\{\pi R^2 - \frac{\sqrt{3}}{4} \times (\text{Side})^2\right\}$$

$$= \frac{1}{3}\left\{16\pi - \frac{\sqrt{3}}{4} \times (4\sqrt{3})^2\right\}$$

$$= \frac{1}{3}(16\pi - 12\sqrt{3})$$

$$= \frac{4}{3}(4\pi - 3\sqrt{3}) \text{ cm}^2$$

46. From the figure, we have

$AB = 7 + 3 = 10$ cm

$AC = 7 + 3 = 10$ cm

$\angle BAC = 90°$

Also, radius of circle $= AP = AR = 7$ cm

$\therefore$ Area of right angled ΔBAC

$$= \frac{1}{2} \times AB \times AC$$

$$= \frac{1}{2} \times 10 \times 10 = 50 \text{ cm}^2$$

Area of the sector

$$APR = \frac{90°}{360°} \times \pi r^2 = \frac{1}{4} \times \pi \times (7)^2$$

$$\left[\because \text{area of sector} = \frac{\theta}{360°} \times \pi r^2\right]$$

$$= \frac{1}{4} \times \frac{22}{7} \times 49 = \frac{11 \times 7}{2} = 38.5 \text{ cm}^2$$

Then, area of base $PBCR$ (shaded) which is to be silver plated

= Area of the right angled ΔBAC – Area of the sector APR

$= 50 - 38.5 = 11.5 \text{ cm}^2$

$\therefore$ Total cost of silver plating at the rate of ₹ 20 per cm^2

$= ₹20 \times 11.5 = ₹\ 230$

47. It is clear from the figure, BC is diameter of the circle

$\therefore \quad \angle BAC = 90°$

[$\because$ angle in a semi-circle is a right angle]

Now, in right angle ΔBAC,

$BC^2 = AB^2 + AC^2$

[using Pythagoras theorem]

$\therefore \quad BC = \sqrt{(15)^2 + (20)^2}$

[$\because AC = 20$ cm, $AB = 15$ cm]

$\Rightarrow \quad BC = \sqrt{625} \Rightarrow BC = 25$ cm

$\therefore$ Radius of the circle, $r = \frac{25}{2}$ cm

Now, area of shaded region

= Area of semi-circle – Area of ΔABC

$$= \frac{\pi r^2}{2} - \frac{1}{2} \times AB \times AC$$

$$= \frac{1}{2} \times \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2} - \frac{1}{2} \times 20 \times 15$$

$$= \frac{6875}{28} - 150 = 245.54 - 150 = 95.54 \text{ cm}^2$$

48. Area of quadrant $OACBO = \frac{1}{4}\pi r^2$

$$= \frac{1}{4} \times \frac{22}{7} \times (4.5)^2 = 15.91 \text{ cm}^2$$

and area of $\Delta BOD = \frac{1}{2} \times BO \times OD$

$$= \frac{1}{2} \times 4.5 \times 3 = 6.75 \text{ cm}^2$$

Hence, area of shaded portion

= Area of quadrant $OACBO$ – Area of ΔBOD

$= 15.91 - 6.75 = 9.16 \text{ cm}^2$

49. We have,

r = Radius of the region representing gold score = 7 cm

r_1 = Radius of the region representing gold and red scoring areas

$= (7 + 7)$ cm $= 14$ cm

r_2 = Radius of the region representing gold, red and blue scoring areas

$= (7 + 7 + 7) = 21$ cm

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r_3 = Radius of the region representing gold, red, blue and black scoring areas

$= (7 + 7 + 7 + 7) = 28$ cm

(P) Now, A_1 = Area of the region representing gold scoring area

$= \pi r^2 = \frac{22}{7} \times 7 \times 7 = 154 \text{ cm}^2$

(Q) A_2 = Area of the region representing red scoring area

$= \pi r_1^2 - \pi r^2 = \frac{22}{7}(14^2 - 7^2)$

$= \frac{22}{7}(14 + 7)(14 - 7) = 462 \text{ cm}^2$

(R) A_3 = Area of the region representing blue scoring area

$= \pi r_2^2 - \pi r_1^2 = \frac{22}{7}(21^2 - 14^2)$

$= \frac{22}{7}(21 + 4)(21 - 14) = 770 \text{ cm}^2$

(S) A_4 = Area of the region representing black scoring area

$= \pi r_3^2 - \pi r_2^2 = \frac{22}{7}(28^2 - 21^2)$

$= \frac{22}{7}(28 + 21)(28 - 21) = 1078 \text{ cm}^2$

50. (A) Area of the shaded region

$= \frac{90}{360°} \pi [(26)^2 - (23)^2]$

$= \frac{1}{4} \times \frac{22}{7} [(26)^2 - (23)^2]$

$= \frac{1}{4} \times \frac{22}{7} [(26 + 23)(26 - 33)]$

$= 115.5 \simeq 115 \text{ m}^2$

(B) $AB = 2 \times AD$

$= 2 \times 6.5 = 13$ cm

$BC = \sqrt{(AB)^2 - (AC)^2}$

$= \sqrt{(13)^2 - (5)^2} = 12$ cm

Area of $\Delta ABC = \frac{1}{2} \times AC \times BC$

$= \frac{1}{2} \times 5 \times 12 = 30 \text{ cm}^2$

$= 0.003 \text{ m}^2$

(C) $AC^2 = AB^2 + BC^2 = 64 + 36 = 100$

$AC = 10$ cm

Area of the shaded region

= (area of the circle) − (area of the rectangle $ABCD$)

$= \left[\frac{22}{7} \times \left(\frac{10}{2}\right)^2\right] - (8 \times 6)$

$= (78.57 - 48) = 30.57 \text{ cm}^2$

(D) Area of the shaded region

$= \frac{60}{360°} \times \frac{22}{7} \times (14.8)^2$

$\left[\because \text{ area of sector } = \frac{\theta}{360°} \times \pi r^2\right]$

$= 114.7 \simeq 115 \text{ m}^2$

51. $C = 2 \times \frac{22}{7} \times r = 176$

$\Rightarrow \quad r = \frac{176 \times 7}{2 \times 22} = 28$ cm

Both Assertion and Reason are True.
Also Reason is the True explanation of the Assertion.

52. Assertion is False, but reason is true.

$2\pi r = 22$

$r = 3.5$ cm

$\therefore$ Area of the circle $= \frac{22}{7} \times 3.5 \times 3.5 = 38.5 \text{ cm}^2$

53. We have, diameter of wheel = 4.2 m

Circumference of circle = one revolution

$= \pi \times 4.2 = \frac{22}{7} \times 4.2 = 13.2$

Distance covered in 75 revolutions

$= (75 \times 13.2)$ m

Speed of wheel $= \frac{\text{Distance travelled}}{\text{Time taken}}$

$= \left(\frac{75 \times 13.2}{1/60} \times \frac{1}{1000}\right)$ km/h

$= 75 \times 13.2 \times 60 = 59.4$ km/h

54. Given, $\frac{2\pi r_1}{2\pi r_2} = \frac{2}{3}$

$\Rightarrow \quad \frac{r_1}{r_2} = \frac{2}{3}$

Now, ratio of their area will be

$\frac{\pi r_1^2}{\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$

Also, circumference of circle $= 2\pi r$

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55. Given, area of a circular playground

$= 22176 \text{ m}^2$

$\therefore \quad \pi r^2 = 22176 \quad [\because \text{area of circle} = \pi r^2]$

$\Rightarrow \quad \frac{22}{7} r^2 = 22176 \Rightarrow r^2 = 1008 \times 7$

$\Rightarrow \quad r^2 = 7056 \Rightarrow r = 84 \text{ m}$

$\therefore$ Circumference of a circle

$= 2\pi r = 2 \times \frac{22}{7} \times 84$

$= 44 \times 12 = 528 \text{ m}$

$\therefore$ Cost of fencing this ground

$= 528 \times 50 = ₹26400$

56. Area of the path $= \pi\left[\left(\frac{10}{2}\right)^2 - \left(\frac{6}{2}\right)^2\right]$

$= \pi(25 - 9) = 16\pi \text{ m}^2$

Both Assertion and Reason are True. Also, Reason is the True explanation of the Assertion.

57. Area of sector $OAPB = \frac{x}{360°} \times \pi r^2$

$\Rightarrow \quad \frac{x}{360°} \times \pi r^2 = \frac{5}{18}\pi r^2$

$\Rightarrow \quad \frac{x}{360°} = \frac{5}{18} \Rightarrow x = 100°$

58. Let the central angle of the sector be θ.

Given that, radius of the sector of circle

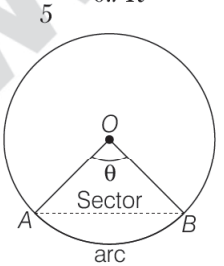
$(r) = 5 \text{ cm}$

and arc length $(l) = 3.5 \text{ cm}$

$\therefore$ Central angle of the sector,

$\theta = \frac{\text{arc length } (l)}{\text{radius}}$

$\Rightarrow \quad \theta = \frac{3.5}{5} = 0.7R \quad \left[\because \theta = \frac{l}{r}\right]$



$\Rightarrow \quad \theta = \left(0.7 \times \frac{180}{\pi}\right)^\circ \quad \left[\because 1R = \frac{180°}{\pi} D°\right]$

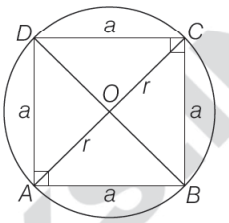
Now, area of sector with angle $\theta = 0.7$

$= \frac{\pi r^2}{360°} \times (0.7) \times \frac{180°}{\pi} = \frac{(5)^2}{2} \times 0.7$

$= \frac{25 \times 7}{2 \times 10} \times \frac{175}{20} = 8.75 \text{ cm}^2$

Hence, required area of the sector of a circle is 8.75 cm^2.

59. Let r be the radius of circle and a be the side of square inscribed in a circle.



In ΔABC, $\angle B = 90°$

$AC^2 = AB^2 + BC^2$

$\Rightarrow \quad (2r)^2 = a^2 + a^2$

$\Rightarrow \quad 4r^2 = 2a^2$

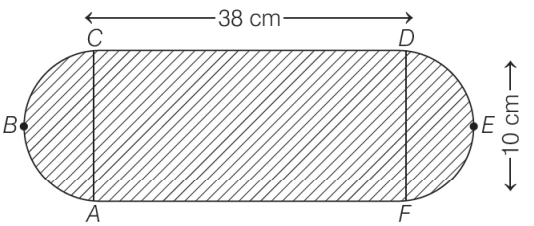
$\Rightarrow \quad a^2 = 2r^2 \quad [\because a^2 = \text{area of square}]$

60. Length and breadth of a circular bed are 38 cm and 10 cm.

$\therefore$ Area of rectangle $ACDF$

$=$ Length $\times$ Breadth

$= 38 \times 10 = 380 \text{ cm}^2$



Both ends of flower bed are semi-circles.

$\therefore$ Radius of semi-circle

$= \frac{DF}{2} = \frac{10}{2} = 5 \text{ cm}$

$\therefore$ Area of one semi-circles

$= \frac{\pi r^2}{2} = \frac{\pi}{2}(5)^2 = \frac{25\pi}{2} \text{ cm}^2$

$\therefore$ Area of two semi-circles

$= 2 \times \frac{25}{2}\pi = 25\pi \text{ cm}^2$

$\therefore$ Total area of flower bed

$=$ Area of rectangle $ACDF$

$+$ Area of two semi-circles

$= (380 + 25\pi) \text{ cm}^2$.

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61. (i) Volume of the earth taken out can be given by the volume of the pit.

Given, $r = \frac{14}{2} = 7$ m

$$\text{Volume} = \pi \times (7)^2 \times 12$$
$$= \pi \times 49 \times 12$$
$$= \frac{22}{7} \times 7 \times 7 \times 12$$
$$= 1848 \text{ m}^3$$

(ii) Area of rectangular field = length × breadth
$$= 60 \times 30$$
$$= 1800 \text{ m}^2$$

(iii) Area of top of the pit $= \pi r^2$
$$= \pi(7)^2$$
$$= \frac{22}{7} \times 49$$
$$= 154 \text{ m}^2$$

(iv) Area of the remaining field
= Area of the rectangular field – area of top of pit
$$= 1800 - 154$$
$$= 1646 \text{ m}^2$$

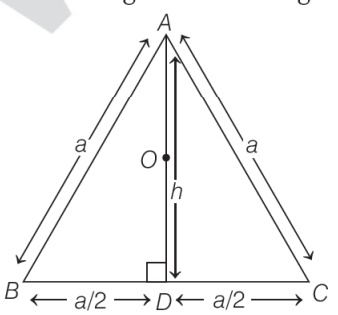
(v) Level rise in the field
$$= \frac{\text{Volume of the earth taken out}}{\text{Area of the remaining field}}$$
$$= \frac{1848}{1646} = 1.12 \text{ m}$$

62. **Directions (i-ii)**

Given, radius of the circle = 32 cm

Let the side of the equilateral ΔABC be a cm.

Let h be the height of the triangle.



We know that in an equilateral triangle, centroid and circumcentre coincide.

$$\therefore \quad AO = \frac{2}{3} h \text{ cm}$$

[∵ centroid divides the median in the ratio 2 : 1]

which is equal to the radius of circle.

$$\therefore \quad \frac{2}{3} h = 32 \Rightarrow h = 48 \text{ cm} \quad \ldots(i)$$

Now, we draw a perpendicular from vertex A to side BC which bisects BC at D.

In right angled ΔADB,
$$AB^2 = BD^2 + AD^2$$
[by Pythagoras theorem]
$$\Rightarrow \quad a^2 = \left(\frac{a}{2}\right)^2 + h^2 \Rightarrow h^2 = a^2 - \frac{a^2}{4} = \frac{3a^2}{4}$$
$$\Rightarrow \quad (48)^2 = \frac{3a^2}{4} \quad \text{[from Eq. (i)]}$$
$$\Rightarrow \quad a^2 = 3072$$
$$\Rightarrow \quad a = \sqrt{3072}$$
[taking positive square root]
$$= 32\sqrt{3} \text{ cm}$$

(i) $32\sqrt{3}$ cm

(ii) 48 cm

Directions (iii-v)

Given, radius of each circle, $r = 7$ cm

∴ Diameter of circle, $d = 14$ cm

[∵ diameter = 2 × radius]

In the given figure, horizontal three circles touch each other.

∴ Length of a side of square = 3 × Diameter of one circle = 3 × 14 = 42 cm

Now, area of one circle $= \pi r^2 = \pi (7)^2$
$$= \frac{22}{7} \times (7)^2 = 154 \text{ cm}^2$$

∴ Area of nine circles $= 9 \times 154 = 1386 \text{ cm}^2$

Area of square $ABCD = (\text{Side})^2$
$$= (42)^2 = 1764 \text{ cm}^2$$

Hence, area of the remaining portion of the handkerchief
= Area of square – Area of nine circles
$$= 1764 - 1386 = 378 \text{ cm}^2$$

(iii) 1764 cm^2

(iv) 154 cm^2

(v) 378 cm^2

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63. (i) Let the radius of the outer most circle be R.

$\therefore \quad 2\pi R = 352$

$$2 \times \frac{22}{7} \times R = 352$$

$$R = \frac{352 \times 7}{2 \times 22}$$

$$R = 56 \text{ m}$$

(ii) Let the radius of the inner most circle be r.

$\therefore \quad 2\pi r = 176$

$$2 \times \frac{22}{7} \times r = 176$$

$$r = \frac{176 \times 7}{2 \times 22}$$

$$r = 28 \text{ m}$$

(iii) Width of the track = radius of the outer most circle – radius of the inner most circle

$$= 56 - 28 = 28 \text{ m}$$

(iv) Area of the race track = Area of the outer circle – Area of the inner circle

$$= \pi R^2 - \pi r^2$$

$$= \frac{22}{7}(56^2 - 28^2)$$

$$= \frac{22}{7} \times 84 \times 28 = 7392 \text{ m}^2$$

(v) Cost of the painting the whole race track

$$= \text{Cost per m}^2 \times \text{Area of the track}$$

$$= 5 \times 7392 = ₹36960$$

64. (i) Given, diameter of circle, $d = 28$ mm

$\therefore$ Circumference of circle $= \pi d \quad [\because d = 2r]$

$$= \frac{22}{7} \times 28 = 88 \text{ mm}$$

Now, length of 4 diameters

$$= 4 \times 28 = 112 \text{ mm}$$

Total length of the silver wire $= \pi d + 4d$

$$= 88 + 112 = 200 \text{ mm}$$

(ii) Here, we see that total circle is divided into 8 parts.

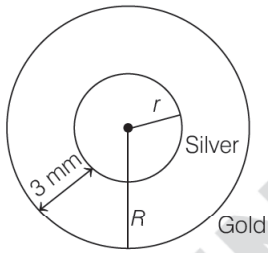
$\therefore$ Area of each sector $= \frac{1}{8} \times$ Area of circle

$$= \frac{1}{8} \times \pi r^2$$

$$= \frac{1}{8} \times \frac{22}{7} \times 14 \times 14$$

$$= 77 \text{ mm}^2$$

Directions (iii-iv)



We have, circumference of silver part

$$= 44 \text{ mm}$$

$\therefore \quad 2\pi r = 44$

$$\Rightarrow \quad r = \frac{44}{2 \times \frac{22}{7}} = 7 \text{ mm}$$

$\therefore \quad R = r + 3 = 7 + 3 = 10$ mm

(iii) Circumference of golden part $= 2\pi R$

$$= 2 \times \frac{22}{7} \times 10$$

$$= 62.86 \text{ mm}$$

(iv) Difference of areas $= \pi R^2 - \pi r^2$

$$= \pi(R^2 - r^2)$$

$$= (10^2 - 7^2)\pi$$

$$= 51\pi \text{ mm}^2$$

(v) Required number of revolutions

$$= \frac{\text{Distance covered}}{\text{Circumference}}$$

$$= \frac{80\pi}{2\pi R} = \frac{80\pi}{2\pi \times 10} = 4$$

65. (i) The area $OSRO$ is one-fourth of the total area.

$\therefore$ Area of the sector $= \frac{1}{4}\pi r^2$

$$= \frac{1}{4} \times \frac{22}{7} \times 21 \times 21 \quad [\because r = 21 \text{ cm}]$$

$$= \frac{9702}{28}$$

$$= 346.5 \text{ cm}^2$$

(ii) Area of POQ = Area of ΔPOQ

$$= \frac{1}{2} \times OP \times OQ$$

$$\left[\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}\right]$$

$$= \frac{1}{2} \times 29 \times 29 = 420.5 \text{ cm}^2$$

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(iii) Cost of golden plating = (cost per unit) × (Area of golden plated region)

Area of golden plated region = Area of ΔOPQ – area of sector $OSRO$.

$= 420.5 - 346.5 = 74 \text{ cm}^2$

$\therefore$ Cost = `$5 \times 74$ = `370

(iv) Area of major sector = Area of circle (πr^2) – area of minor sector

$$= \pi r^2 - \frac{1}{4}\pi r^2$$
$$= \frac{3}{4}\pi r^2$$
$$= \frac{3}{4} \times \frac{22}{7} \times 21 \times 21$$
$$= \frac{29106}{28}$$
$$= 1039.5 \text{ cm}^2$$

(v) Length of arc $SR = \frac{\theta}{360°} \times 2\pi r$

$$= \frac{90°}{360°} \times 2 \times \frac{22}{7} \times 21$$
$$= \frac{83160}{2520} = 33 \text{ cm}$$

66. (i) From the figure,

Area of the region having blue colour

$$= \frac{80°}{360°}\pi(10)^2 - \frac{80°}{360°} \times \pi(6)^2$$
$$= \frac{80°}{360°} \times \frac{22}{7} \times [(10)^2 - (6)^2]$$
$$= \frac{80°}{360°} \times \frac{22}{7} \times 16 \times 4$$
$$= \frac{112640}{2520}$$
$$= 44.69 \text{ cm}^2$$

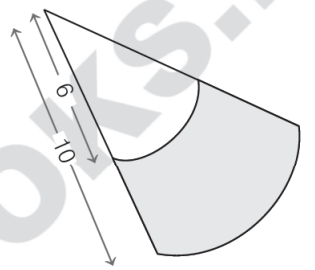
(ii) Similarly,

Area of the region having black colour

$$= \frac{40°}{360°} \times \frac{22}{7} \times 16 \times 4$$
$$= \frac{56320}{2520} = 22.34 \text{ cm}^2$$

(iii) Similarly,

Perimeter of the region having pink colour = 2(10 – 6) + length of arc having radius 6 cm + length of arc having radius 10 cm.



$$= 8 + \frac{30°}{360°} \times 2 \times \frac{22}{7} \times 6 + \frac{30°}{360°} \times 2 \times \frac{22}{7} \times 10$$
$$= 8 + \frac{7920}{2520} + \frac{13200}{2520}$$
$$= 8 + 3.142 + 5.238$$
$$= 16.38 \text{ cm}$$

(iv) Total angle = 80° + 40° + 30° = 150°

$\therefore$ Area of the region

$$= \frac{150°}{360°} \times \frac{22}{7} \times 6 \times 6$$
$$= \frac{118,800}{2520} = 47.14 \text{ cm}^2$$

(v) Total angle in the given sector = 150°

Hence, it represents the minor sector.

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08

Probability

Quick Revision

Probability is the study of the chances (or likelihood) of events happening. By means of probability, the chance (or likelihood) of events is measured by a number lying from 0 to 1.

Experiment

An operation which produces some well defined outcomes, is called an experiment.

e.g. Tossing a coin, throwing a dice, etc.

(i) **Random experiment** If an experiment is repeated under identical conditions and they do not produce the same outcomes every time, then it is said to be random (or probabilistic) experiment.

(ii) **Deterministic experiment** If an experiment is repeated under identical conditions and they produce the same outcomes every time, then it is is said to be deterministic experiment.

An event for an experiment is the collection of some outcomes of the experiment. We generally denote it by capital letter E.
e.g. Getting an even number in a single throw of a die is an event. This event would consist of three outcomes, namely 2, 4 and 6.

Elementary Event

An event having only one outcome of the random experiment is called an elementary event. e.g. In tossing of a coin, the possible outcomes are head (H) and tail (T). Getting H or T are known as elementary events.

Occurrence of an Event

An event E associated to a random experiment is said to be occur (or happen) in a trial, if the outcome of trial is one of the outcomes that favours E.

e.g. If a die is rolled and the outcome of a trial is 4, then we say that event getting an even number has happened (or occurred).

Probability of an Event (or Probability of occurrence of an Event)

If E is an event associated with a random experiment, then probability of E, denoted by $P(E)$, represents the chance of occurrence of event E.

e.g. If E denotes the event of getting an even number in a single throw of a die, then $P(E)$ represents the chance of occurrence of event E, i.e. the chance of getting 2, 4 or 6.

Compound Event

A collection of two or more elementary events associated with an experiment is called a compound event. e.g. In the random experiment of tossing of two coins simultaneously, if we define the event of getting exactly one head, then it is a collection of elementary events (or outcomes) HT and TH. So, it is a compound event.

Equally Likely Outcomes

The outcomes of a random experiment are said to be equally likely, when each outcome is as likely to occur as the other, i.e. when we have no reason to believe that one is more likely to occur than the other. e.g. When a die is thrown, all the six outcomes, i.e. 1, 2, 3, 4, 5 and 6 are equally likely to appear. So, the outcomes 1, 2, 3, 4, 5 and 6 are equally likely outcomes.

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Favourable Outcomes

The outcomes which ensure the occurrence of an event are called favourable outcomes to the event.
e.g. The favourable outcomes to the event of getting an even number when a die is thrown are 2, 4 and 6.

Complement of an Event/Negation of an Event

Let E be an event associated with a random experiment. Then, we can define the complement of event E or negation of event E, denoted by $\overline{E}$, as an event which occurs if and only if E does not occur.

e.g. Let E be the event of getting an even number in a single throw of a die. Then, its complement can be define as event $\overline{E}$ of getting an odd number, as E is consisting 2, 4 and 6. Therefore, $\overline{E}$ would consist 1, 3 and 5.

Note E and $\overline{E}$ are called **complementary events**.

Theoretical (Classical) Definition of Probability

Let us assume all the outcomes of an experiment are equally likely and E is an event associated with the experiment, then the theoretical probability (or classical probability) of the event E is given by

$$P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Total number of outcomes}}$$

$$= \frac{n(E)}{n(S)}$$

(i) Probability of an event can never be negative.
(ii) The sum of the probabilities of complementary events of an experiment is 1.

i.e. If E and $\overline{E}$ are complementry events.

Then, $P(E) + P(\overline{E}) = 1$ or $P(\overline{E}) = 1 - P(E)$

or $P(E) = 1 - P(\overline{E})$

where, $P(E)$ represents the probability of occurrence of an event E and $P(\overline{E})$ represents the probability of non-occurrence of an event E.

Impossible Event

An event which is impossible to occur, is called an impossible event and probability of impossible event is always zero.

e.g. In throwing a die, there are only six possible outcomes 1, 2, 3, 4, 5 and 6. Let we are interested in getting a number 7 on throwing a die. Since, no face of the die is marked with 7. So, 7 cannot come in any throw. Hence, getting 7 is an impossible event.

Then, $P(\text{getting a number } 7) = \frac{0}{6} = 0$

Sure Event or Certain Event

An event which is sure to occur, is called a sure event or certain event and probability of sure event is always 1. e.g. Suppose we want to find the probability of getting a number less than 7 in a single throw of a die having numbers 1 to 6 on its six faces.

We are sure that, we shall always get a number less than 7, whenever we throw a die. So, getting a number less than 7 is a sure event.

Then, $P(\text{getting a number less than } 7) = \frac{6}{6} = 1$

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Objective Questions

Multiple Choice Questions

1. The experiments which when repeated under identical conditions produce the same results or outcomes are known as
(a) random experiments
(b) probabilistic experiment
(c) elementary experiment
(d) deterministic experiment

2. An outcome of a random experiment is called an ..... event.
(a) elementary (b) complementary
(c) equally-likely (d) None of these

3. An event associated to a random experiment is a compound event if it is obtained by combining two or more elementary events associated to the random experiment
(a) True (b) False
(c) Can't say (d) Partially true/False

4. The sum of probabilities of all the outcomes of an experiment is greater than one
(a) True (b) False
(c) Can't say (d) Partially true/False

5. The sum of the probability of all elementary events of an experiment is p, then
(a) $0 < p < 1$ (b) $0 \le p < 1$
(c) $p = 1$ (d) $p = 0$

6. For an event E, $P(E) + P(\overline{E}) = q$, then
(a) $0 \le q < 1$ (b) $0 < q \le 1$
(c) $0 < q < 1$ (d) None of these

7. If $P(E) = 0.05$, the probability of 'not E' is ..... .
(a) 0.85 (b) 0.95
(c) 0.25 (d) None of these

8. If an event cannot occur, then its probability is ***[NCERT Exemplar]***
(a) 1 (b) $\frac{3}{4}$
(c) $\frac{1}{2}$ (d) 0

9. Which of the following cannot be the probability of an event?
(a) 1.5 (b) $\frac{3}{5}$
(c) 25% (d) 0.3

10. An event is very unlikely to happen. Its probability is closest to ***[NCERT Exemplar]***
(a) 0.0001 (b) 0.001
(c) 0.01 (d) 0.1

11. A number x is chosen at random from the numbers $-4, -3, -2, -1, 0, 1, 2, 3, 4$. What is the probability that $|x| < 1$?
(a) 1 (b) 0
(c) $\frac{2}{9}$ (d) $\frac{1}{9}$

12. A letter is chosen at random from the word 'MATHEMATICS'. What is the probability that it will be a vowel?
(a) $\frac{1}{2}$ (b) $\frac{3}{8}$
(c) $\frac{3}{11}$ (d) $\frac{4}{11}$

13. The probability that an ordinary year contains 53 Sundays is
(a) $\frac{2}{7}$ (b) $\frac{1}{7}$
(c) $\frac{7}{53}$ (d) $\frac{7}{52}$

14. A letter is chosen at random from the letters of the word 'ASSASSINATION', then the probability that the letter

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chosen is a vowel and is in the form of $\frac{6}{2x+1}$, then x is equal to

(a) 5 (b) 6
(c) 7 (d) 8

15. A con is tossed twice. The probability of getting both heads is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) 1

16. Two unbiased coins are tossed simultaneously then the probability of getting no head is $\frac{A}{B}$, then $(A+B)^2$ is equal to

(a) 1 (b) 4
(c) 5 (d) 25

17. A coin and a die is tossed simultaneously. The probability of the event that 'tail' and a prime number turns up

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$
(c) $\frac{1}{3}$ (d) $\frac{2}{3}$

18. Three unbiased coins are tossed together, then which of the following is true?

(a) the probability of getting exactly 2 heads is 1/2
(b) the probability of getting atleast one head is 5/8
(c) the probability of getting atmost 2 tails is 3/8
(d) the probability of getting exactly one tail is 3/8

19. If three different coins are tossed together, then the probability of getting two heads is

(a) $\frac{1}{8}$ (b) $\frac{3}{8}$
(c) $\frac{5}{8}$ (d) None of these

20. Three coins are tossed together. The possible outcomes are no head, 1 head, 2 head and 3 heads. So, I say that probability of no head is $\frac{1}{4}$

(a) True (b) False
(c) Can't say (d) Partially true/False

21. A die is thrown once, the probability of getting a prime number is ..... .

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$
(c) $\frac{2}{3}$ (d) $\frac{1}{2}$

22. On a single roll of a die, the probability of getting a number less than 7 is ..... .

(a) 1 (b) 0
(c) $\frac{2}{3}$ (d) None of these

23. A die is thrown once. The probability of getting a number which is not a factor of 36 is

(a) $\frac{1}{6}$ (b) $\frac{2}{3}$
(c) $\frac{1}{5}$ (d) 0

24. A fair dice is rolled. Probability of getting a number x such that $1 \le x \le 6$, is

(a) 0 (b) >1
(c) between 0 and 1 (d) 1

25. In a throw of a pair of dice. What is the probability of getting a doublet?

(a) $\frac{1}{2}$ (b) $\frac{1}{6}$
(c) $\frac{2}{3}$ (d) $\frac{1}{3}$

26. Two dice are thrown together. The probability that sum of the two numbers will be a multiple of 4, is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{8}$ (d) $\frac{1}{4}$

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27. Two dice are rolled once. Then, the probability of getting such numbers on the two dice, whose product is 12 is

(a) $\frac{1}{9}$ (b) $\frac{2}{9}$

(c) $\frac{4}{9}$ (d) $\frac{5}{9}$

28. Two dice are thrown at the same time the probability that, the sum of two numbers appearing on the top of the dice is greater than 6 but less than 9, is

(a) $\frac{12}{13}$ (b) $\frac{11}{36}$

(c) $\frac{14}{13}$ (d) $\frac{9}{5}$

29. Two dice are thrown simultaneously. Select the correct option.

(a) the probability of not getting doublet is $\frac{5}{6}$

(b) the probability of getting a total of at least 10 is 1/6

(c) the probability of not getting a total as a perfect square is 29/36

(d) All of the above

30. Three dice are thrown once. The probability that all the dice show different faces is

(a) $\frac{5}{18}$ (b) $\frac{2}{9}$

(c) $\frac{8}{15}$ (d) $\frac{5}{9}$

31. A card is selected at random from a well shuffled deck of 52 playing cards. The probability of its being a face card is $\frac{3}{13}$.

(a) True

(b) False

(c) Can't say

(d) Partially true/False

32. A card is selected from a deck of 52 cards, then the probability of its being a red face card is ***[NCERT]***

(a) $\frac{3}{26}$ (b) $\frac{3}{13}$

(c) $\frac{2}{13}$ (d) $\frac{1}{2}$

33. A card is drawn from a deck of 52 cards. The event E is that card is not an ace of hearts. The number of outcomes favourable to E is ***[NCERT]***

(a) 4 (b) 13

(c) 48 (d) 51

34. One card is drawn from a well-shuffled deck of 52 cards. Then, the probability of getting a king of red colour is ***[NCERT]***

(a) $\frac{1}{14}$ (b) $\frac{12}{24}$

(c) $\frac{1}{8}$ (d) $\frac{1}{26}$

35. One card is drawn from a well shuffled deck of 52 cards, then which of the following is true?

(a) the probability that the card will be diamond is 1/2

(b) the probability of an ace of heart is 1/52

(c) the probability of not a heart is 1/4

(d) the probability of king or queen is 1/26

36. From a well shuffled pack of cards, a card is drawn at random. The probability of getting a black queen is

(a) $\frac{1}{6}$

(b) $\frac{1}{12}$

(c) $\frac{1}{26}$

(d) None of the above

37. A bag contains 5 red balls and some blue balls. If the probability of drawings a blue ball is double that of a red ball, the number of blue balls in the bag is 10.

(a) True

(b) False

(c) Can't say

(d) Partially true/False

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38. A bag contains 8 red balls and some blue balls. If the probability of drawing a blue ball is three times of a red ball, then the number of blue balls in the bag

(a) 12 (b) 18
(c) 24 (d) 36

39. A bag contains 3 red, 5 black and 7 white balls. A ball is drawn from the bag at random. The probability that the ball drawn is not black, is ***[CBSE 2020]***

(a) $\frac{1}{3}$ (b) $\frac{9}{15}$
(c) $\frac{5}{10}$ (d) $\frac{2}{3}$

40. The probability of getting a defective bulb in a lot of 500 bulbs is 0.290. Then, the number of defective bulbs in the lot is

(a) 140 (b) 145
(c) 50 (d) 100

41. Someone is asked to make a number from 1 to 100. The probability that it is a prime is .....

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) $\frac{2}{3}$

42. If a number x is chosen at random from the numbers $-2, -1, 0, 1, 2$. Then, the probability that $x^2 < 2$ is

(a) $\frac{2}{5}$ (b) $\frac{4}{5}$
(c) $\frac{1}{5}$ (d) $\frac{3}{5}$

43. A number x is selected from the numbers 1,2,3 and then a second number y is randomly selected from the numbers 1,4,9, then the probability that the product xy of the two numbers will be less than 9 is

(a) $\frac{3}{7}$ (b) $\frac{4}{9}$
(c) $\frac{5}{9}$ (d) $\frac{7}{9}$

44. A man is known to speak truth 3 out of 4 times. He throws a die and a number other than six comes up. Find the probability that he reports it is a six

(a) $\frac{3}{4}$ (b) $\frac{1}{4}$
(c) $\frac{1}{2}$ (d) 1

45. There are 1000 sealed envelopes in a box, 10 of them contain a cash prize of ₹ 100 each, 100 of them contain a cash prize of ₹ 50 each and 200 of them contain a cash prize of ₹ 10 each and rest do not contain any cash prize. If they are well-shuffled and an envelope is picked up out, then the probability that is contains no cash prize is

(a) 0.65 (b) 0.69
(c) 0.54 (d) 0.57

46. Tickets numbered from 1 to 20 are mixed up together and then a ticket is drawn at random, then the probability that the ticket has a number which is a multiple of 3 or 7 is

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$
(c) $\frac{4}{5}$ (d) $\frac{1}{5}$

47. Ramesh buys a fish from a shop for his aquarium. The shopkeeper takes out one fish at random a tank containing 5 male fish and 9 female fish. Then, the probability that the fish taken out is a male fish, is

(a) $\frac{5}{13}$ (b) $\frac{5}{14}$
(c) $\frac{6}{13}$ (d) $\frac{7}{13}$

48. In a family having three children, there may be no girl, one girl, two girls or three girls. So, the probability of each is $\frac{1}{4}$. Is it true?

(a) True (b) False
(c) Data insufficient (d) None of these

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49. Match option of Column I with the appropriate option of Column II.

	Column I		Column II
A.	Probability of getting number 5 in throwing a dice.	p.	0
B.	Probability of obtaining three heads in a single throw of a coin.	q.	$\frac{1}{6}$
C.	Probability of getting the sum of the numbers as 7, when two dice are thrown	r.	1
D.	Probability of occurrence of two sure independent events.	s.	$\frac{6}{36}$

Codes

	A	B	C	D
(a)	p	q	s	r
(b)	q	p	s	r
(c)	q	r	p	s
(d)	p	q	s	r

50. Match option of Column I with the appropriate option of Column II.

	Column I		Column II
A.	The probability of a sure event is	p.	0
B.	The probability of impossible event is	q.	1
C.	Number of face cards in the pack of cards is	r.	$\frac{2}{7}$
D.	Probability of occuring 53 Sundays in a leap year is	s.	12

Codes

	A	B	C	D
(a)	q	p	s	r
(b)	p	s	r	q
(c)	p	r	q	s
(d)	q	p	r	s

Assertion-Reasoning MCQs

Directions (Q.Nos. 51-60) Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are true and Reason is not the correct explanation of Assertion.
(c) If Assertion is true but Reason is false.
(d) If Assertion is false but Reason is true.

51. **Assertion** The probability of winning a game is 0.4, then the probability of losing it, is 0.6.

Reason $P(E) + P(\text{not } E) = 1$.

52. **Assertion** If the probability of an event is P, then probability of its complementary event will be $1 - P$.

Reason When E and $\overline{E}$ are complementary events, then $P(E) + P(\overline{E}) = 1$.

53. **Assertion** An event is very unlikely to happen. Its probability is 0.0001.

Reason If $P(A)$ denote the probability of an event A, then $0 \le P(A) \le 1$.

54. **Assertion** When two coins are tossed simultaneously then the probability of getting no tail is $\frac{1}{4}$.

Reason The probability of getting a head (i.e., no tail) in one toss of a coin is $\frac{1}{2}$.

55. **Assertion** In rolling a dice, the probability of getting number 8 is zero.

Reason Its an impossible event.

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56. **Assertion** If a die is thrown, the probability of getting a number less than 3 and greater than 2 is zero.

Reason Probability of an impossible event is zero.

57. **Assertion** The probability of getting a prime number. When a die is thrown once is $\frac{2}{3}$.

Reason Prime numbers on a die are 2, 3, 5.

58. **Assertion** In a simultaneously throw a pair of dice. The probability of getting a double is $\frac{1}{6}$.

Reason Probability of an event may be negative.

59. **Assertion** Card numbered as 1, 2, 3 …… 15 are put in a box and mixed throughly, one card is then drawn at random. The probability of drawing an even number is $\frac{1}{2}$.

Reason For any event E, we have $0 \le P(E) \le 1$.

60. **Assertion** If a box contains 5 white, 2 red and 4 black marbles, then the probability of not drawing a white marble from the box is $\frac{5}{11}$.

Reason $P(\overline{E}) = 1 - P(E)$, where E is any event.

Case Based MCQs

61. On a weekend Rani was playing cards with her family. The deck has 52 cards. If her brother drew one card.

[CBSE Question Bank]

(i) Find the probability of getting a king of red colour.

(a) $\frac{1}{26}$ (b) $\frac{1}{13}$
(c) $\frac{1}{52}$ (d) $\frac{1}{4}$

(ii) Find the probability of getting a face card.

(a) $\frac{1}{26}$ (b) $\frac{1}{13}$
(c) $\frac{2}{13}$ (d) $\frac{3}{13}$

(iii) Find the probability of getting a jack of hearts.

(a) $\frac{1}{26}$ (b) $\frac{1}{52}$
(c) $\frac{3}{52}$ (d) $\frac{3}{26}$

(iv) Find the probability of getting a red face card.

(a) $\frac{3}{13}$ (b) $\frac{1}{13}$
(c) $\frac{1}{52}$ (d) $\frac{3}{26}$

(v) Find the probability of getting a spade.

(a) $\frac{1}{26}$ (b) $\frac{1}{13}$
(c) $\frac{1}{52}$ (d) $\frac{1}{4}$

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62. In a play zone, Sujesa is playing arcade arcade game which consists of 50 teddy bears, 40 pokemons, 30 tigers and 60 monkeys. Sujesa picks a puppet at random. Now, find the probability of getting

(i) a tiger

(a) $\frac{1}{15}$ (b) $\frac{1}{7}$

(c) $\frac{1}{6}$ (d) $\frac{1}{8}$

(ii) a monkey

(a) $\frac{1}{5}$ (b) $\frac{1}{3}$

(c) $\frac{1}{6}$ (d) $\frac{1}{8}$

(iii) a teddy bear

(a) $\frac{5}{18}$ (b) $\frac{1}{6}$

(c) $\frac{1}{3}$ (d) $\frac{1}{7}$

(iv) not a monkey

(a) $\frac{1}{25}$ (b) $\frac{2}{3}$

(c) $\frac{1}{5}$ (d) $\frac{17}{25}$

(v) not a pokemon

(a) $\frac{7}{9}$ (b) $\frac{1}{18}$

(c) $\frac{61}{100}$ (d) $\frac{79}{100}$

63. Teacher wants to distribute chocolates in his class on farewell party. The chocolates are of three types : Milk chocolate, White chocolate and Dark chocolate. If the total number of students in the class is 66 and everyone gets a chocolate, then answer the following questions.

(i) If the probability of distributing milk chocolates is $\frac{1}{3}$, then the number of milk chocolates Teacher has, is

(a) 18 (b) 20

(c) 22 (d) 30

(ii) If the probability of distributing dark chocolate is $\frac{5}{11}$ then the number of dark chocolates Teacher has, is

(a) 18 (b) 25

(c) 24 (d) 30

(iii) The probability of distributing white chocolates is

(a) $\frac{7}{33}$ (b) $\frac{8}{21}$

(c) $\frac{1}{9}$ (d) $\frac{2}{9}$

(iv) The probability of distributing both milk and white chocolates is

(a) $\frac{6}{17}$ (b) $\frac{3}{17}$

(c) $\frac{6}{11}$ (d) $\frac{5}{11}$

(v) The probability of distributing all the chocolates is

(a) 0 (b) 1

(c) $\frac{1}{2}$ (d) $\frac{3}{4}$

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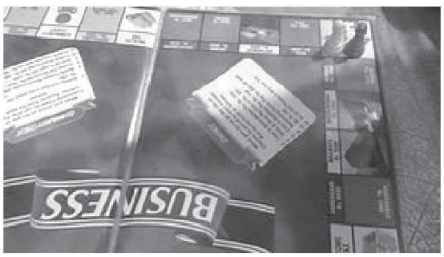
64. Rahul and Ravi planned to play Business (board game) in which they were supposed to use two dice.

CBSE Question Bank



(i) Ravi got first chance to roll the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is 8?

(a) $\frac{1}{26}$ (b) $\frac{5}{36}$

(c) $\frac{1}{18}$ (d) 0

(ii) Rahul got next chance. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is 13?

(a) 1 (b) $\frac{5}{36}$

(c) $\frac{1}{18}$ (d) 0

(iii) Now it was Ravi's turn. He rolled the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is less than or equal to 12 ?

(a) 1 (b) $\frac{5}{36}$

(c) $\frac{1}{18}$ (d) 0

(iv) Rahul got next chance. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is equal to 7 ?

(a) $\frac{5}{9}$ (b) $\frac{5}{36}$

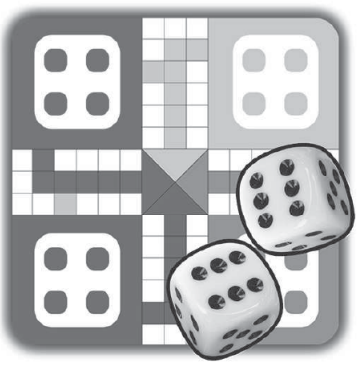
(c) $\frac{1}{6}$ (d) 0

(v) Now it was Ravi's turn. He rolled the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is greater than 8 ?

(a) 1 (b) $\frac{5}{36}$

(c) $\frac{1}{18}$ (d) $\frac{5}{18}$

65. Two friends were playing a game with two dice. Pratima has a blue dice and Riya has a grey dice. They decided to throw both the dice simultaneously and note down all the possible outcomes appearing on the top of both the dice.



On the basis of above information, answer the following questions.

(i) The total number of possible outcomes they noted, is

(a) 24 (b) 36

(c) 18 (d) 6

(ii) The probability of getting the sum of numbers on two dice is 19 is

(a) 1 (b) $\frac{5}{36}$

(c) 0 (d) $\frac{18}{35}$

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(iii) The probability that both the numbers are odd numbers, is

(a) 0 (b) $\frac{1}{2}$

(c) $\frac{1}{4}$ (d) $\frac{1}{8}$

(iv) The probability that sum of two numbers is even is

(a) 1 (b) $\frac{1}{2}$

(c) $\frac{1}{4}$ (d) $\frac{1}{8}$

(v) The probability that difference between numbers is one, is

(a) $\frac{2}{21}$ (b) $\frac{3}{4}$

(c) $\frac{5}{16}$ (d) $\frac{5}{18}$

66. In a toy shop, there is a spinning wheel for their customers. The spinning wheel has different types of prizes as shown in figure. A customer can only spin the wheel after buying something from the shop.

On the basis of above information, answer the following questions.

(i) If Mr. Mehta spins the wheel, then the probability that he gets 15% discount is

(a) 0 (b) $\frac{1}{10}$

(c) $\frac{1}{5}$ (d) $\frac{1}{4}$

(ii) If Rita spins the wheel, then the probability of getting video game

(a) $\frac{1}{10}$ (b) $\frac{1}{5}$

(c) $\frac{3}{10}$ (d) $\frac{2}{5}$

(iii) Deepak spins the wheel. The probability that the wheel stops at basket ball is

(a) $\frac{1}{10}$ (b) $\frac{1}{5}$

(c) $\frac{3}{10}$ (d) $\frac{2}{5}$

(iv) The probability that one customer wins 75% discount is

(a) $\frac{1}{10}$ (b) $\frac{1}{5}$

(c) $\frac{3}{10}$ (d) $\frac{2}{5}$

(v) The probability of getting a Lucky coupon

(a) $\frac{1}{10}$ (b) $\frac{1}{5}$

(c) $\frac{3}{10}$ (d) $\frac{2}{5}$

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ANSWERS

Multiple Choice Questions

1. (d)	2. (a)	3. (a)	4. (b)	5. (c)	6. (d)	7. (b)	8. (d)	9. (a)	10. (a)
11. (d)	12. (d)	13. (b)	14. (b)	15. (c)	16. (d)	17. (b)	18. (d)	19. (b)	20. (b)
21. (d)	22. (a)	23. (a)	24. (d)	25. (b)	26. (d)	27. (a)	28. (b)	29. (d)	30. (d)
31. (a)	32. (a)	33. (d)	34. (d)	35. (b)	36. (c)	37. (a)	38. (c)	39. (d)	40. (b)
41. (c)	42. (d)	43. (c)	44. (b)	45. (b)	46. (a)	47. (b)	48. (b)	49. (b)	50. (a)

Assertion-Reasoning MCQs

51. (a)	52. (a)	53. (b)	54. (b)	55. (a)	56. (a)	57. (d)	58. (c)	59. (d)	60. (d)

Case Based MCQs

61. (i) - (a); (ii) - (d); (iii) - (b); (iv) - (d); (v) - (d)
62. (i) - (c); (ii) - (b); (iii) - (a); (iv) - (b); (v) - (a)
63. (i) - (c); (ii) - (d); (iii) - (a); (iv) - (c); (v) - (b)
64. (i) - (b); (ii) - (d); (iii) - (a); (iv) - (c); (v) - (d)
65. (i) - (b); (ii) - (c); (iii) - (c); (iv) - (b); (v) - (d)
66. (i) - (c); (ii) - (a); (iii) - (b); (iv) - (a); (v) - (d)

SOLUTIONS

1. The experiments which when repeated under identical conditions produce the same results or outcomes are known as deterministic experiments.
2. An outcome of a random experiment is known as elementary event.
3. (True) An event to a random experiment is a compound even if it is obtained by combining two or more elementary events associated to the random experiments.
4. (False) The sum of probabilities of all the outcomes of an experiment is equal to one.
5. The probability p of any event must be greater than or equal to 0.

   $$0 \le p \le 1$$

   Since, 1 is the maximum limit all probabilities must be less than or equal to 1.

   The sum of the probabilities of all the elementary events of an experiment is 1.
6. Given, $P(E) + P(\overline{E}) = q$

   We know that, total probability of possible outcomes is 1

   $$P(\overline{E}) = 1 - P(E)$$

   The value of $q = 1$
7. $P(E) = 0.05$

   $P(\overline{E}) = 1 - P(E)$

   $= 1 - 0.05 = 0.95$
8. If an event is not occuring then it has the probability of occurence as 0.
9. Probability of any event cannot be more than 1. 1.5 cannot be the probability of any event.
10. The probability of any event which is very unlikely to happen is closest to zero and form the given options 0.0001 is closest to zero.
11. Number of all possible outcomes = 9

    Numbers favourable to $|x| < 1$ are 0.

    $\therefore$ Number of favourable outcomes = 1

    So, required probability $= \frac{1}{9}$
12. Total number of letters in the word 'MATHEMATICS' = 11

    Number of vowels = 4

    i.e., (A, E, A,I)

    $\therefore$ Required probability $= \frac{4}{11}$

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13. There are 365 days in an ordinary year.
Number of full weeks in 365 days
$= 52\ [365 = 7 \times 52 + 1]$
The remaining 1 day can be any one of the seven week days.
Thus, the probability of this day to be
Sunday $= \frac{1}{7}$

14. There are 13 letters in the word 'ASSASSINATION' out of which one letter can be chosen in 13 ways.
$\therefore$ Total number of outcomes $= 13$
There are 6 vowels in the word 'ASSASSINATION'. So, there are 6 ways of selecting a vowel.
$\therefore$ Required probability $= \frac{6}{13}$
But given that,
$$\frac{6}{2x+1} = \frac{6}{13}$$
$\Rightarrow \quad 2x + 1 = 13$
$\Rightarrow \quad 2x = 12$
$\Rightarrow \quad x = 6$

15. Sample space $= \{HH, HT, TH, TT\}$
Number of total possible outcomes $= 4$
Number of favourable outcomes $= 1$
$$P(E) = \frac{1}{4}$$

16. If two unbiased coins are tossed simultaneously we obtain possible outcomes.
HH, HT, TH, TT
$\therefore$ Total number of outcomes $= 4$
No head is obtained if the event TT occurs.
$\therefore$ Number of favourable outcomes $= 1$
$\therefore$ Required probality $= \frac{1}{4}$
But, given probability $= \frac{A}{B}$
So, $A = 1$ and $B = 4$
Therefore, $(A + B)^2 = (1 + 4)^2$
$= (5)^2 = 25$

17. Total number of outcomes $= 2 \times 6 = 12$
Favourable outcomes are $\{T2, T3, T5\}$
i.e. 3 in number.
$\therefore$ Required probability $= \frac{3}{12} = \frac{1}{4}$

18. Three coins tossed $= \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$
(a) P (exactly 2 heads) $= 3/8$
(b) P (atleast one head) $= 7/8$
(c) P (atmost 2 tails) $= 7/8$
(d) P (exactly one tail) $= 3/8$

19. Three coins tossed together possible outcomes.
$\{HHH, HHT, HTH, THH, TTT, TTH, THT, HTT\}$.
Number of two head together $= 3$
Probability of getting two head $= \frac{3}{8}$

20. No, the outcomes are not equally likely, because outcome 'no head' means 'TTT'; and outcome 'one head' means THT, HTT, TTH and so on $P(TTT) = \frac{1}{8}$, which is not equal to $\frac{1}{4}$

21. Number of prime number (2, 3 and 5) = 3
Number of total outcomes = 6
$$P(E) = \frac{3}{6} = \frac{1}{2}$$

22. Total number less than 7 on a dice are 6 i.e. 1, 2, 3, 4, 5, 6
Total possible outcomes = 6
$$P(E) = \frac{6}{6} = 1$$

23. Number of all possible outcomes (1, 2, 3, 4, 5, 6) = 6
Number of favourable outcome = 1 (i.e., number 5)
$\therefore$ Required Probability $= \frac{1}{6}$

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24. A fair dice has 6 faces and each face have a unique digit from 1 to 6.

Now, favourable case to get a number (x) between 1 to 6 = 6 and total case = 6

Then, probability = $\frac{\text{Favourable case}}{\text{Total case}}$

$$P(E) = \frac{6}{6} = 1$$

25. Total number of possible outcomes

$$= 6 \times 6 = 36$$

Favourable outcomes = (1, 1), (2, 2), (3, 3) (4, 4), (5, 5) and (6, 6).

Total number of favourable outcomes = 6

$$P(E) = \frac{6}{36} = \frac{1}{6}$$

26. Here, $S = \{(3,1), (2,2), (1,3), (6,2), (5,3), (4,4), (3, 5), (2, 6), (6, 6)\}$.

Total number of possible outcomes = 36

Number of favourable outcomes = 9

$\therefore P$ (sum of two numbers will be multiple of 4)

$$= \frac{9}{36} = \frac{1}{4}$$

27. Total number of elementary outcomes = 36

Favourable outcomes are (4, 3), (3, 4), (6, 2), (2, 6) i.e. 4 in number.

$\therefore$ Required probability $= \frac{4}{36} = \frac{1}{9}$

28. Total favourable outcomes are (6, 1), (6, 2), (5, 2), (5, 3), (4, 3), (4, 4), (3, 4), (3, 5), (2, 5), (2, 6), (1, 6).

P (sum is greater than 6 but less than 9)

$$= \frac{11}{36}$$

29. Two dice are thrown simultaneously

Total number of outcomes = 36

Doublet = {(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)}

Total of atleast 10 = {(4, 6), (5, 5), (6, 4), (5, 6), (6, 5), (6, 6)}

Total is perfect square = {(1, 3), (2, 2), (3, 1), (3, 6), (4, 5), (5, 4), (6, 3)}

(a) P (doublet) = 6 / 36 = 1 / 6,

P (not doublet) $= 1 - \frac{1}{6} = \frac{5}{6}$

(b) P (getting total of atleast 10)

= 6 / 36 = 1 / 6

(c) P (perfect square) = 7 / 36,

P (not a perfect square) $= 1 - \frac{7}{36} = \frac{29}{36}$

30. Total number of outcomes $= 6 \times 6 \times 6 = 216$

Number of favourable outcomes

$$= 6 \times 5 \times 4 = 120$$

$\therefore$ Required probability $= \frac{120}{216} = \frac{5}{9}$

31. Total face cards (king, queen and jack)

$$= 3 \times 4 = 12$$

P (Face card) $= \frac{\text{Total Face Cards}}{\text{Total cards}}$

$$= \frac{12}{52} = \frac{3}{13}$$

32. In a deck of 52 cards, there are 12 face cards i.e., 6 red and 6 black cards.

$\therefore$ So, probability of getting a red face card

$$= \frac{6}{52} = \frac{3}{26}$$

33. In a deck of 52 cards, there are 13 cards of heart and 1 is ace of heart.

$\therefore$ The number of outcomes favourable to $E = 51$

34. Total number of cards in one deck of cards, $n(S) = 52$

Let E_1 = Event of getting a king of red colour

$\therefore \quad n(E_1) = 2$

($\because$ In a deck of cards, 26 cards are red and 26 cards are black. There are four kings in a deck in which two are red and two are black)

Probability of getting a king of red colour

$$= \frac{n(E_1)}{n(S)} = \frac{2}{52} = \frac{1}{26}$$

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35. Total number of cards = 52

Total number of diamond cards = 13

(a) P (diamond cards) = 13 / 52 = 1 / 4

(b) P (an ace of heart) = 1 / 52

(c) P (not heart) $= 1 - \frac{1}{4} = \frac{3}{4}$

(d) P (king or queen) $= \frac{4}{52} + \frac{4}{52} = \frac{8}{52} = \frac{2}{13}$

36. Total number of outcomes = 52

Number of favourable outcomes = 2

$P(E) = \frac{2}{52} = \frac{1}{26}$

37. Number of red balls = 5

Let the number of blue balls in the bag $= x$

$\therefore$ Total number of balls $= x + 5$

$\therefore$ Probability of red ball $= \frac{5}{5+x}$

and probability (blue balls) $= \frac{x}{5+x}$

According to question, $\frac{x}{5+x} = 2 \times \frac{5}{5+x}$

$$x = 10$$

38. Let there be x blue balls in the bag.

$\therefore$ Total number of balls in the bag $= (8 + x)$

and Now, P_1 = Probability of drawing a blue ball $= \frac{x}{8+x}$

and P_2 = Probability of drawing a red ball $= \frac{8}{8+x}$

It is given that,

$$P_1 = 3P_2$$

$$\Rightarrow \quad \frac{x}{8+x} = 3 \times \frac{8}{(8+x)}$$

$$\Rightarrow \quad \frac{x}{8+x} = \frac{24}{8+x}$$

$$\Rightarrow \quad x = 24$$

Hence, there are 24 blue balls in the bag.

39. Total number of balls in a bag = 3 + 5

$\therefore$ Total number of possible outcomes is 15.

The number of favourable outcomes of drawing non-black ball is 10.

$\therefore$ Required probability

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{10}{15} = \frac{2}{3}$$

40. Let the number of defective bulbs $= x$

Probability of getting a defective bulb $= \frac{x}{500}$

According to question, $\frac{x}{500} = 0.290$

$\Rightarrow x = 0.290 \times 500 = 145$

41. Prime number between 1 to 100

= 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

31, 37, 41, 43, 47, 53, 59, 61

67, 71, 73, 79, 83, 89, 97 = 25

Total outcomes = 100

$$P(E) = \frac{25}{100} = \frac{1}{4}$$

42. Clearly, number x can take any one of the five given values.

So, total number of possible outcomes = 5.

We observe that $x^2 < 2$ when x takes any one of the following three values – 1, 0 and 1.

So, favourable number of elementary events = 3

Hence, $P(x^2 < 2) = \frac{3}{5}$

43. Number x can be selected in three ways and corresponding to each such way there are three ways of selecting number y.

Therefore, two numbers can be selected in 9 ways as listed below

(1, 1), (1,4), (1,9), (2, 1), (2, 4), (2,9), (3,1), (3,4), (3,9)

So, total numbers of possible outcomes = 9

The product xy will be less than 9, if x and y are chosen in one of the following ways

(1, 1), (1,4), (2, 1), (2, 4), (3,1)

$\therefore$ Favourable number of elementary events = 5

Hence, required probability $= \frac{5}{9}$

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44. As given that a number other than six has appeared.

So, the man repeating it to be six means he is speaking false. Effectively the question is asking the probability

P (He will lie) $= 1 - \frac{3}{4} = \frac{1}{4}$

Hence, probability that he reports it is a six is $\frac{1}{4}$

45. Total number of envelopes in the box

$= 1000$

Number of envelopes containing cash prize

$= 10 + 100 + 200 = 310$

Number of envelopes containing no cash prize $= 1000 - 310 = 690$

$\therefore$ Required probability $= \frac{690}{1000} = 0.69$

46. Out of 20 tickets numbered from 1 to 20, one can be chosen in 20 ways. So, total number of possible outcomes associated with the given random experiment is 20. Out of 20 tickets numbered 1 to 20, tickets bearing numbers which are multiple of 3 or 7 bear numbers 3, 6, 7, 9, 12, 14, 15 and 18.

$\therefore$ Favourable number of elementary events $= 8$

Hence, required probability $= \frac{8}{20} = \frac{2}{5}$

47. There are $14 = (5 + 9)$ fish out of which one can be chosen in 14 ways.

$\therefore$ Total numbers of possible outcomes $= 14$

There are 5 male fish out of which one male fish can be chosen in 5 ways.

$\therefore$ Favourable number of elementary events $= 5$

Hence, required probability $= \frac{5}{14}$

48. Let boys be B and girl be G

Outcomes can be BBB, GGG, BBG, BGB, GBB, GGB, GBG, BGG

Then, probability of 3 girls $= \frac{1}{8}$

Probability of 0 girls $= \frac{1}{8}$

Probability of 2 girls $= \frac{3}{8}$

Probability of 1 girls $= \frac{3}{8}$

49. (A) Probability of getting number 5 in throwing a dice $= \frac{1}{6}$

(B) Probability of getting three heads in a single throw of coin $= 0$

(C) Probability of getting the sum of the number as 7 [(3, 4), (4, 3), (1, 6), (6, 1), (2, 5), (5, 2)] when two dice are thrown $= \frac{6}{36}$

(D) Probability of occurence of two sure independent events is 1

50. (A) The probability of sure event is 1.

(B) The probability of impossible event is 0.

(C) Number of face cards in the pack of cards is $(3 \times 4) = 12$

(D) Probability of occuring 53 Sundays in a leap year is $\frac{2}{7}$.

51. We have, $P(E) = 0.4$,

where E = event of winning

$P(\text{Not } E) = 1 - P(E)$

$= 1 - 0.4 = 0.6$

Hence, both Assertion and Reason are true and Reason is the correct explanation of Assertion.

52. If the probability of an event is P, the probability of its complementary will be $1 - P$.

$\Rightarrow$ Sum of probability of an event and its complementary event $= 1$

$\Rightarrow \quad P(E) + P(\overline{E}) = 1$

$\Rightarrow \quad P(\overline{E}) = 1 - P(E)$

Hence, both Assertion and Reason are true and Reason is the correct explanation of Assertion.

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53. The probability of an event to be unlikely if the probability is near to '0'.

As 0.0001 is near to 0, the occuring of event is unlikely.

Now, we know probability of an event lies in between 0 and 1 because total possibilities will be always greater than equal to favourable outcomes.

Hence, both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

54. Probability of getting no tail when two coins tossed simultaneously i.e., both are head.

Probability of both head

$$= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Hence, both Assertion and Reason are true and Reason is not the correct explanation of Assertion.

55. As, dice is only have 6 number, it is impossible to show as 8-digit. Hence, only reason is true 8-digit never comes in dice.

Hence, both Assertion and Reason are true and Reason is the correct explanation of Assertion.

56. Now, where dice is thrown the possible outcomes are {1, 2, 3, 4, 5, 6}, Now, if you see the outcomes getting a number greater than "2" and less than "3" is impossible

∴ Probability is zero

The probability of an impossible event

= '0'

Hence, both Assertion and Reason are true and Reason is the correct explanation of Assertion.

57. When a die is thrown once, total possible outcomes = 6

and prime numbers in it are {2, 3, 5}

Total favourable outcomes = 3

Probability of getting a prime $= \frac{3}{6} = \frac{1}{2}$

Hence, Assertion is false but Reason is true.

58. When two dice are tossed.

Total possible outcomes = 36

$$n(S) = 36$$

and total favourable outcomes (doublet)

= {(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)}

$$n(E) = 6$$

∴ Probability $= \frac{6}{36} = \frac{1}{6}$ and

We know that, $0 \le P(E) \le 1$

Hence, Assertion is true but Reason is false.

59. Total possible outcomes = 15.

$$n(S) = 15$$

Total favourable numbers are 2, 4, 6, 8, 10, 12, 14.

$$E = \{2, 4, 6, 8, 10, 12, 14\}$$

$$n(E) = 7$$

∴ Probability of drawing an even number $= \frac{7}{15}$

Hence, Assertion is false but Reason is true

60. P (white marble) $= \frac{5}{5+2+4} = \frac{5}{11}$

P (not white marble) $= 1 - \frac{5}{11}$

$$= \frac{11-5}{11} = \frac{6}{11}$$

Hence, Assertion is false but Reason is true.

61. Total number of cards in one deck of cards is 52.

∴ Total number of outcomes = 52

(i) Let E_1 = Event of getting a king of red colour

∴ Number of outcomes favourable to $E_1 = 2$

[∵ there are four kings in a deck of playing cards out of which two are red and two are black]

Hence, probability of getting a king of red colour,

$$P(E_1) = \frac{2}{52} = \frac{1}{26}$$

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(ii) Let E_2 = Event of getting a face card

$\therefore$ Number of outcomes favourable to $E_2 = 12$

[$\because$ in a deck of cards, there are 12 face cards, namely 4 kings, 4 jacks, 4 queens]

Hence, probability of getting a face card,

$$P(E_2) = \frac{12}{52} = \frac{3}{13}$$

(iii) Let E_3 = Event of getting a jack of heart

$\therefore$ Number of outcomes favourable to $E_3 = 1$

[$\because$ there are four jack cards in a deck, namely 1 of heart, 1 of club,1 of spade and 1 of diamond]

Hence, probability of getting a jack of heart,

$$P(E_3) = \frac{1}{52}$$

(iv) Let E_4 = Event of getting a red face card.

$\therefore$ Number of outcomes favourable to $E_4 = 6$

[$\because$ in a deck of cards, there are 12 face cards out of which 6 are red cards]

Hence, probability of getting a red face card,

$$P(E_4) = \frac{6}{52} = \frac{3}{26}$$

(v) Let E_5 = Event of getting a spade

$\therefore$ Number of outcomes favourable to $E_5 = 13$ [$\because$ in a deck of cards, there are 13 spades, 13 clubs, 13 hearts and 13 diamonds]

Hence, probability of getting a spade,

$$P(E_5) = \frac{13}{52} = \frac{1}{4}$$

62. Total number of Puppet in Arcade game

$$= 50 + 40 + 30 + 60 = 180$$

(i) P (Picking a tiger) $= \frac{30}{180} = \frac{1}{6}$

(ii) P (Picking a monkey) $= \frac{60}{180} = \frac{1}{3}$

(iii) P (Picking a teddy bear) $= \frac{50}{180} = \frac{5}{18}$

(iv) P (Picking a monkey) $= \frac{1}{3}$

P (Not a monkey) $= 1 - \frac{1}{3} = \frac{2}{3}$

(v) P (Picking a pokemon) $= \frac{40}{180} = \frac{2}{9}$

P (Not a pokemons) $= 1 - \frac{2}{9} = \frac{7}{9}$

63. Since every student got one chocolate. So, number of chocolates teacher has is equal to the number of student in the class.

(i) Let number of milk chocolates teacher has = x

Probability of distributing milk chocolate $= \frac{1}{3}$

$$\Rightarrow \quad \frac{x}{66} = \frac{1}{3}$$

$$\therefore \quad x = \frac{66}{3} = 22$$

(ii) Let number of dark chocolates teacher has = y

Probability of distributing dark chocolates $= \frac{5}{11}$

$$\frac{y}{66} = \frac{5}{11}$$

$$y = 5 \times 6 = 30$$

(iii) Number of white chocolate teacher has $= 66 - (22 + 30)$

$= 66 - 52 = 14$

$\therefore$ Required probability $= \frac{14}{66} = \frac{7}{33}$

(iv) Total number of milk and white chocolates $= 22 + 14$

$\therefore$ Required probability $= \frac{36}{66} = \frac{18}{33} = \frac{6}{11}$

(v) Since all students gets one chocolate.

So total number of chocolates distributed = 66

$\therefore$ Required probability $= \frac{66}{66} = 1$

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64. Total number of out comes $= 6 \times 6 = 36$

(i) Let E_1 = Event of getting sum 8

$\therefore$ Number of favourable outcomes to $E_1 = 5$

i.e. (2, 6), (3, 5), (4, 4), (5, 3), (6, 2)

$\therefore \quad P(E_1) = \frac{5}{36}$

(ii) Let E_2 = Event of getting sum 13.

Since, we can't get sum more than 12.

$\therefore \quad P(E_2) = 0$

(iii) Let E_3 = Event of getting sum less than or equal to 12.

$\therefore$ Number of favourable outcomes = 36

As sum of all the out comes is less than or equal to 12

$\therefore \quad P(E_3) = \frac{36}{36} = 1$

(iv) Let E_4 = Event of getting sum 7.

$\therefore$ Number of favourable outcomes to $E_2 = 6$

i.e. (1, 6), (2, 5), (3, 4), (4, 3), (5, 2) (6, 1)

$\therefore \quad P(E_4) = \frac{6}{36} = \frac{1}{6}$

(v) Let E_5 = Event of getting sum greater than 8 i.e. getting sum equal to 8, 9, 10, 11, 12

$\therefore$ Favourable outcomes = 10 i.e. (3, 6), (4, 5), (5, 4), (6, 3), (4, 6), (5, 5), (6, 4), (5, 6), (6, 5), (6, 6).

$\therefore \quad P(E_5) = \frac{10}{36} = \frac{5}{18}$

65. (i) Total number of possible outcomes on throwing two dice simultaneously $= 6 \times 6 = 36$.

(ii) As we know, that maximum sum of numbers on two dice $= 6 + 6 = 12$

$\therefore$ It is an impossible event so required probability = 0

(iii) The probability that both the odd number

(1, 1), (1, 3), (1, 5), (3, 1), (3, 3), (3, 5), (5, 1), (5, 3), (5, 5)

Probability that both the odd number is $= \frac{9}{36} = \frac{1}{4}$

(iv) Let B the event that sum of two numbers is even

$\therefore$ B = (1, 1), (1, 3), (1, 5), (2, 2), (2, 4), (2, 6), (3, 1), (3, 3), (3, 5), (4, 2), (4, 4), (4, 6), (5, 1), (5, 3), (5, 5), (6, 2), (6, 4), (6, 6)

$n(B) = 18$

$p(B) = \frac{18}{36} = \frac{1}{2}$

(v) Let C be the event of difference between number is one.

(3, 2), (2, 1), (1, 2), (2, 3), (4, 3), (3, 4), (5, 4), (4, 5), (6, 5), (5, 6)

$n(C) = 10$

$p(C) = \frac{10}{36} = \frac{5}{18}$

66. Total number of possible outcomes = 10

(i) Total number of 15% discount event = 2

P(getting 15% discount) $= \frac{2}{10} = \frac{1}{5}$

(ii) P(getting a video game) $= \frac{1}{10}$

(iii) P(getting a basket ball) $= \frac{2}{10} = \frac{1}{5}$

(iv) P(getting a 75% discount) $= \frac{1}{10}$

(v) P(getting a lucky coupon) $= \frac{4}{10} = \frac{2}{5}$

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PRACTICE PAPER 1

Mathematics Class 10th (Term I)

Instructions

1. This paper has 40 questions.
2. All questions are compulsory.
3. Each question carry 1 mark.
4. Answer the questions as per given instructions.

Time : 90 Minutes **Max. Marks : 40**

Multiple Choice Questions

1. The rational form of $0.2\overline{54}$ is in the form of $\frac{p}{q}$, then $(p+q)$ is

(a) 14 (b) 55
(c) 69 (d) 79

2. If two positive integers p and q can be expressed as $p = ab^2$ and $q = a^3b$; where a, b being prime numbers, then LCM (p, q) is equal to

(a) ab (b) a^2b^2
(c) a^3b^2 (d) a^3b^3

3. After how many decimal points, number $\frac{5}{1600}$ will terminate?

(a) 5 (b) 6
(c) 7 (d) 8

4. Thee smallest prime number is

(a) 1 (b) 2
(c) 3 (d) 0

5. If the square of difference of the zeroes of the quadratic polynomial $x^2 + px + 45$ is equal to 144, then the value of p is

(a) ± 9 (b) ± 12
(c) ± 15 (d) ± 18

6. A quadratic polynomial, whose zeroes are -3 and 4, is

(a) $x^2 - x + 12$
(b) $x^2 + x + 12$
(c) $\frac{x^2}{2} - \frac{x}{2} - 6$
(d) $2x^2 + 2x - 24$

7. The degree of the polynomial $\frac{t^8 - 3t^7 + 2t^5 - 6t^2}{t^2}$ is

(a) 4 (b) 6
(c) 3 (d) 2

8. If 2 and 3 are zeroes of polynomial $3x^2 - 2kx + 2m$, then the values of k and m are

(a) $9, \frac{7}{2}$ (b) 7, 9
(c) $9, \frac{15}{2}$ (d) None of these

9. In the given figure, $DE \| BC$. If $AD = 3$ cm, $DB = 4$ cm and $AE = 6$ cm. Then, the value of EC is

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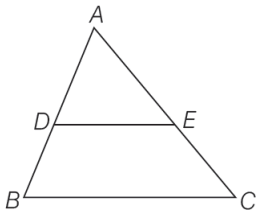


(a) 8 cm (b) 9 cm
(c) 7 cm (d) 5 cm

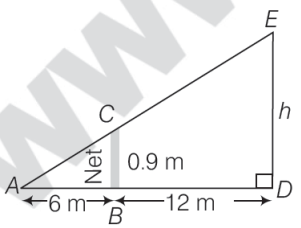
10. In ΔABC and ΔDEF, $\angle B = \angle E$, $\angle F = \angle C$ and $AB = 3DE$, then both triangles will be

(a) congruent but not similar
(b) similar but not congruent
(c) neither congruent nor similar
(d) both congruent and similar

11. In ΔABC, D and E are points on the sides AB and AC respectively, such that $DE \parallel BC$. If $AD = 4x - 3$, $AE = 8x - 7$, $BD = 3x - 1$ and $CE = 5x - 3$, then the value of x is

(a) 1 (b) 2
(c) 3 (d) 4

12. The value of the height 'h' in the adjoining figure, at which the tennis ball must be hit, so that it will just pass over the net and land 6 m away from the base of the net.



(a) 0.18 m (b) 10.8 cm
(c) 2.7 m (d) None of these

13. If $\sin\theta = \operatorname{cosec}\theta$ and $0 \le \theta \le \pi$, then the value of θ is

(a) π (b) $\frac{\pi}{2}$
(c) $\frac{\pi}{4}$ (d) $0°$

14. If $\sin\theta = \frac{a}{b}$, then $\cos\theta$ is equal to

(a) $\frac{b}{\sqrt{b^2 - a^2}}$ (b) $\frac{b}{a}$
(c) $\frac{\sqrt{b^2 - a^2}}{b}$ (d) $\frac{a}{\sqrt{b^2 - a^2}}$

15. If $\tan\theta + \sin\theta = m$ and $\tan\theta - \sin\theta = n$, then $m^2 - n^2$ is equal to

(a) $\sqrt{mn}$ (b) $\sqrt{\frac{m}{n}}$
(c) $4\sqrt{mn}$ (d) None of these

16. If $\sin A = \frac{1}{2}$, then the value of $\cot A$ is

(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$
(c) $\frac{\sqrt{3}}{2}$ (d) 1

17. The probability that a non-leap year selected at random will contains 53 Sunday is

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$
(c) $\frac{3}{7}$ (d) $\frac{5}{7}$

18. Which of the following cannot be the probability of an event?

(a) $\frac{2}{3}$ (b) -1.5
(c) 15% (d) 0.7

19. The probability of getting a bad egg in a lot of 400 is 0.035. The number of bad eggs in the lot is

(a) 7 (b) 14
(c) 21 (d) 28

20. If $P(E) = 0.05$ then, the probability of 'not E' is

(a) 0.05 (b) 1.05
(c) 0.85 (d) 0.95

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Assertion-Reasoning MCQs

For question numbers 21 to 25, two statements are given-one labelled **Assertion** (A) and the other labelled **Reason** (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is true.

21. **Assertion** If LCM $\{p, q\} = 30$ HCF $\{p, q\} = 5$, then $p \cdot q = 150$.

Reason LCM of $(a, b) \times$ HCF of $(a, b) = a \cdot b$.

22. **Assertion** $x^2 + 4x + 5$ has two zeroes.

Reason A quadratic polynomial can have atmost two zeroes.

23. **Assertion** In a rhombus of side 15 cm, one of the diagonals is 20 cm long. The lenght of the $10\sqrt{6}$ cm.

Reason The sum of the squares of the sides of a rhombus is equal to the sum of the squares of its diagonals.

24. **Assertion** In a right angled triangle, if $\cos\theta = \frac{1}{2}$ and $\sin\theta = \frac{\sqrt{3}}{2}$, then $\tan\theta = \sqrt{3}$.

Reason $\tan\theta = \frac{\sin\theta}{\cos\theta}$

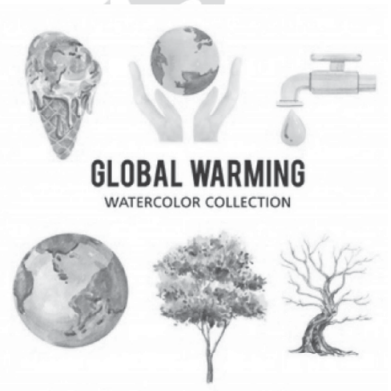
25. **Assertion** If a die is thrown, the probability of getting a number less than 3 and greater than 2 is zero.

Reason Probability of an impossible event is zero.

Case Based MCQs

Direction Answer the questions from 26-30 based on the following case.

Student of class-10 undertake to work for the campaign "STOP GLOBAL WARMING". Team A took the region under the coordinates $(2, 4)$, $(5, y)$, $(x, 8)$ and $(4, 7)$ and Team B took the region under the coordinates $\left(-1, \frac{3}{2}\right)$, $(2, 4)$, $\left(5, \frac{3}{2}\right)$ and $(2, -1)$.



Based on the above information, answer the following questions.

26. If region covered by Team A forms a parallelogram, where the coordinates are taken in the given order, then

(a) $x = 8, y = 4$ (b) $x = 7, y = 5$
(c) $x = 2, y = 4$ (d) $x = 4, y = 2$

27. Perimeter of the region covered by Team A is

(a) $2\sqrt{10}$ units (b) $\sqrt{13}$ units
(c) $(\sqrt{10} + \sqrt{13})$ units (d) None of these

28. If the coordinates of region covered by Team B, taken in the same order forms a quadrilateral, then the length of each of its diagonals is

(a) $4\sqrt{2}$ units, $2\sqrt{2}$ units (b) $6\sqrt{2}$ units, $\sqrt{2}$ units
(c) $3\sqrt{2}$ units, $2\sqrt{2}$ units (d) None of these

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29. If region covered by Team B forms a rhombus, where the coordinates are taken in given order, then the perimeter of this region is

(a) $\sqrt{61}$ units
(b) $2\sqrt{61}$ units
(c) $3\sqrt{61}$ units
(d) $4\sqrt{61}$ units

30. The coordinates of the point which divides the line joining the points $P(x_1, y_1)$ and $Q(x_2, y_2)$ internally in the ratio $m : n$ is

(a) $\left(\frac{mx_2 + ny_2}{m+n}, \frac{mx_1 + ny_1}{m+n}\right)$
(b) $\left(\frac{mx_1 + ny_1}{m+n}, \frac{mx_2 + ny_2}{m+n}\right)$
(c) $\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$
(d) None of the above

Direction Answer the questions from 31-35 based on the following case.

From a grocery shop Priyanka bought 4 kg of rice and 6 kg of flour for ₹1700 and Charu bought 6 kg of rice and 4 kg of flour for ₹1800. Consider the price of one kg of rice and that of one kg of flour be ₹x and ₹y respectively.

Based on the above information, answer the following questions.

31. Represent the situation faced by Priyanka, algebraically.

(a) $4x + 6y = 1700$
(b) $6x + 4y = 1700$
(c) $4x - 6y = 850$
(d) $6x - 4y = 850$

32. Represent the situation faced by Charu, algebraically.

(a) $4x + 6y = 900$
(b) $6x + 4y = 1800$
(c) $2x - 3y = 900$
(d) $3x - 2y = 900$

33. The price of one kg of flour is

(a) ₹ 80 (b) ₹ 100
(c) ₹ 150 (d) ₹ 200

34. The price of one kg of rice is

(a) ₹ 80 (b) ₹ 100
(c) ₹ 150 (d) ₹ 200

35. Ths system of linear equations represented by above situation, has

(a) unique solution
(b) no solution
(c) infinitely many solutions
(d) None of the above

Direction Answer the questions from 36-40 based on the following case.

Shivam has his hostel located at P and his school located at Q. Shivam drives his motorbike three day in a week and rides his car in the remaining 3 days,
to go to his school and back to hostel. POQ is a sector of a circle with centre O, central angle 60° and radius 4.2 km. Path POQ is the route for driving by motorbike and path PRQ is for car only.

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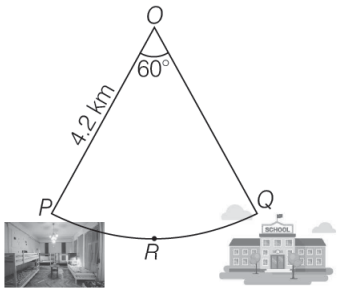

36. The total distance travelled by Shivam through the motorbike in a week to go to school is

(a) 50.4 km (b) 55 km
(c) 56.4 km (d) 48 km

37. The total distance travelled by Shivam through the car in a week to go to school is

(a) 30.17 km
(b) 26.4 km
(c) 28 km
(d) 29.4 km

38. The area of sector POQ is

(a) 17.88 km^2
(b) 18.24 km^2
(c) 19.24 km^2
(d) 12.06 km^2

39. If the cost of fuel for the motorbike is ₹ 10 per km, then the total cost of fuel used in a week in going school is

(a) ₹ 520
(b) ₹ 500
(c) ₹ 480
(d) ₹ 600

40. If the angle of sector changed from 60° to 90°, then the total length of the available paths is

(a) 18 km
(b) 17.14 km
(c) 14 km
(d) None of the above

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PRACTICE PAPER 1

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PRACTICE PAPER 2

Mathematics Class 10th (Term I)

Instructions

1. This paper has 40 questions.
2. All questions are compulsory.
3. Each question carry 1 mark.
4. Answer the questions as per given instructions.

Time : 90 Minutes **Max. Marks : 40**

Multiple Choice Questions

1. The rational number of the form $\frac{p}{q}$, $q \neq 0$. p and q are positive integer, which represents $0.1\overline{34}$ i.e., (0.1343434 ....)

(a) $\frac{134}{999}$ (b) $\frac{134}{990}$
(c) $\frac{133}{999}$ (d) $\frac{133}{990}$

2. Product of two co-prime numbers is 117. Their LCM should be

(a) 1
(b) 118
(c) equal to their HCF
(d) lies between 115 to 120

3. The diameter of a wheel is 40 cm. The number of revolutions it will make in covering 176 m is

(a) 140 (b) 150
(c) 160 (d) 166

4. A steel wire, when bent in the form of a square, enclosed an area of 121 cm^2. Some wire is bent in the form of a circle. The area of the circle is

(a) 154 cm^2 (b) 145 cm^2
(c) 451 cm^2 (d) 541 cm^2

5. For what value of k, do the equations $3x - y + 8 = 0$ and $6x - ky = -16$ represents coincident lines?

(a) $\frac{1}{2}$ (b) $-\frac{1}{2}$
(c) 2 (d) -2

6. The sum of the digits of a two-digit number is 9. If 27 is added to it. The digit of the number get reversed. The number is

(a) 25
(b) 72
(c) 63
(d) 36

7. If $\tan\theta = \frac{x\sin\phi}{1 - x\cos\phi}$ and, $\tan\phi = \frac{y\sin\theta}{1 - y\cos\theta}$, then $\frac{x}{y}$ is equal to

(a) $\frac{\sin\phi}{\sin\theta}$ (b) $\frac{\sin\theta}{\sin\phi}$
(c) $\frac{\sin\theta}{1-\cos\theta}$ (d) $\frac{\sin\theta}{1-\cos\phi}$

8. If $\operatorname{cosec}\theta - \sin\theta = l$ and $\sec\theta - \cos\theta = m$, then $l^2 m^2 (l^2 + m^2 + 3) =$

(a) 0 (b) 1
(c) 2 (d) 3

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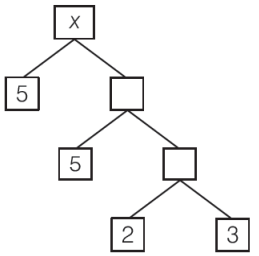
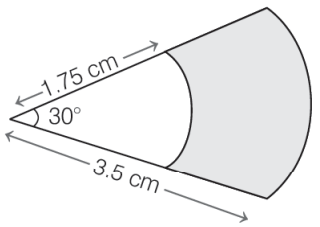
9. In the factor tree, the composite number x is



(a) 140 (b) 30
(c) 150 (d) None of these

10. In the given figure, sectors of two concentric circles of radii 3.5 cm and 1.75 cm are shown, then the area of the shaded region is



(a) $\frac{77}{16}$ cm^2 (b) $\frac{77}{32}$ cm^2
(c) $\frac{77}{48}$ cm^2 (d) $\frac{77}{96}$ cm^2

11. $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}$ is equal to

(a) $1+\sec\theta\,\text{cosec}\,\theta$
(b) $\sec\theta\,\text{cosec}\,\theta$
(c) $1-\sec\theta\,\text{cosec}\,\theta$
(d) $1-\sec^2\theta\,\text{cosec}^2\theta$

12. If the centroid of the triangle formed by the points (a, b), (b, c) and (c, a) is at the origin, then $a^3+b^3+c^3$ is equal to

(a) abc (b) 0
(c) $a+b+c$ (d) $3abc$

13. If $\frac{7}{625}$ is a rational number, then the decimal expansion of it, which terminates is

(a) 0.0112 (b) 0.112
(c) 0.0121 (d) None of these

14. If $5\cot\theta = 3$, then $\frac{5\sin\theta-3\cos\theta}{4\sin\theta+3\cos\theta}$ is equal to

(a) $\frac{11}{18}$ (b) $\frac{16}{29}$
(c) $\frac{14}{27}$ (d) None of these

15. Y-axis divides the line joining the points $P(-4, 2)$ and $Q(8, 3)$ in the ratio

(a) 3 : 1 (b) 1 : 3
(c) 2 : 1 (d) 1 : 2

16. If the pair of linear equations $x-y-k=0$ and $6x-2y-3=0$ represents an infinite solution, then the value of k is

(a) $k=1$ (b) $k=2$
(c) $k=0$ (d) No value of k

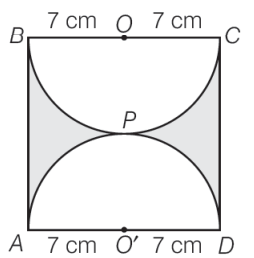
17. The values of x and y in the pair of equation $2x-5y=12$ and $7x+5y=15$ is

(a) $x=3, y=-\frac{5}{3}$ (b) $x=3, y=-\frac{6}{5}$
(c) $x=4, y=-\frac{6}{5}$ (d) None of these

18. If $A(5, 3)$, $B(11, -5)$ and $P(12, y)$ are the vertices of a right triangle, right angles at P, then y is equal to

(a) $-2, 4$ (b) $-2, -4$
(c) $2, -4$ (d) $2, 4$

19. In the given figure, $ABCD$ is a square of side 14 cm and APD and BPC are semi-circles. The area of the shaded region is



(a) 42 cm^2 (b) 40 cm^2
(c) 43 cm^2 (d) 44 cm^2

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20. The points (a, b), (a_1, b_1) and $(a - a_1, b - b_1)$ are collinear, if

(a) $ab = a_1b_1$ (b) $ab_1 = a_1b$
(c) $a = b$ (d) $a_1 = b_1$

Assertion-Reasoning MCQs

For question numbers 21 to 25, two statements are given-one labelled **Assertion** (A) and the other labelled **Reason** (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is true.

21. **Assertion** The LCM and HCF of two numbers is 180 and 6 respectively and if one number is 30, then the other number is 36.

Reason HCF $\times$ LCM = Product of two numbers.

22. **Assertion** The pair of equations $x + 2y + 5 = 0$ and $-4x - 8y + 1 = 0$ have no solutions.

Reason If a pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ represents intersecting lines, then $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

23. **Assertion** The coordinates of the points which divide the line segment joining $A(4, -1)$ and $B(-2, -3)$ into three equal parts are $\left(2, \frac{-5}{3}\right)$ and $\left(0, \frac{-7}{3}\right)$.

Reason The points which divide AB in the ratio 1 : 3 and 3 : 1 are called points of trisection of AB.

24. **Assertion** In a right angled triangle, if $\tan\theta = \frac{3}{4}$, the greatest side of the triangle is 5 units.

Reason $(\text{greatest side})^2 = (\text{hypotenuse})^2$
$= (\text{perpendicular})^2 + (\text{base})^2$

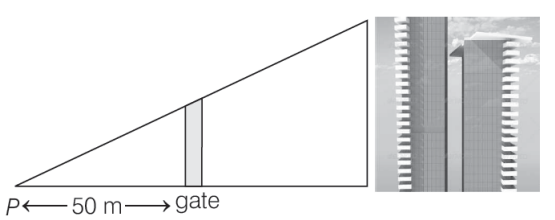
25. **Assertion** If a wire of length 22 cm is bent in the shape of a circle, then area of the circle so formed is 40 cm^2.

Reason Circumference of the circle = length of the wire.

Case Based MCQs

Direction Answer the questions from 26-30 based on the following case.

Bhoomika visited to her elder sister's house. From a point P, where Bhoomika was standing, society's gate and building come in a straight line as shown in the figure.



Based on the above information, answer the following questions.

26. Which similarity criteria can be seen in this case, if gate and building are considered in a straight line?

(a) AA (b) SAS
(c) SSS (d) ASA

27. If the distance between Bhoomika and the gate is twice as much as the height of the gate, then the height of the gate is

(a) 40 m
(b) 12.5 m
(c) 15 m
(d) 25 m

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28. If the distance of Bhoomika from the building is twelve times the height of the gate, then the ratio of the heights of gate and building is

(a) 3 : 1 (b) 1 : 4
(c) 1 : 6 (d) 2 : 3

29. What is the ratio of the distance between Bhoomika and top of the gate to the distance between the top of the gate and building?

(a) 1 : 5
(b) 1 : 6
(c) 2 : 5
(d) Cannot be determined

30. What is the height of the building?

(a) 150 m (b) 75 m
(c) 120 m (d) 30 m

Direction Answer the questions from 31-35 based on the following case.

Quadratic polynomial can be used to model the shape of many architectural structures in the world. One of the example in Berlin is shown here.

Based on the above information, answer the following questions.

31. If the Arch is represented by $\frac{x^2}{2} - \frac{x}{2} - 6 = 0$, then its zeroes are

(a) 1, – 3 (b) – 1, 2
(c) – 3, 4 (d) 3, – 4

32. The zeroes of the polynomial are the points where its graph

(a) intersect the X-axis
(b) intersect the Y-axis
(c) intersect either of the axes
(d) Cannot say

33. The quadratic polynomial whose sum of zeroes is 0 and product of zeroes is 2 is given by

(a) $x^2 - x$
(b) $x^2 + x$
(c) $x^2 - 2$
(d) $x^2 + 2$

34. Which of the following has 5 and – 2 as their zeroes?

(a) $6x^2 - 4x + 6$
(b) $3x^2 - x + 2$
(c) $x^2 - 3x - 10$
(d) $2x^2 - 3x - 2$

35. The product of zeroes of the polynomial $x^2 + 4\sqrt{3}x - 15$ is

(a) 4 (b) – 15 (c) 8 (d) 10

Direction *Answer the questions from 36-40 based on the following case.*

Rajesh decided to do fisheries near his house in a pond. He puts 15 guppy fish. 20 flowerhorn fish. 25 koi fish and 10 angel fish in the pond. Now, he selects a fish at random.

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On the basis of above information, answer the following questions.

36. If total number of male fish in the aquarium is 40, then the probability of selecting a female fish is

(a) $\frac{1}{2}$ (b) $\frac{3}{7}$

(c) $\frac{1}{4}$ (d) $\frac{1}{5}$

37. The probability of selecting a flowerhorn fish is

(a) $\frac{2}{7}$ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) $\frac{1}{5}$

38. The probability of not selecting a koi fish is

(a) $\frac{2}{9}$ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) $\frac{9}{14}$

39. The probability of selecting neither angle fish nor flowerhorn fish is

(a) $\frac{16}{27}$ (b) $\frac{25}{54}$

(c) $\frac{4}{7}$ (d) $\frac{25}{27}$

40. The probability of selecting a guppy fish is

(a) 0 (b) 1

(c) $\frac{13}{54}$ (d) None of these

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40	a	b	c	d

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PRACTICE PAPER 3

Mathematics Class 10th (Term I)

Instructions

1. This paper has 40 questions.
2. All questions are compulsory.
3. Each question carry 1 mark.
4. Answer the questions as per given instructions.

Time : 90 Minutes **Max. Marks : 40**

Multiple Choice Questions

1. If HCF of two numbers is 12 and their product is 360, then their LCM is

(a) 60 (b) 40
(c) 30 (d) None of these

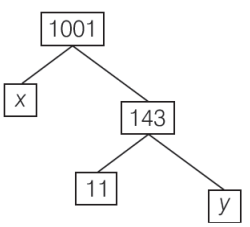
2. The rational form of $0.3\overline{24}$ is in the form of $\frac{m}{n}$, then $(m + n)$ is

(a) $\frac{101}{312}$ (b) $\frac{107}{330}$
(c) $\frac{107}{320}$ (d) None of these

3. The product of a non-zero rational and an irrational number is

(a) always irrational
(b) always rational
(c) rational or irrational
(d) one

4. The value of x and y is the given figure are



(a) 7, 13 (b) 13, 7
(c) 9, 12 (d) 12, 9

5. If one of the zeroes of the quadratic polynomial $(2k - 1)x^2 + 3kx + 1$ is -5, then the value of k is

(a) $\frac{15}{34}$ (b) $\frac{18}{35}$
(c) $\frac{-2}{3}$ (d) $\frac{24}{35}$

6. A quadratic polynomial, whose zeroes are 2 and -3, is

(a) $x^2 + x - 6$ (b) $x^2 - x + 6$
(c) $x^2 + x + 6$ (d) $x^2 - x - 6$

7. If the difference of the zeroes of the quadratic polynomial $x^2 + kx + 45$ is equal to 144, then the value of k is

(a) ± 9 (b) ± 12
(c) ± 15 (d) ± 18

8. If a and b are zeroes and the quadratic polynomial $f(x) = x^2 - 4x - 12$, then the value of $\frac{1}{a} + \frac{1}{b} - a \cdot b$ is

(a) $\frac{35}{3}$ (b) $-\frac{35}{3}$
(c) $\frac{32}{6}$ (d) $-\frac{32}{6}$

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9. If in two ΔXYZ and ΔMNO $\frac{XY}{NO} = \frac{YZ}{MO} = \frac{ZX}{MN}$, then

(a) $\Delta MNO \sim \Delta ZXY$ (b) $\Delta MNO \sim \Delta XYZ$
(c) $\Delta ZYX \sim \Delta MNO$ (d) $\Delta YZX \sim \Delta MNO$

10. If $\Delta ABC \sim \Delta PQR$ with $\frac{BC}{QR} = \frac{2}{5}$, then $\frac{\text{Perimeter of } \Delta(ABC)}{\text{Perimeter of } \Delta(PQR)} =$

(a) $\frac{2}{25}$ (b) $\frac{4}{5}$
(c) $\frac{2}{5}$ (d) None of these

11. The area of right angled triangle is 20 sq ft and its perimeter is 40 ft. Then, length of its hypotenuse is

(a) 6 units (b) 8 units
(c) 12 units (d) 10 units

12. In ΔABC and ΔDEF, $\angle B = \angle E$, $\angle F = \angle C$ and $AB = 3DE$. Then, the two triangles are

(a) Congruent but not similar
(b) Similar but not congruent
(c) Neither congruent nor similar
(d) Congruent as well as similar

13. If $\tan A = \frac{3}{4}$, then the value of $\tan^2 A + \cot^2 A$ is

(a) $\frac{331}{124}$ (b) $\frac{325}{129}$
(c) $\frac{324}{124}$ (d) $\frac{337}{144}$

14. If $\cot A = \sqrt{3}$, then $\sec^2 A - \cos^2 A$ is equal to ..... .

(a) $\frac{4}{3}$ (b) $\frac{7}{12}$
(c) $\frac{3}{4}$ (d) $\frac{25}{12}$

15. The value of $\frac{1 - \tan^2 30°}{1 + \tan^2 30°}$ is equal to

(a) 2 (b) $-\frac{1}{2}$
(c) 4 (d) $\frac{1}{2}$

16. If $\sin\theta = 1$, then the value of $\sin 2\theta$ is

(a) -1 (b) 0
(c) 1 (d) 2

17. If a number X is chosen at random from the numbers $-2, -1, 0, 1, 2$. Then, the probability that $X^2 < 2$ is

(a) $\frac{2}{5}$ (b) $\frac{4}{5}$
(c) $\frac{1}{5}$ (d) $\frac{3}{5}$

18. A bag contain 6 yellow and 4 green marbles. If a marble is drawn at random, then the probability of drawing a green marble is

(a) $\frac{1}{5}$ (b) $\frac{2}{5}$
(c) $\frac{3}{5}$ (d) $\frac{4}{5}$

19. Two coins are tossed simultaneously, then the probability of getting exactly one head is

(a) $\frac{1}{3}$ (b) $\frac{2}{6}$
(c) $\frac{1}{2}$ (d) $\frac{1}{8}$

20. A die is thrown once, then the probability of getting a number less than 3 is

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$
(c) $\frac{4}{6}$ (d) $\frac{1}{4}$

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Assertion-Reasoning MCQs

For question numbers 21 to 25, two statements are given-one labelled **Assertion** (A) and the other labelled **Reason** (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is true.

21. **Assertion** If p is prime number then, the LCM of p, p^2, p^3 is p^3.

Reason If p is a prime and p divides a^2, then p divides a, also where a is a positive integer.

22. **Assertion** The polynomial whose zeroes are $2+\sqrt{3}, 2-\sqrt{3}$ is $x^2 - 4x + 7$.

Reason $x^2 + 4x + 5$ has two zeroes.

23. **Assertion** Two figures having the same shape but not necessarily the same size are called similar figures.

Reason All the congruent figures are similar but the converse is not true.

24. **Assertion** In a right angled triangle, if $\cos\theta = \frac{5}{13}$ and $\sin\theta = \frac{12}{13}$, then $\tan\theta = \frac{7}{13}$.

Reason $\tan\theta = \frac{\sin\theta}{\cos\theta}$

25. **Assertion** If a die is thrown, the probability of getting a number less than 3 and greater than 2 is zero.

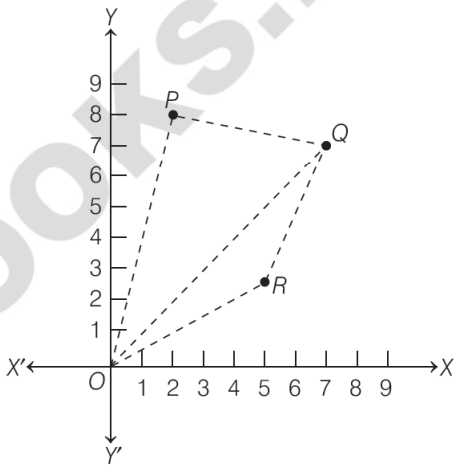
Reason Probability of an impossible event is zero.

Case Based MCQs

Direction Answer the questions from 26-30 based on the following case.

Three friends Ashok, Nikhil and Dolly lives in societies represented by the points P, Q and R respectively. They all work in the same office located at O.

If they decided to share a cab to go to the office, then answer the following questions.



26. Which society is nearest to the office?

(a) P (b) Q
(c) R (d) Both P and Q

27. What is the distance between P and R?

(a) $\sqrt{33}$ units
(b) $\sqrt{34}$ units
(c) $\sqrt{48}$ units
(d) None of the above

28. Which of the following distances is least?

(a) PQ
(b) OP
(c) QR
(d) None of the above

29. Which of the following is the best route to go to the office?

(a) $RPQO$ (b) $RQPO$
(c) $PQRO$ (d) All of these

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30. If Nikhil and Dolly planned to meet at a mall situated at a point S represented by the mid-point of the line joining the points Q and R, then find the coordinates of S.

(a) (2, 6) (b) (6, 5)
(c) (5, 3) (d) (6, 4)

Direction Answer the questions from 31-35 based on the following case.

Mohit went for shopping in the evening by metro with his father who is an expert in mathematics. He told Mohit that path of metro A is given by the equation $x + 2y = 4$ and path of metro B is given by the equation $x + 2y = 6$. Help Mohit to solve the questions.

31. Equation $x + 2y = 4$ intersect the X-axis and Y-axis respectively at

(a) (4, 0), (0, 2) (b) (0, 4), (2, 0)
(c) (4, 0), (2, 0) (d) (0, 4), (0, 2)

32. Equation $x + 2y = 9$ intersects the X-axis and Y-axis respectively at

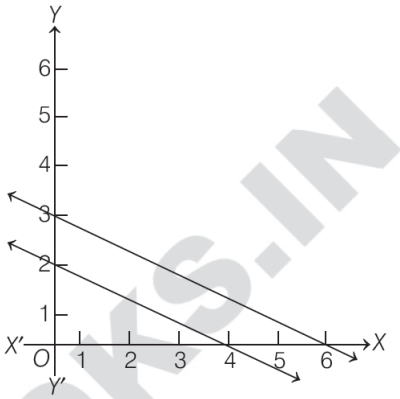
(a) (6, 0), (0, 8) (b) (0, 6), (0, 8)
(c) (6, 0), (0, 3) (d) (0, 6), (0, 3)

33. Coordinates of point of intersection of two given equations are

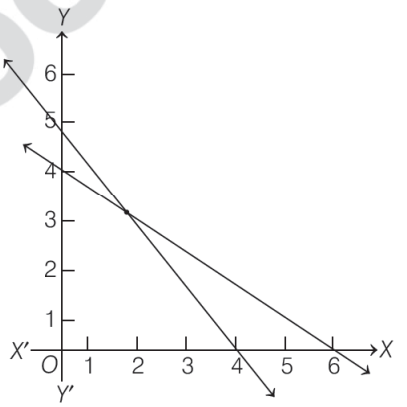
(a) (1, 2) (b) (2, 4)
(c) (3, 7) (d) does not exist

34. Representation of the equations $x + 2y = 4$ and $x + 2y = 6$ graphically is

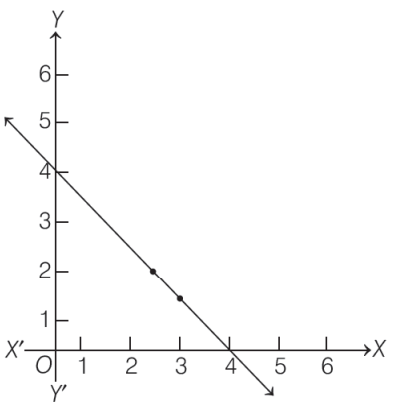
(a)



(b)



(c)



(d) None of the above

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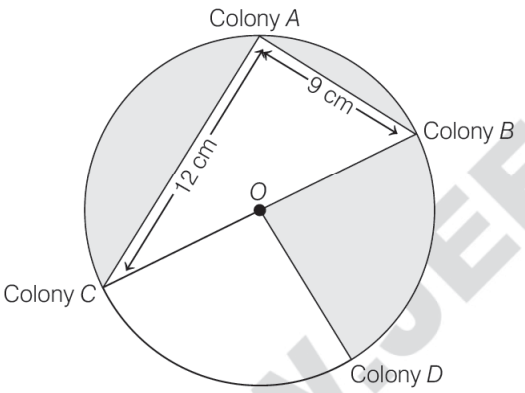
35. System of linear equations represented by two given lines is

(a) inconsistent
(b) having infinitely many solutions
(c) consistent
(d) overlapping each other

Direction Answer the questions from 36-40 based on the following case.

To find the polluted region in different area of Dwarka (a part of Delhi represented by the circle given below)
a survey was conducted by the students of class *X*. It is found that the shaded region is the polluted region, where *O* is the centre of the circle.



Based on the above information, answer the following questions.

36. The radius of the circle is

(a) 12.5 cm (b) 13.5 cm
(c) 15 cm (d) 7.5 cm

37. The area of the circle is

(a) 481.7 cm^2
(b) 176.62 cm^2
(c) 491.07 cm^2
(d) 495.6 cm^2

38. If *D* lies at the middle of arc *BC*, then area of region *COD* is

(a) 121 cm^2
(b) 122.76 cm^2
(c) 44.15 cm^2
(d) 129.8 cm^2

39. Area of the ΔBAC is

(a) 54 cm^2 (b) 79 cm^2
(c) 81 cm^2 (d) 84 cm^2

40. The area of the polluted region is

(a) 280.31 cm^2
(b) 284.31 cm^2
(c) 285.31 cm^2
(d) 132.47 cm^2

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PRACTICE PAPER 3

OMRSHEET

Instructions

- Use black or blue ball point pens and avoid gel pens and fountain pens for filling the sheets
- Darken the bubbles completely. Don't put a tick mark or a cross mark half-filled or over-filled bubbles will not be read by the software.

Incorrect Incorrect Incorrect Correct

- Do not write anything on the OMR Sheet
- Multiple markings are invalid

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
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34	a	b	c	d
35	a	b	c	d
36	a	b	c	d
37	a	b	c	d
38	a	b	c	d
39	a	b	c	d
40	a	b	c	d

Students should not write anything below this line

SIGNATURE OF EXAMINER WITH DATE	MARKS SCORED

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ANSWERS

Practice Set 1

1. (c)	2. (c)	3. (b)	4. (b)	5. (d)	6. (c)	7. (b)	8. (c)	9. (a)	10. (b)
11. (a)	12. (c)	13. (b)	14. (c)	15. (c)	16. (a)	17. (a)	18. (b)	19. (b)	20. (d)
21. (a)	22. (d)	23. (c)	24. (a)	25. (a)	26. (b)	27. (a)	28. (d)	29. (b)	30. (c)
31. (a)	32. (b)	33. (c)	34. (d)	35. (a)	36. (d)	37. (a)	38. (d)	39. (c)	40. (b)

Practice Set 2

1. (d)	2. (d)	3. (a)	4. (a)	5. (c)	6. (d)	7. (b)	8. (b)	9. (c)	10. (b)
11. (a)	12. (d)	13. (a)	14. (b)	15. (d)	16. (d)	17. (b)	18. (c)	19. (a)	20. (b)
21. (a)	22. (b)	23. (c)	24. (c)	25. (d)	26. (a)	27. (d)	28. (c)	29. (a)	30. (a)
31. (c)	32. (a)	33. (d)	34. (c)	35. (b)	36. (b)	37. (a)	38. (d)	39. (c)	40. (d)

Practice Set 3

1. (c)	2. (b)	3. (a)	4. (a)	5. (d)	6. (a)	7. (d)	8. (a)	9. (a)	10. (c)
11. (b)	12. (b)	13. (d)	14. (b)	15. (d)	16. (b)	17. (d)	18. (b)	19. (c)	20. (a)
21. (b)	22. (c)	23. (b)	24. (d)	25. (a)	26. (c)	27. (b)	28. (c)	29. (c)	30. (b)
31. (a)	32. (c)	33. (d)	34. (a)	35. (a)	36. (d)	37. (b)	38. (c)	39. (a)	40. (c)

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