

8. Consider the functions $f(x)$, $g(x)$, $h(x)$ as given below. Show that $(f \circ g) \circ h = f \circ (g \circ h)$ in each case.
- (i) $f(x) = x - 1$, $g(x) = 3x + 1$ and $h(x) = x^2$
- (ii) $f(x) = x^2$, $g(x) = 2x$ and $h(x) = x + 4$
- (iii) $f(x) = x - 4$, $g(x) = x^2$ and $h(x) = 3x - 5$
9. Let $f = \{(-1, 3), (0, -1), (2, -9)\}$ be a linear function from \mathbb{Z} into \mathbb{Z} . Find $f(x)$.
10. In electrical circuit theory, a circuit $C(t)$ is called a linear circuit if it satisfies the superposition principle given by $C(at_1 + bt_2) = aC(t_1) + bC(t_2)$, where a, b are constants. Show that the circuit $C(t) = 3t$ is linear.



Exercise 1.6



Multiple choice questions

- If $n(A \times B) = 6$ and $A = \{1, 3\}$ then $n(B)$ is
(A) 1 (B) 2 (C) 3 (D) 6
- $A = \{a, b, p\}$, $B = \{2, 3\}$, $C = \{p, q, r, s\}$ then $n[(A \cup C) \times B]$ is
(A) 8 (B) 20 (C) 12 (D) 16
- If $A = \{1, 2\}$, $B = \{1, 2, 3, 4\}$, $C = \{5, 6\}$ and $D = \{5, 6, 7, 8\}$ then state which of the following statement is true.
(A) $(A \times C) \subset (B \times D)$ (B) $(B \times D) \subset (A \times C)$
(C) $(A \times B) \subset (A \times D)$ (D) $(D \times A) \subset (B \times A)$
- If there are 1024 relations from a set $A = \{1, 2, 3, 4, 5\}$ to a set B , then the number of elements in B is
(A) 3 (B) 2 (C) 4 (D) 8
- The range of the relation $R = \{(x, x^2) \mid x \text{ is a prime number less than } 13\}$ is
(A) $\{2, 3, 5, 7\}$ (B) $\{2, 3, 5, 7, 11\}$
(C) $\{4, 9, 25, 49, 121\}$ (D) $\{1, 4, 9, 25, 49, 121\}$
- If the ordered pairs $(a + 2, 4)$ and $(5, 2a + b)$ are equal then (a, b) is
(A) $(2, -2)$ (B) $(5, 1)$ (C) $(2, 3)$ (D) $(3, -2)$
- Let $n(A) = m$ and $n(B) = n$ then the total number of non-empty relations that can be defined from A to B is
(A) m^n (B) n^m (C) $2^{mn} - 1$ (D) 2^{mn}
- If $\{(a, 8), (6, b)\}$ represents an identity function, then the value of a and b are respectively
(A) $(8, 6)$ (B) $(8, 8)$ (C) $(6, 8)$ (D) $(6, 6)$

9. Let $A = \{1, 2, 3, 4\}$ and $B = \{4, 8, 9, 10\}$. A function $f : A \rightarrow B$ given by $f = \{(1, 4), (2, 8), (3, 9), (4, 10)\}$ is a
- (A) Many-one function (B) Identity function
(C) One-to-one function (D) Into function
10. If $f(x) = 2x^2$ and $g(x) = \frac{1}{3x}$, then $f \circ g$ is
- (A) $\frac{3}{2x^2}$ (B) $\frac{2}{3x^2}$ (C) $\frac{2}{9x^2}$ (D) $\frac{1}{6x^2}$
11. If $f : A \rightarrow B$ is a bijective function and if $n(B) = 7$, then $n(A)$ is equal to
- (A) 7 (B) 49 (C) 1 (D) 14
12. Let f and g be two functions given by
- $f = \{(0, 1), (2, 0), (3, -4), (4, 2), (5, 7)\}$
- $g = \{(0, 2), (1, 0), (2, 4), (-4, 2), (7, 0)\}$ then the range of $f \circ g$ is
- (A) $\{0, 2, 3, 4, 5\}$ (B) $\{-4, 1, 0, 2, 7\}$ (C) $\{1, 2, 3, 4, 5\}$ (D) $\{0, 1, 2\}$
13. Let $f(x) = \sqrt{1 + x^2}$ then
- (A) $f(xy) = f(x) \cdot f(y)$ (B) $f(xy) \geq f(x) \cdot f(y)$
(C) $f(xy) \leq f(x) \cdot f(y)$ (D) None of these
14. If $g = \{(1, 1), (2, 3), (3, 5), (4, 7)\}$ is a function given by $g(x) = \alpha x + \beta$ then the values of α and β are
- (A) $(-1, 2)$ (B) $(2, -1)$ (C) $(-1, -2)$ (D) $(1, 2)$
15. $f(x) = (x + 1)^3 - (x - 1)^3$ represents a function which is
- (A) linear (B) cubic (C) reciprocal (D) quadratic

Unit Exercise - 1



1. If the ordered pairs $(x^2 - 3x, y^2 + 4y)$ and $(-2, 5)$ are equal, then find x and y .
2. The cartesian product $A \times A$ has 9 elements among which $(-1, 0)$ and $(0, 1)$ are found. Find the set A and the remaining elements of $A \times A$.
3. Given that $f(x) = \begin{cases} \sqrt{x-1} & x \geq 1 \\ 4 & x < 1 \end{cases}$. Find
- (i) $f(0)$ (ii) $f(3)$ (iii) $f(a+1)$ in terms of a . (Given that $a \geq 0$)
4. Let $A = \{9, 10, 11, 12, 13, 14, 15, 16, 17\}$ and let $f : A \rightarrow N$ be defined by $f(n) =$ the highest prime factor of $n \in A$. Write f as a set of ordered pairs and find the range of f .



Exercise 2.10



Multiple choice questions

- Euclid's division lemma states that for positive integers a and b , there exist unique integers q and r such that $a = bq + r$, where r must satisfy.
(A) $1 < r < b$ (B) $0 < r < b$ (C) $0 \leq r < b$ (D) $0 < r \leq b$
- Using Euclid's division lemma, if the cube of any positive integer is divided by 9 then the possible remainders are
(A) 0, 1, 8 (B) 1, 4, 8 (C) 0, 1, 3 (D) 1, 3, 5
- If the HCF of 65 and 117 is expressible in the form of $65m - 117$, then the value of m is
(A) 4 (B) 2 (C) 1 (D) 3
- The sum of the exponents of the prime factors in the prime factorization of 1729 is
(A) 1 (B) 2 (C) 3 (D) 4
- The least number that is divisible by all the numbers from 1 to 10 (both inclusive) is
(A) 2025 (B) 5220 (C) 5025 (D) 2520
- $7^{4k} \equiv \underline{\hspace{1cm}} \pmod{100}$
(A) 1 (B) 2 (C) 3 (D) 4
- Given $F_1 = 1$, $F_2 = 3$ and $F_n = F_{n-1} + F_{n-2}$ then F_5 is
(A) 3 (B) 5 (C) 8 (D) 11
- The first term of an arithmetic progression is unity and the common difference is 4. Which of the following will be a term of this A.P.
(A) 4551 (B) 10091 (C) 7881 (D) 13531
- If 6 times of 6th term of an A.P. is equal to 7 times the 7th term, then the 13th term of the A.P. is
(A) 0 (B) 6 (C) 7 (D) 13
- An A.P. consists of 31 terms. If its 16th term is m , then the sum of all the terms of this A.P. is
(A) 16 m (B) 62 m (C) 31 m (D) $\frac{31}{2} m$
- In an A.P., the first term is 1 and the common difference is 4. How many terms of the A.P. must be taken for their sum to be equal to 120?
(A) 6 (B) 7 (C) 8 (D) 9
- If $A = 2^{65}$ and $B = 2^{64} + 2^{63} + 2^{62} + \dots + 2^0$ which of the following is true?
(A) B is 2^{64} more than A (B) A and B are equal
(C) B is larger than A by 1 (D) A is larger than B by 1

13. The next term of the sequence $\frac{3}{16}, \frac{1}{8}, \frac{1}{12}, \frac{1}{18}, \dots$ is
 (A) $\frac{1}{24}$ (B) $\frac{1}{27}$ (C) $\frac{2}{3}$ (D) $\frac{1}{81}$
14. If the sequence t_1, t_2, t_3, \dots are in A.P. then the sequence $t_6, t_{12}, t_{18}, \dots$ is
 (A) a Geometric Progression (B) an Arithmetic Progression
 (C) neither an Arithmetic Progression nor a Geometric Progression
 (D) a constant sequence
15. The value of $(1^3 + 2^3 + 3^3 + \dots + 15^3) - (1 + 2 + 3 + \dots + 15)$ is
 (A) 14400 (B) 14200 (C) 14280 (D) 14520

Unit Exercise - 2



- Prove that $n^2 - n$ divisible by 2 for every positive integer n .
- A milk man has 175 litres of cow's milk and 105 litres of buffalow's milk. He wishes to sell the milk by filling the two types of milk in cans of equal capacity. Calculate the following (i) Capacity of a can (ii) Number of cans of cow's milk (iii) Number of cans of buffalow's milk.
- When the positive integers a , b and c are divided by 13 the respective remainders are 9, 7 and 10. Find the remainder when $a + 2b + 3c$ is divided by 13.
- Show that 107 is of the form $4q + 3$ for any integer q .
- If $(m + 1)^{\text{th}}$ term of an A.P. is twice the $(n + 1)^{\text{th}}$ term, then prove that $(3m + 1)^{\text{th}}$ term is twice the $(m + n + 1)^{\text{th}}$ term.
- Find the 12th term from the last term of the A. P $-2, -4, -6, \dots -100$.
- Two A.P.'s have the same common difference. The first term of one A.P. is 2 and that of the other is 7. Show that the difference between their 10th terms is the same as the difference between their 21st terms, which is the same as the difference between any two corresponding terms.
- A man saved ₹16500 in ten years. In each year after the first he saved ₹100 more than he did in the preceding year. How much did he save in the first year?
- Find the G.P. in which the 2nd term is $\sqrt{6}$ and the 6th term is $9\sqrt{6}$.
- The value of a motor cycle depreciates at the rate of 15% per year. What will be the value of the motor cycle 3 year hence, which is now purchased for ₹ 45,000?

Points to Remember



● Euclid's division lemma

If a and b are two positive integers then there exist unique integers q and r such that $a = bq + r$, $0 \leq r < |b|$

● Fundamental theorem of arithmetic

Every composite number can be expressed as a product of primes and this factorization is unique except for the order in which the prime factors occur.

6. Show that the matrices $A = \begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 1 & -2 \\ -3 & 1 \end{pmatrix}$ satisfy commutative property $AB=BA$
7. Let $A = \begin{pmatrix} 1 & 2 \\ 1 & 3 \end{pmatrix}$, $B = \begin{pmatrix} 4 & 0 \\ 1 & 5 \end{pmatrix}$, $C = \begin{pmatrix} 2 & 0 \\ 1 & 2 \end{pmatrix}$ Show that (i) $A(BC) = (AB)C$
(ii) $(A - B)C = AC - BC$ (iii) $(A - B)^T = A^T - B^T$
8. If $A = \begin{pmatrix} \cos \theta & 0 \\ 0 & \cos \theta \end{pmatrix}$, $B = \begin{pmatrix} \sin \theta & 0 \\ 0 & \sin \theta \end{pmatrix}$ then show that $A^2 + B^2 = I$.
9. If $A = \begin{pmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{pmatrix}$ prove that $AA^T = I$.
10. Verify that $A^2 = I$ when $A = \begin{pmatrix} 5 & -4 \\ 6 & -5 \end{pmatrix}$
11. If $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ show that $A^2 - (a + d)A = (bc - ad)I_2$
12. If $A = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 7 \\ 1 & 2 \\ 5 & -1 \end{pmatrix}$ verify that $(AB)^T = B^T A^T$
13. If $A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$ show that $A^2 - 5A + 7I_2 = 0$



Exercise 3.20



Multiple choice questions

- A system of three linear equations in three variables is inconsistent if their planes
 - intersect only at a point
 - intersect in a line
 - coincides with each other
 - do not intersect
- The solution of the system $x + y - 3z = -6$, $-7y + 7z = 7$, $3z = 9$ is
 - $x = 1, y = 2, z = 3$
 - $x = -1, y = 2, z = 3$
 - $x = -1, y = -2, z = 3$
 - $x = 1, y = -2, z = 3$
- If $(x - 6)$ is the HCF of $x^2 - 2x - 24$ and $x^2 - kx - 6$ then the value of k is
 - 3
 - 5
 - 6
 - 8
- $\frac{3y - 3}{y} \div \frac{7y - 7}{3y^2}$ is
 - $\frac{9y}{7}$
 - $\frac{9y^3}{(21y - 21)}$
 - $\frac{21y^2 - 42y + 21}{3y^3}$
 - $\frac{7(y^2 - 2y + 1)}{y^2}$

5. $y^2 + \frac{1}{y^2}$ is not equal to
 (A) $\frac{y^4 + 1}{y^2}$ (B) $\left(y + \frac{1}{y}\right)^2$ (C) $\left(y - \frac{1}{y}\right)^2 + 2$ (D) $\left(y + \frac{1}{y}\right)^2 - 2$
6. $\frac{x}{x^2 - 25} - \frac{8}{x^2 + 6x + 5}$ gives
 (A) $\frac{x^2 - 7x + 40}{(x - 5)(x + 5)}$ (B) $\frac{x^2 + 7x + 40}{(x - 5)(x + 5)(x + 1)}$
 (C) $\frac{x^2 - 7x + 40}{(x^2 - 25)(x + 1)}$ (D) $\frac{x^2 + 10}{(x^2 - 25)(x + 1)}$
7. The square root of $\frac{256x^8y^4z^{10}}{25x^6y^6z^6}$ is equal to
 (A) $\frac{16}{5} \left| \frac{x^2z^4}{y^2} \right|$ (B) $16 \left| \frac{y^2}{x^2z^4} \right|$ (C) $\frac{16}{5} \left| \frac{y}{xz^2} \right|$ (D) $\frac{16}{5} \left| \frac{xz^2}{y} \right|$
8. Which of the following should be added to make $x^4 + 64$ a perfect square
 (A) $4x^2$ (B) $16x^2$ (C) $8x^2$ (D) $-8x^2$
9. The solution of $(2x - 1)^2 = 9$ is equal to
 (A) -1 (B) 2 (C) $-1, 2$ (D) None of these
10. The values of a and b if $4x^4 - 24x^3 + 76x^2 + ax + b$ is a perfect square are
 (A) 100, 120 (B) 10, 12 (C) $-120, 100$ (D) 12, 10
11. If the roots of the equation $q^2x^2 + p^2x + r^2 = 0$ are the squares of the roots of the equation $qx^2 + px + r = 0$, then q, p, r are in _____
 (A) $A.P$ (B) $G.P$ (C) Both $A.P$ and $G.P$ (D) none of these
12. Graph of a linear equation is a _____
 (A) straight line (B) circle (C) parabola (D) hyperbola
13. The number of points of intersection of the quadratic polynomial $x^2 + 4x + 4$ with the X axis is
 (A) 0 (B) 1 (C) 0 or 1 (D) 2
14. For the given matrix $A = \begin{pmatrix} 1 & 3 & 5 & 7 \\ 2 & 4 & 6 & 8 \\ 9 & 11 & 13 & 15 \end{pmatrix}$ the order of the matrix A^T is
 (A) 2×3 (B) 3×2 (C) 3×4 (D) 4×3
15. If A is a 2×3 matrix and B is a 3×4 matrix, how many columns does AB have
 (A) 3 (B) 4 (C) 2 (D) 5

16. If number of columns and rows are not equal in a matrix then it is said to be a
 (A) diagonal matrix (B) rectangular matrix
 (C) square matrix (D) identity matrix

17. Transpose of a column matrix is
 (A) unit matrix (B) diagonal matrix
 (C) column matrix (D) row matrix

18. Find the matrix X if $2X + \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix} = \begin{pmatrix} 5 & 7 \\ 9 & 5 \end{pmatrix}$
 (A) $\begin{pmatrix} -2 & -2 \\ 2 & -1 \end{pmatrix}$ (B) $\begin{pmatrix} 2 & 2 \\ 2 & -1 \end{pmatrix}$ (C) $\begin{pmatrix} 1 & 2 \\ 2 & 2 \end{pmatrix}$ (D) $\begin{pmatrix} 2 & 1 \\ 2 & 2 \end{pmatrix}$

19. Which of the following can be calculated from the given matrices

$$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix}, B = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}, \text{ (i) } A^2 \text{ (ii) } B^2 \text{ (iii) } AB \text{ (iv) } BA$$

- (A) (i) and (ii) only (B) (ii) and (iii) only
 (C) (ii) and (iv) only (D) all of these

20. If $A = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 0 \\ 2 & -1 \\ 0 & 2 \end{pmatrix}$ and $C = \begin{pmatrix} 0 & 1 \\ -2 & 5 \end{pmatrix}$. Which of the following statements

are correct? (i) $AB + C = \begin{pmatrix} 5 & 5 \\ 5 & 5 \end{pmatrix}$ (ii) $BC = \begin{pmatrix} 0 & 1 \\ 2 & -3 \\ -4 & 10 \end{pmatrix}$

(iii) $BA + C = \begin{pmatrix} 2 & 5 \\ 3 & 0 \end{pmatrix}$ (iv) $(AB)C = \begin{pmatrix} -8 & 20 \\ -8 & 13 \end{pmatrix}$

- (A) (i) and (ii) only (B) (ii) and (iii) only
 (C) (iii) and (iv) only (D) all of these

Unit Exercise - 3



- Solve $\frac{1}{3}(x + y - 5) = y - z = 2x - 11 = 9 - (x + 2z)$
- One hundred and fifty students are admitted to a school. They are distributed over three sections A, B and C. If 6 students are shifted from section A to section C, the sections will have equal number of students. If 4 times of students of section C exceeds the number of students of section A by the number of students in section B, find the number of students in the three sections.

16. Draw a tangent to the circle from the point P having radius 3.6 cm, and centre at O . Point P is at a distance 7.2 cm from the centre.



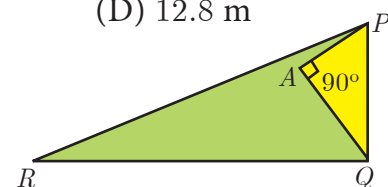
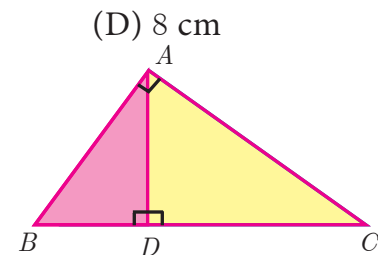
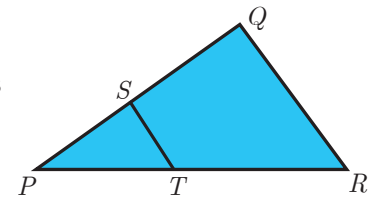
Multiple choice questions



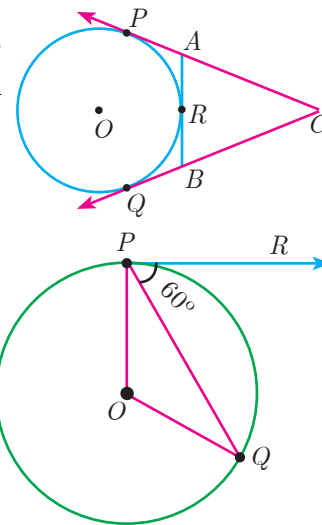
Exercise 4.5



- If in triangles ABC and EDF , $\frac{AB}{DE} = \frac{BC}{FD}$ then they will be similar, when
 (A) $\angle B = \angle E$ (B) $\angle A = \angle D$ (C) $\angle B = \angle D$ (D) $\angle A = \angle F$
- In $\triangle LMN$, $\angle L = 60^\circ$, $\angle M = 50^\circ$. If $\triangle LMN \sim \triangle PQR$ then the value of $\angle R$ is
 (A) 40° (B) 70° (C) 30° (D) 110°
- If $\triangle ABC$ is an isosceles triangle with $\angle C = 90^\circ$ and $AC = 5$ cm, then AB is
 (A) 2.5 cm (B) 5 cm (C) 10 cm (D) $5\sqrt{2}$ cm
- In a given figure $ST \parallel QR$, $PS = 2$ cm and $SQ = 3$ cm. Then the ratio of the area of $\triangle PQR$ to the area of $\triangle PST$ is
 (A) 25 : 4 (B) 25 : 7
 (C) 25 : 11 (D) 25 : 13
- The perimeters of two similar triangles $\triangle ABC$ and $\triangle PQR$ are 36 cm and 24 cm respectively. If $PQ = 10$ cm, then the length of AB is
 (A) $6\frac{2}{3}$ cm (B) $\frac{10\sqrt{6}}{3}$ cm (C) $66\frac{2}{3}$ cm (D) 15 cm
- If in $\triangle ABC$, $DE \parallel BC$. $AB = 3.6$ cm, $AC = 2.4$ cm and $AD = 2.1$ cm then the length of AE is
 (A) 1.4 cm (B) 1.8 cm (C) 1.2 cm (D) 1.05 cm
- In a $\triangle ABC$, AD is the bisector of $\angle BAC$. If $AB = 8$ cm, $BD = 6$ cm and $DC = 3$ cm. The length of the side AC is
 (A) 6 cm (B) 4 cm (C) 3 cm (D) 8 cm
- In the adjacent figure $\angle BAC = 90^\circ$ and $AD \perp BC$ then
 (A) $BD \cdot CD = BC^2$ (B) $AB \cdot AC = BC^2$
 (C) $BD \cdot CD = AD^2$ (D) $AB \cdot AC = AD^2$
- Two poles of heights 6 m and 11 m stand vertically on a plane ground. If the distance between their feet is 12 m, what is the distance between their tops?
 (A) 13 m (B) 14 m (C) 15 m (D) 12.8 m
- In the given figure, $PR = 26$ cm, $QR = 24$ cm, $\angle PAQ = 90^\circ$, $PA = 6$ cm and $QA = 8$ cm. Find $\angle PQR$
 (A) 80° (B) 85° (C) 75° (D) 90°



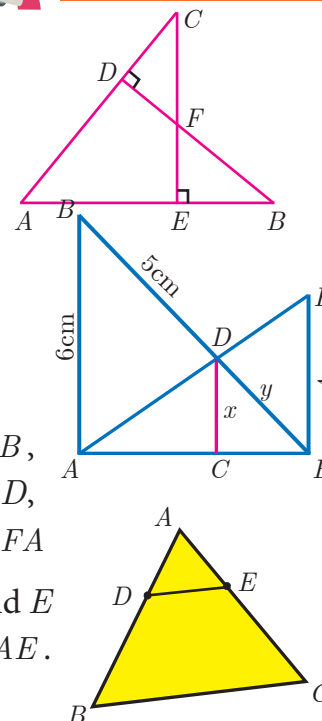
11. A tangent is perpendicular to the radius at the
 (A) centre (B) point of contact (C) infinity (D) chord
12. How many tangents can be drawn to the circle from an exterior point?
 (A) one (B) two (C) infinite (D) zero
13. The two tangents from an external points P to a circle with centre at O are PA and PB . If $\angle APB = 70^\circ$ then the value of $\angle AOB$ is
 (A) 100° (B) 110° (C) 120° (D) 130°
14. In figure CP and CQ are tangents to a circle with centre at O . ARB is another tangent touching the circle at R . If $CP = 11$ cm and $BC = 7$ cm, then the length of BR is
 (A) 6 cm (B) 5 cm
 (C) 8 cm (D) 4 cm
15. In figure if PR is tangent to the circle at P and O is the centre of the circle, then $\angle POQ$ is
 (A) 120° (B) 100°
 (C) 110° (D) 90°



Unit Exercise - 4



1. In the figure, if $BD \perp AC$ and $CE \perp AB$, prove that
 (i) $\triangle AEC \sim \triangle ADB$ (ii) $\frac{CA}{AB} = \frac{CE}{DB}$
2. In the given figure $AB \parallel CD \parallel EF$.
 If $AB = 6$ cm, $CD = x$ cm, $EF = 4$ cm, $BD = 5$ cm and $DE = y$ cm. Find x and y .
3. O is any point inside a triangle ABC . The bisector of $\angle AOB$, $\angle BOC$ and $\angle COA$ meet the sides AB , BC and CA in point D , E and F respectively. Show that $AD \times BE \times CF = DB \times EC \times FA$
4. In the figure, ABC is a triangle in which $AB = AC$. Points D and E are points on the side AB and AC respectively such that $AD = AE$. Show that the points B , C , E and D lie on a same circle.
5. Two trains leave a railway station at the same time. The first train travels due west and the second train due north. The first train travels at a speed of 20 km/hr and the second train travels at 30 km/hr. After 2 hours, what is the distance between them?





Exercise 5.4

- Find the slope of the following straight lines (i) $5y - 3 = 0$ (ii) $7x - \frac{3}{17} = 0$
- Find the slope of the line which is
(i) parallel to $y = 0.7x - 11$ (ii) perpendicular to the line $x = -11$
- Check whether the given lines are parallel or perpendicular
(i) $\frac{x}{3} + \frac{y}{4} + \frac{1}{7} = 0$ and $\frac{2x}{3} + \frac{y}{2} + \frac{1}{10} = 0$
(ii) $5x + 23y + 14 = 0$ and $23x - 5y + 9 = 0$
- If the straight lines $12y = -(p + 3)x + 12$, $12x - 7y = 16$ are perpendicular then find 'p'.
- Find the equation of a straight line passing through the point $P(-5, 2)$ and parallel to the line joining the points $Q(3, -2)$ and $R(-5, 4)$.
- Find the equation of a line passing through $(6, -2)$ and perpendicular to the line joining the points $(6, 7)$ and $(2, -3)$.
- $A(-3, 0)$, $B(10, -2)$ and $C(12, 3)$ are the vertices of $\triangle ABC$. Find the equation of the altitude through A and B .
- Find the equation of the perpendicular bisector of the line joining the points $A(-4, 2)$ and $B(6, -4)$.
- Find the equation of a straight line through the intersection of lines $7x + 3y = 10$, $5x - 4y = 1$ and parallel to the line $13x + 5y + 12 = 0$
- Find the equation of a straight line through the intersection of lines $5x - 6y = 2$, $3x + 2y = 10$ and perpendicular to the line $4x - 7y + 13 = 0$
- Find the equation of a straight line joining the point of intersection of $3x + y + 2 = 0$ and $x - 2y - 4 = 0$ to the point of intersection of $7x - 3y = -12$ and $2y = x + 3$
- Find the equation of a straight line through the point of intersection of the lines $8x + 3y = 18$, $4x + 5y = 9$ and bisecting the line segment joining the points $(5, -4)$ and $(-7, 6)$.



Exercise 5.5



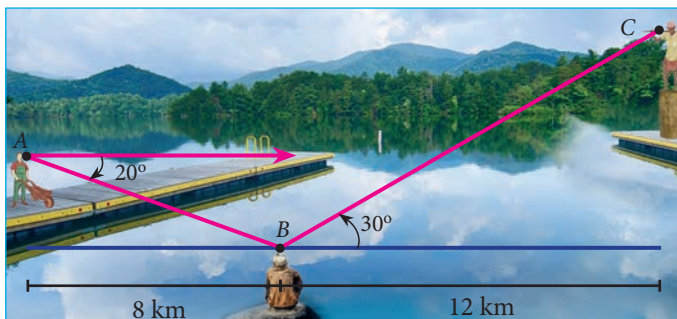
Multiple choice questions

- The area of triangle formed by the points $(-5, 0)$, $(0, -5)$ and $(5, 0)$ is
(A) 0 sq.units (B) 25 sq.units (C) 5 sq.units (D) none of these
- A man walks near a wall, such that the distance between him and the wall is 10 units. Consider the wall to be the Y axis. The path travelled by the man is
(A) $x = 10$ (B) $y = 10$ (C) $x = 0$ (D) $y = 0$
- The straight line given by the equation $x = 11$ is
(A) parallel to X axis (B) parallel to Y axis
(C) passing through the origin (D) passing through the point $(0, 11)$



4. If $(5,7)$, $(3,p)$ and $(6,6)$ are collinear, then the value of p is
 (A) 3 (B) 6 (C) 9 (D) 12
5. The point of intersection of $3x - y = 4$ and $x + y = 8$ is
 (A) $(5,3)$ (B) $(2,4)$ (C) $(3,5)$ (D) $(4,4)$
6. The slope of the line joining $(12,3)$, $(4,a)$ is $\frac{1}{8}$. The value of ' a ' is
 (A) 1 (B) 4 (C) -5 (D) 2
7. The slope of the line which is perpendicular to a line joining the points $(0,0)$ and $(-8,8)$ is
 (A) -1 (B) 1 (C) $\frac{1}{3}$ (D) -8
8. If slope of the line PQ is $\frac{1}{\sqrt{3}}$ then slope of the perpendicular bisector of PQ is
 (A) $\sqrt{3}$ (B) $-\sqrt{3}$ (C) $\frac{1}{\sqrt{3}}$ (D) 0
9. If A is a point on the Y axis whose ordinate is 8 and B is a point on the X axis whose abscissae is 5 then the equation of the line AB is
 (A) $8x + 5y = 40$ (B) $8x - 5y = 40$ (C) $x = 8$ (D) $y = 5$
10. The equation of a line passing through the origin and perpendicular to the line $7x - 3y + 4 = 0$ is
 (A) $7x - 3y + 4 = 0$ (B) $3x - 7y + 4 = 0$ (C) $3x + 7y = 0$ (D) $7x - 3y = 0$
11. Consider four straight lines
 (i) l_1 ; $3y = 4x + 5$ (ii) l_2 ; $4y = 3x - 1$ (iii) l_3 ; $4y + 3x = 7$ (iv) l_4 ; $4x + 3y = 2$
 Which of the following statement is true ?
 (A) l_1 and l_2 are perpendicular (B) l_1 and l_4 are parallel
 (C) l_2 and l_4 are perpendicular (D) l_2 and l_3 are parallel
12. A straight line has equation $8y = 4x + 21$. Which of the following is true
 (A) The slope is 0.5 and the y intercept is 2.6
 (B) The slope is 5 and the y intercept is 1.6
 (C) The slope is 0.5 and the y intercept is 1.6
 (D) The slope is 5 and the y intercept is 2.6
13. When proving that a quadrilateral is a trapezium, it is necessary to show
 (A) Two sides are parallel. (B) Two parallel and two non-parallel sides.
 (C) Opposite sides are parallel. (D) All sides are of equal length.
14. When proving that a quadrilateral is a parallelogram by using slopes you must find
 (A) The slopes of two sides (B) The slopes of two pair of opposite sides
 (C) The lengths of all sides (D) Both the lengths and slopes of two sides
15. $(2, 1)$ is the point of intersection of two lines.
 (A) $x - y - 3 = 0$; $3x - y - 7 = 0$ (B) $x + y = 3$; $3x + y = 7$
 (C) $3x + y = 3$; $x + y = 7$ (D) $x + 3y - 3 = 0$; $x - y - 7 = 0$

2. A man is standing on the deck of a ship, which is 40 m above water level. He observes the angle of elevation of the top of a hill as 60° and the angle of depression of the base of the hill as 30° . Calculate the distance of the hill from the ship and the height of the hill. ($\sqrt{3} = 1.732$)
3. If the angle of elevation of a cloud from a point ' h ' metres above a lake is θ_1 and the angle of depression of its reflection in the lake is θ_2 . Prove that the height that the cloud is located from the ground is $\frac{h(\tan \theta_1 + \tan \theta_2)}{\tan \theta_2 - \tan \theta_1}$.
4. The angle of elevation of the top of a cell phone tower from the foot of a high apartment is 60° and the angle of depression of the foot of the tower from the top of the apartment is 30° . If the height of the apartment is 50 m, find the height of the cell phone tower. According to radiations control norms, the minimum height of a cell phone tower should be 120 m. State if the height of the above mentioned cell phone tower meets the radiation norms.
5. The angles of elevation and depression of the top and bottom of a lamp post from the top of a 66 m high apartment are 60° and 30° respectively. Find
 - (i) The height of the lamp post.
 - (ii) The difference between height of the lamp post and the apartment.
 - (iii) The distance between the lamp post and the apartment. ($\sqrt{3} = 1.732$)
6. Three villagers A , B and C can see each other using telescope across a valley. The horizontal distance between A and B is 8 km and the horizontal distance between B and C is 12 km. The angle of depression of B from A is 20° and the angle of elevation of C from B is 30° . Calculate : (i) the vertical height between A and B .
(ii) the vertical height between B and C . ($\tan 20^\circ = 0.3640$, $\sqrt{3} = 1.732$)



Exercise 6.5



Multiple choice questions

1. The value of $\sin^2 \theta + \frac{1}{1 + \tan^2 \theta}$ is equal to

(A) $\tan^2 \theta$	(B) 1	(C) $\cot^2 \theta$	(D) 0
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2. $\tan \theta \operatorname{cosec}^2 \theta - \tan \theta$ is equal to

(A) $\sec \theta$	(B) $\cot^2 \theta$	(C) $\sin \theta$	(D) $\cot \theta$
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3. If $(\sin \alpha + \operatorname{cosec} \alpha)^2 + (\cos \alpha + \sec \alpha)^2 = k + \tan^2 \alpha + \cot^2 \alpha$, then the value of k is equal to

(A) 9	(B) 7	(C) 5	(D) 3
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4. If $\sin \theta + \cos \theta = a$ and $\sec \theta + \operatorname{cosec} \theta = b$, then the value of $b(a^2 - 1)$ is equal to
 (A) $2a$ (B) $3a$ (C) 0 (D) $2ab$
5. If $5x = \sec \theta$ and $\frac{5}{y} = \tan \theta$, then $x^2 - \frac{1}{y^2}$ is equal to
 (A) 25 (B) $\frac{1}{25}$ (C) 5 (D) 1
6. If $\sin \theta = \cos \theta$, then $2 \tan^2 \theta + \sin^2 \theta - 1$ is equal to
 (A) $\frac{-3}{2}$ (B) $\frac{3}{2}$ (C) $\frac{2}{3}$ (D) $\frac{-2}{3}$
7. If $x = a \tan \theta$ and $y = b \sec \theta$ then
 (A) $\frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$ (B) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ (C) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (D) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 0$
8. $(1 + \tan \theta + \sec \theta)(1 + \cot \theta - \operatorname{cosec} \theta)$ is equal to
 (A) 0 (B) 1 (C) 2 (D) -1
9. $a \cot \theta + b \operatorname{cosec} \theta = p$ and $b \cot \theta + a \operatorname{cosec} \theta = q$ then $p^2 - q^2$ is equal to
 (A) $a^2 - b^2$ (B) $b^2 - a^2$ (C) $a^2 + b^2$ (D) $b - a$
10. If the ratio of the height of a tower and the length of its shadow is $\sqrt{3} : 1$, then the angle of elevation of the sun has measure
 (A) 45° (B) 30° (C) 90° (D) 60°
11. The electric pole subtends an angle of 30° at a point on the same level as its foot. At a second point 'b' metres above the first, the depression of the foot of the pole is 60° . The height of the pole (in metres) is equal to
 (A) $\sqrt{3} b$ (B) $\frac{b}{3}$ (C) $\frac{b}{2}$ (D) $\frac{b}{\sqrt{3}}$
12. A tower is 60 m high. Its shadow reduces by x metres when the angle of elevation of the sun increases from 30° to 45° then x is equal to
 (A) 41.92 m (B) 43.92 m (C) 43 m (D) 45.6 m
13. The angle of depression of the top and bottom of 20 m tall building from the top of a multistoried building are 30° and 60° respectively. The height of the multistoried building and the distance between two buildings (in metres) is
 (A) 20, $10\sqrt{3}$ (B) 30, $5\sqrt{3}$ (C) 20, 10 (D) 30, $10\sqrt{3}$
14. Two persons are standing 'x' metres apart from each other and the height of the first person is double that of the other. If from the middle point of the line joining their feet an observer finds the angular elevations of their tops to be complementary, then the height of the shorter person (in metres) is
 (A) $\sqrt{2} x$ (B) $\frac{x}{2\sqrt{2}}$ (C) $\frac{x}{\sqrt{2}}$ (D) $2x$



4. A solid right circular cone of diameter 14 cm and height 8 cm is melted to form a hollow sphere. If the external diameter of the sphere is 10 cm, find the internal diameter.
5. Seenu's house has an overhead tank in the shape of a cylinder. This is filled by pumping water from a sump (underground tank) which is in the shape of a cuboid. The sump has dimensions $2\text{ m} \times 1.5\text{ m} \times 1\text{ m}$. The overhead tank has its radius of 60 cm and height 105 cm. Find the volume of the water left in the sump after the overhead tank has been completely filled with water from the sump which has been full, initially.
6. The internal and external diameter of a hollow hemispherical shell are 6 cm and 10 cm respectively. If it is melted and recast into a solid cylinder of diameter 14 cm, then find the height of the cylinder.
7. A solid sphere of radius 6 cm is melted into a hollow cylinder of uniform thickness. If the external radius of the base of the cylinder is 5 cm and its height is 32 cm, then find the thickness of the cylinder.
8. A hemispherical bowl is filled to the brim with juice. The juice is poured into a cylindrical vessel whose radius is 50% more than its height. If the diameter is same for both the bowl and the cylinder then find the percentage of juice that can be transferred from the bowl into the cylindrical vessel.

**Exercise 7.5****Multiple choice questions**

1. The curved surface area of a right circular cone of height 15 cm and base diameter 16 cm is
(A) $60\pi\text{ cm}^2$ (B) $68\pi\text{ cm}^2$ (C) $120\pi\text{ cm}^2$ (D) $136\pi\text{ cm}^2$
2. If two solid hemispheres of same base radius r units are joined together along their bases, then curved surface area of this new solid is
(A) $4\pi r^2$ sq. units (B) $6\pi r^2$ sq. units (C) $3\pi r^2$ sq. units (D) $8\pi r^2$ sq. units
3. The height of a right circular cone whose radius is 5 cm and slant height is 13 cm will be
(A) 12 cm (B) 10 cm (C) 13 cm (D) 5 cm
4. If the radius of the base of a right circular cylinder is halved keeping the same height, then the ratio of the volume of the cylinder thus obtained to the volume of original cylinder is
(A) 1:2 (B) 1:4 (C) 1:6 (D) 1:8
5. The total surface area of a cylinder whose radius is $\frac{1}{3}$ of its height is
(A) $\frac{9\pi h^2}{8}$ sq. units (B) $24\pi h^2$ sq. units (C) $\frac{8\pi h^2}{9}$ sq. units (D) $\frac{56\pi h^2}{9}$ sq. units
6. In a hollow cylinder, the sum of the external and internal radii is 14 cm and the width is 4 cm. If its height is 20 cm, the volume of the material in it is
(A) $5600\pi\text{ cm}^3$ (B) $1120\pi\text{ cm}^3$ (C) $56\pi\text{ cm}^3$ (D) $3600\pi\text{ cm}^3$

7. If the radius of the base of a cone is tripled and the height is doubled then the volume is
(A) made 6 times (B) made 18 times (C) made 12 times (D) unchanged
8. The total surface area of a hemi-sphere is how much times the square of its radius.
(A) π (B) 4π (C) 3π (D) 2π
9. A solid sphere of radius x cm is melted and cast into a shape of a solid cone of same radius. The height of the cone is
(A) $3x$ cm (B) x cm (C) $4x$ cm (D) $2x$ cm
10. A frustum of a right circular cone is of height 16cm with radii of its ends as 8cm and 20cm. Then, the volume of the frustum is
(A) $3328\pi \text{ cm}^3$ (B) $3228\pi \text{ cm}^3$ (C) $3240\pi \text{ cm}^3$ (D) $3340\pi \text{ cm}^3$
11. A shuttle cock used for playing badminton has the shape of the combination of
(A) a cylinder and a sphere (B) a hemisphere and a cone
(C) a sphere and a cone (D) frustum of a cone and a hemisphere
12. A spherical ball of radius r_1 units is melted to make 8 new identical balls each of radius r_2 units. Then $r_1 : r_2$ is
(A) 2:1 (B) 1:2 (C) 4:1 (D) 1:4
13. The volume (in cm^3) of the greatest sphere that can be cut off from a cylindrical log of wood of base radius 1 cm and height 5 cm is
(A) $\frac{4}{3}\pi$ (B) $\frac{10}{3}\pi$ (C) 5π (D) $\frac{20}{3}\pi$
14. The height and radius of the cone of which the frustum is a part are h_1 units and r_1 units respectively. Height of the frustum is h_2 units and radius of the smaller base is r_2 units. If $h_2 : h_1 = 1 : 2$ then $r_2 : r_1$ is
(A) 1 : 3 (B) 1 : 2 (C) 2 : 1 (D) 3 : 1
15. The ratio of the volumes of a cylinder, a cone and a sphere, if each has the same diameter and same height is
(A) 1:2:3 (B) 2:1:3 (C) 1:3:2 (D) 3:1:2

Unit Exercise - 7



1. The barrel of a fountain-pen cylindrical in shape, is 7 cm long and 5 mm in diameter. A full barrel of ink in the pen will be used for writing 330 words on an average. How many words can be written using a bottle of ink containing one fifth of a litre?
2. A hemi-spherical tank of radius 1.75 m is full of water. It is connected with a pipe which empties the tank at the rate of 7 litre per second. How much time will it take to empty the tank completely?
3. Find the maximum volume of a cone that can be carved out of a solid hemisphere of radius r units.
4. An oil funnel of tin sheet consists of a cylindrical portion 10 cm long attached to a frustum of a cone. If the total height is 22 cm, the diameter of the cylindrical portion



Exercise 8.5



Multiple choice questions

- Which of the following is not a measure of dispersion?
(A) Range (B) Standard deviation
(C) Arithmetic mean (D) Variance
- The range of the data 8, 8, 8, 8, 8, ... 8 is
(A) 0 (B) 1 (C) 8 (D) 3
- The sum of all deviations of the data from its mean is
(A) Always positive (B) always negative (C) zero (D) non-zero integer
- The mean of 100 observations is 40 and their standard deviation is 3. The sum of squares of all observations is
(A) 40000 (B) 160900 (C) 160000 (D) 30000
- Variance of first 20 natural numbers is
(A) 32.25 (B) 44.25 (C) 33.25 (D) 30
- The standard deviation of a data is 3. If each value is multiplied by 5 then the new variance is
(A) 3 (B) 15 (C) 5 (D) 225
- If the standard deviation of x, y, z is p then the standard deviation of $3x + 5, 3y + 5, 3z + 5$ is
(A) $3p + 5$ (B) $3p$ (C) $p + 5$ (D) $9p + 15$
- If the mean and coefficient of variation of a data are 4 and 87.5% then the standard deviation is
(A) 3.5 (B) 3 (C) 4.5 (D) 2.5
- Which of the following is incorrect?
(A) $P(A) > 1$ (B) $0 \leq P(A) \leq 1$ (C) $P(\phi) = 0$ (D) $P(A) + P(\bar{A}) = 1$
- The probability a red marble selected at random from a jar containing p red, q blue and r green marbles is
(A) $\frac{q}{p+q+r}$ (B) $\frac{p}{p+q+r}$ (C) $\frac{p+q}{p+q+r}$ (D) $\frac{p+r}{p+q+r}$
- A page is selected at random from a book. The probability that the digit at units place of the page number chosen is less than 7 is
(A) $\frac{3}{10}$ (B) $\frac{7}{10}$ (C) $\frac{3}{9}$ (D) $\frac{7}{9}$
- The probability of getting a job for a person is $\frac{x}{3}$. If the probability of not getting the job is $\frac{2}{3}$ then the value of x is
(A) 2 (B) 1 (C) 3 (D) 1.5

13. Kamalam went to play a lucky draw contest. 135 tickets of the lucky draw were sold. If the probability of Kamalam winning is $\frac{1}{9}$, then the number of tickets bought by Kamalam is
 (A) 5 (B) 10 (C) 15 (D) 20
14. If a letter is chosen at random from the English alphabets $\{a, b, \dots, z\}$, then the probability that the letter chosen precedes x
 (A) $\frac{12}{13}$ (B) $\frac{1}{13}$ (C) $\frac{23}{26}$ (D) $\frac{3}{26}$
15. A purse contains 10 notes of ₹2000, 15 notes of ₹500, and 25 notes of ₹200. One note is drawn at random. What is the probability that the note is either a ₹500 note or ₹200 note?
 (A) $\frac{1}{5}$ (B) $\frac{3}{10}$ (C) $\frac{2}{3}$ (D) $\frac{4}{5}$

Unit Exercise - 8



1. The mean of the following frequency distribution is 62.8 and the sum of all frequencies is 50. Compute the missing frequencies f_1 and f_2 .

Class Interval	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	f_1	10	f_2	7	8

2. The diameter of circles (in mm) drawn in a design are given below.

Diameters	33-36	37-40	41-44	45-48	49-52
Number of circles	15	17	21	22	25

Calculate the standard deviation.

3. The frequency distribution is given below.

x	k	$2k$	$3k$	$4k$	$5k$	$6k$
f	2	1	1	1	1	1

In the table, k is a positive integer, has a variance of 160. Determine the value of k .

4. The standard deviation of some temperature data in degree celsius ($^{\circ}\text{C}$) is 5. If the data were converted into degree Fahrenheit ($^{\circ}\text{F}$) then what is the variance?
5. If for a distribution, $\sum (x - 5) = 3$, $\sum (x - 5)^2 = 43$, and total number of observations is 18, find the mean and standard deviation.
6. Prices of peanut packets in various places of two cities are given below. In which city, prices were more stable?

Prices in city A	20	22	19	23	16
Prices in city B	10	20	18	12	15

7. If the range and coefficient of range of the data are 20 and 0.2 respectively, then find the largest and smallest values of the data.