

# Case-Based Questions

## (Issued by CBSE in April-2021)

### Math Standard-X

**Q. 1.** 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 QB, 2021]



**(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 |

**Sol.** Correct option: (c).

**Explanation:** We have to find the LCM of 32 and 36.

$$\text{LCM}(32, 36) = 2^5 \times 3^2 = 288$$

Hence, the minimum number of books required to distribute equally among students of section A and section B are 288.

**(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 |

**Sol.** Correct option: (b).

**(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) $2^0 \times 3^0$ |

**Sol.** Correct option: (a).

**(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

**Sol.** Correct option: (b).

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

- |              |              |
|--------------|--------------|
| (a) $ab$     | (b) $a^2b^2$ |
| (c) $a^3b^2$ | (d) $a^3b^3$ |

**Sol.** Correct option: (b).

**Explanation:** Given,  $p = ab^2 = a \times b \times b$

$$q = a^2b = a \times a \times b$$

$$\text{LCM of } (p, q) = a^2b^2$$

**Q. 2.** 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 QB, 2021]



**(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 |

**Sol.** Correct option: (b).

**Explanation:** No. of participants seated in each room would be HCF of all the three values above.

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

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

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

Hence, HCF = 12.

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

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

**Sol.** Correct option: (d).

**Explanation:** Minimum no. of rooms required are total number of students divided by number of students in each room.

$$\begin{aligned} \text{No. of rooms} &= \frac{60 + 84 + 108}{12} \\ &= 21 \end{aligned}$$

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

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

**Sol.** Correct option: (a).

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

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

**Sol.** Correct option: (d).

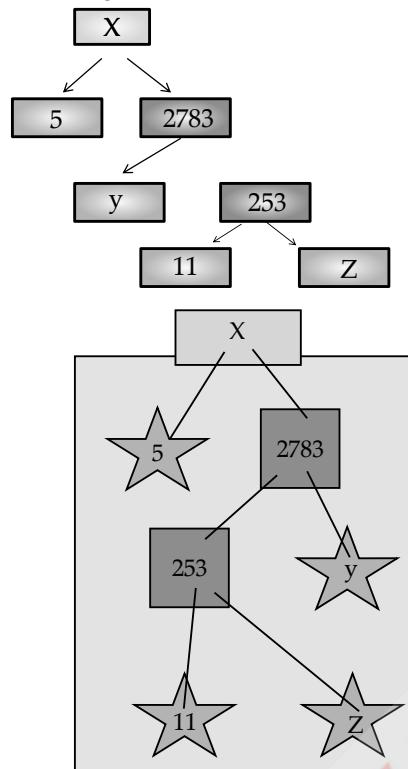
**(v) 108 can be expressed as a product of its primes as**

- |                      |                      |
|----------------------|----------------------|
| (a) $2^3 \times 3^2$ | (b) $2^3 \times 3^3$ |
| (c) $2^2 \times 3^2$ | (d) $2^2 \times 3^3$ |

**Sol.** Correct option: (d).

**Q. 3.** 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 asks for your help in completing a quiz for the audience.

Observe the following factor tree and answer the following:



(i) What will be the value of  $x$ ?

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

Sol. Correct option: (b).

Explanation:  $x = 2783 \times 5$   
 $x = 13915$

(ii) What will be the value of  $y$ ?

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

Sol. Correct option: (c).

Explanation:  $2783 = y \times 253$

$$y = \frac{2783}{253}$$

$$y = 11$$

(iii) What will be the value of  $z$ ?

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

Sol. Correct option: (b).

Explanation:  $253 = 11 \times z$

$$z = \frac{253}{11}$$

$$z = 23$$

(iv) According to Fundamental Theorem of Arithmetic

13915 is a

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

Sol. Correct option: (a).

(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) $5 \times 11^2 \times 23^2$ |

Sol. Correct option: (c).

**Q. 4.** 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 QB, 2021]





- (i) In the standard form of quadratic polynomial,  $ax^2 + bx + c$ ,  $a$ ,  $b$  and  $c$  are
- All are real numbers.
  - All are rational numbers.
  - ' $a$ ' is a non zero real number and  $b$  and  $c$  are any real numbers.
  - All are integers.

**Sol.** Correct option: (c).

- (ii) If the roots of the quadratic polynomial are equal, where the discriminant  $D = b^2 - 4ac$ , then
- $D > 0$
  - $D < 0$
  - $D$
  - $D = 0$

**Sol.** Correct option: (d).

**Explanation:** If the roots of the quadratic polynomial are equal, then discriminant is equal to zero

$$D = b^2 - 4ac = 0$$

- (iii) If  $\alpha$  are  $\frac{1}{\alpha}$  the zeroes of the quadratic polynomial

$2x^2 - x + 8k$ , then  $k$  is

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>4</li> <li><math>\frac{1}{4}</math></li> </ol> | <ol style="list-style-type: none"> <li><math>\frac{-1}{4}</math></li> <li>2</li> </ol> |
|---|--|

**Sol.** Correct option: (b).

**Explanation:** Given equation,  $2x^2 - x + 8k$

$$\text{Sum of zeroes} = \alpha + \frac{1}{\alpha}$$

$$\text{Product of zeroes} = \alpha \cdot \frac{1}{\alpha} = 1$$

$$\text{Product of zeroes} = \frac{c}{a} = \frac{8k}{2}$$

$$\text{So, } \frac{8k}{2} = 1$$

$$k = \frac{2}{8}$$

$$k = \frac{1}{4}$$

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

- Intersects  $x$ -axis at two distinct points.
- Touches  $x$ -axis at a point.

- Neither touches nor intersects  $x$ -axis.

- Either touches or intersects  $x$ -axis.

**Sol.** Correct option: (c).

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

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li><math>k\left(-px^2 + \frac{x}{p} + 1\right)</math></li> <li><math>k\left(px^2 - \frac{x}{p} - 1\right)</math></li> </ol> | <ol style="list-style-type: none"> <li><math>k\left(x^2 + px - \frac{1}{p}\right)</math></li> <li><math>k\left(x^2 + px + \frac{1}{p}\right)</math></li> </ol> |
|---|--|

**Sol.** Correct option: (c).

- Q. 5. 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 QB, 2021]



- (i) The shape of the poses shown is

- Spiral
- Ellipse
- Linear
- Parabola

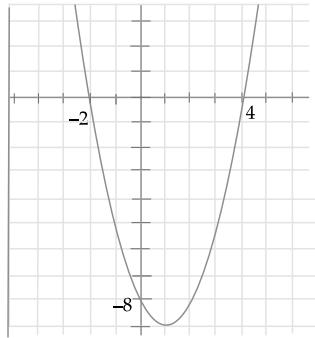
**Sol.** Correct option: (d).

(ii) The graph of parabola opens downwards, if \_\_\_\_\_

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

Sol. Correct option: (c).

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



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

Sol. Correct option: (c).

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

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

Sol. Correct option: (b).

(v) The zeroes of the quadratic polynomial

$$4\sqrt{3}x^2 + 5x - 2\sqrt{3}$$

- (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)  $-\frac{2}{\sqrt{3}}, -\frac{\sqrt{3}}{4}$

Sol. Correct option: (b).

Explanation:  $4\sqrt{3}x^2 + 5x - 2\sqrt{3}$  (given)

$$\begin{aligned} &= 4\sqrt{3}x^2 + (8-3)x - 2\sqrt{3} \\ &= 4\sqrt{3}x^2 + 8x - 3x - 2\sqrt{3} \\ &= 4x(\sqrt{3}x + 2) - \sqrt{3}(\sqrt{3}x + 2) \\ &= (\sqrt{3}x + 2)(4x - \sqrt{3}) \end{aligned}$$

$$\text{Hence, zeroes of polynomial} = \frac{-2}{\sqrt{3}}, \frac{\sqrt{3}}{4}$$

Q. 6. 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 QB, 2021]



(i) The shape of the path traced shown is

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

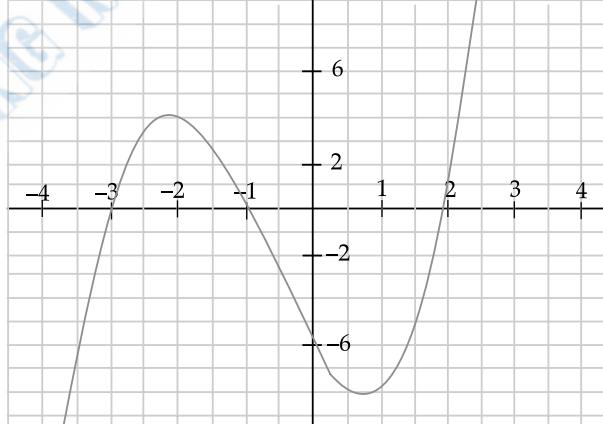
Sol. Correct option: (d).

(ii) The graph of parabola opens upwards, if \_\_\_\_\_

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

Sol. Correct option: (c).

(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

Sol. Correct option: (d).

Explanation: The number of zeroes of polynomial is the number of times the curve intersects the  $x$ -axis, i.e. attains the value 0.

Here, the polynomial meets the  $x$ -axis at 3 points.

So, number of zeroes = 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

Sol. Correct option: (c).

(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)  $x^3 + 2x^2 + 5x + 6$

Sol. Correct option: (a).

**Explanation:** Since, the three zeroes =  $-3, -1, 2$

Hence, the expression is  $(x + 3)(x + 1)(x - 2)$

$$\begin{aligned} &= [x^2 + x + 3x + 3](x - 2) \\ &= x^3 + 4x^2 + 3x - 2x^2 - 8x - 6 \\ &= x^3 + 2x^2 - 5x - 6 \end{aligned}$$

**Q. 7.** 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.

[CBSE QB, 2021]

Type of Question	Marks given for correct answer	Marks deducted for wrong answer
True/False	1	0.25

Let the no of questions whose answer is known to the student  $x$  and questions attempted by cheating be  $y$

$$\begin{aligned} x + y &= 120 \\ \frac{x-1}{4y} &= 90 \end{aligned}$$

Solving these two

$$x = 96 \text{ and } y = 24$$

(i) If answer to all questions he attempted by guessing were wrong, then how many questions did he answer correctly?

Sol. He answered 96 questions correctly.

(ii) How many questions did he guess ?

Sol. He attempted 24 questions by guessing.

(iii) If answer to all questions he attempted by guessing were wrong and answered 80 correctly, then how many marks he got ?

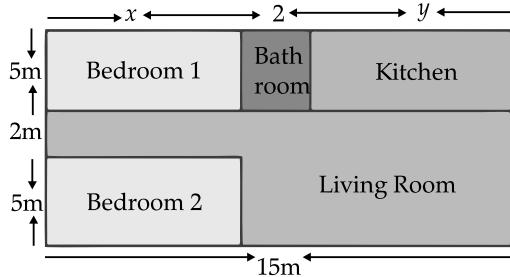
Sol. Marks =  $80 - \frac{1}{4} \times 40 = 70$

(iv) If answer to all questions he attempted by guessing were wrong, then how many questions answered correctly to score 95 marks ?

Sol.  $x - \frac{1}{4} \times (120 - x) = 95$

$$5x = 500, x = 100$$

**Q. 8.** 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 QB, 2021]



Based on the above information, answer the following questions:

(i) Form the pair of linear equations in two variables from this situation.

Sol. Area of two bedrooms =  $10x$  sq. m

Area of kitchen =  $5y$  sq. m

$$10x + 5y = 95$$

$$2x + y = 19$$

$$\text{Also, } x + 2 + y = 15$$

$$x + y = 13$$

(ii) Find the length of the outer boundary of the layout.

$$\begin{aligned} \text{Sol. Length of outer boundary} &= 12 + 15 + 12 + 15 \\ &= 54 \text{ m} \end{aligned}$$

(iii) Find the area of each bedroom and kitchen in the layout.

Sol. On solving two equation part (i)

$$x = 6 \text{ m and } y = 7 \text{ m}$$

$$\text{area of bedroom} = 5 \times 6 = 30 \text{ m}$$

$$\text{area of kitchen} = 5 \times 7 = 35 \text{ m}$$

(iv) Find the area of living room in the layout.

$$\begin{aligned} \text{Sol. Area of living room} &= (15 \times 7) - 30 \\ &= 105 - 30 \\ &= 75 \text{ sq. m} \end{aligned}$$

(v) Find the cost of laying tiles in kitchen at the rate of ₹ 50 per sq. m

$$\begin{aligned} \text{Sol. Total cost of laying tiles in the kitchen} &= ₹ 50 \times 35 \\ &= ₹ 1750 \end{aligned}$$

**Q. 9.** 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

[CBSE QB, 2021]



Name of the city	Distance travelled (km)	Amount paid (₹)
City A	10	75
	15	110

City B	8	9
	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.

Refer situation 1

(i) If the fixed charges of auto rickshaw be ₹  $x$  and the running charges be ₹  $y$  km/hr, 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)  $10x + y = 75, 15x + y = 110$

**Sol.** Correct option: (b).

**Explanation:** According to given situation, we have

$$x + 10y = 75 \quad \dots(i)$$

$$x + 15y = 110 \quad \dots(ii)$$

(ii) A person travels a distance of 50 km. The amount he has to pay is

- (a) ₹ 155
- (b) ₹ 255
- (c) ₹ 355
- (d) ₹ 455

**Sol.** Correct option: (c).

**Explanation:** Solving two equations,

$$x + 10y = 75$$

$$x + 15y = 110$$

$$\begin{array}{r} - \\ - \\ \hline -5y = -35 \end{array}$$

$$y = 7$$

Now, putting  $y = 7$  in equation (i)

$$x + 10 \times 7 = 75$$

$$x + 70 = 75$$

$$x = 75 - 70$$

$$x = 5$$

Now, if a person travels a distance of 50 km

$$\begin{aligned} \text{then, } \text{amount} &= x + 50y \\ &= 5 + 50 \times 7 \\ &= 5 + 350 \\ &= 355 \end{aligned}$$

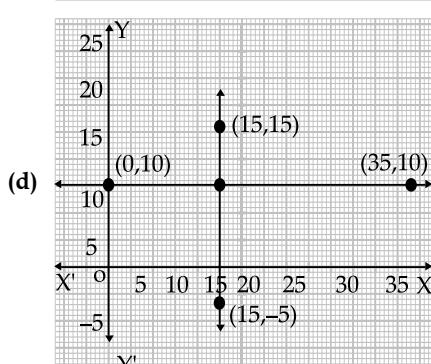
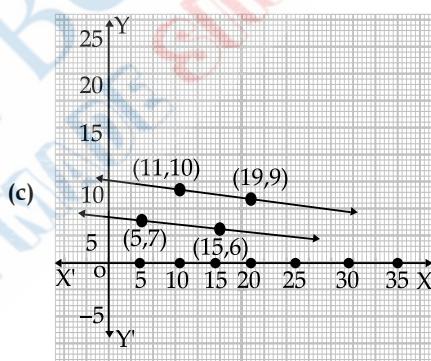
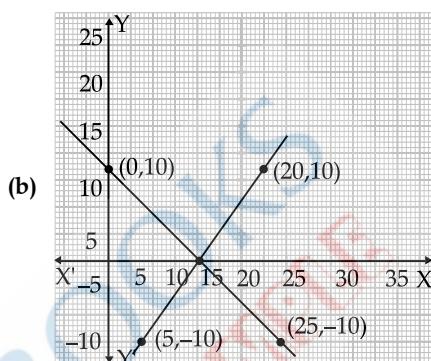
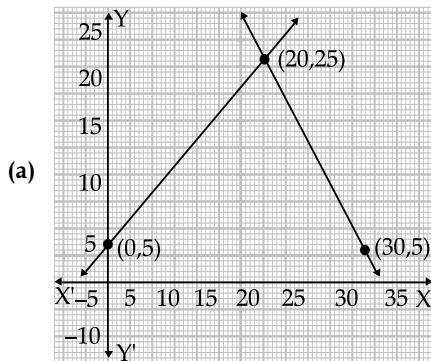
Refer situation 2

(iii) What will a person have to pay for travelling a distance of 30 km ?

- (a) ₹ 185
- (b) ₹ 289
- (c) ₹ 275
- (d) ₹ 305

**Sol.** Correct option: (b).

(iv) The graph of lines representing the conditions are:  
(situation 2)



**Sol.** Correct option: (c).

**Q. 10.** Raj and Ajay are very close friends. Both the families decide to go to Ranikhet by their own cars. Raj's car travels at a speed of  $x$  km/h while Ajay's car travels 5 km/h faster than Raj's car. Raj took 4 hours more than Ajay to complete the journey of 400 km. [CBSE QB, 2021]



(i) What will be the distance covered by Ajay's car in two hours ?

- (a)  $2(x + 5)$  km      (b)  $(x - 5)$  km  
 (c)  $2(x + 10)$  km      (d)  $(2x + 5)$  km

Sol. Correct option: (a).

**Explanation:** Speed of Raj's car =  $x$  km/hr

Speed of Ajay's car =  $(x + 5)$  km/hr

Distance covered by Ajay in 2 hours

$$= [(x + 5) \times 2] \text{ km} \\ = 2(x + 5) \text{ km.}$$

(ii) Which of the following quadratic equation describe the speed of Raj's car ?

- (a)  $x^2 - 5x - 500 = 0$       (b)  $x^2 + 4x - 400 = 0$   
 (c)  $x^2 + 5x - 500 = 0$       (d)  $x^2 - 4x + 400 = 0$

Sol. Correct option: (c).

(iii) What is the speed of Raj's car ?

- (a) 20 km/hour      (b) 15 km/hour  
 (c) 25 km/hour      (d) 10 km/hour

Sol. Correct option: (c).

(iv) How much time took Ajay to travel 400 km ?

- (a) 20 hour      (b) 40 hour  
 (c) 25 hour      (d) 16 hour

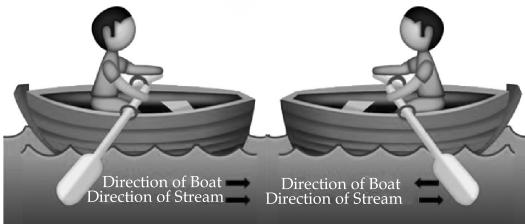
Sol. Correct option: (d).

Q. 11. The speed of a motor boat is 20 km/hr. For covering the distance of 15 km the boat took 1 hour more for upstream than downstream. [CBSE QB, 2021]



Downstream(a)

Upstream(b)



(i) Let speed of the stream be  $x$  km/hr. then speed of the motorboat in upstream will be

- (a) 20 km/hr      (b)  $(20 + x)$  km/hr  
 (c)  $(20 - x)$  km/hr      (d) 2 km/hr

Sol. Correct option: (c).

**Explanation:** Speed of motorboat in upstream

$$= \text{Speed of motorboat}$$

$$- \text{Speed of stream}$$

$$= (20 - x) \text{ km/hr}$$

(ii) What is the relation between speed ,distance and time ?

- (a) speed = (distance )/time  
 (b) distance = (speed )/time  
 (c) time = speed  $\times$  distance  
 (d) speed = distance  $\times$  time

Sol. Correct option: (b).

(iii) Which is the correct quadratic equation for the speed of the current ?

- (a)  $x^2 + 30x - 200 = 0$       (b)  $x^2 + 20x - 400 = 0$   
 (c)  $x^2 + 30x - 400 = 0$       (d)  $x^2 - 20x - 400 = 0$

Sol. Correct option: (c).

(iv) What is the speed of current ?

- (a) 20 km/hour      (b) 10 km/hour  
 (c) 15 km/hour      (d) 25 km/hour

Sol. Correct option: (b).

(v) How much time boat took in downstream?

- (a) 90 minute      (b) 15 minute  
 (c) 30 minute      (d) 45 minute

Sol. Correct option: (c).

Q. 12. India is competitive manufacturing location due to the low cost of manpower and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6th year and 22600 in 9th year.

[CBSE QB, 2021]



Based on the above information, answer the following questions:

(i) Find the production during first year.

Sol. ₹ 5000

**Explanation:**  $a_6 = 16,000$

$$a + (n + 1)d = 16,000$$

$$a + (6 - 1)d = 16,000$$

$$a + 5d = 16,000$$

$$a_9 = 22,600$$

$$a + (n - 1)d = 22,600$$

$$a + (9 - 1)d = 22,600$$

... (i)

$$a + 8d = 22,600$$

... (ii)

Sol. Solving equation (i) and (ii)

$$a + 5d = 16,000$$

$$a + 8d = 22,600$$

$$\begin{array}{r} - \\ - \\ \hline -3d = -6,600 \\ d = 2,200 \end{array}$$

Now, putting  $d = 2,200$  in equation (i)

$$a + 5d = 16,000$$

$$a + 5 \times 2,200 = 16,000$$

$$a + 11,000 = 16,000$$

$$a = 5,000$$

(ii) Find the production during 8<sup>th</sup> year.

Sol. Production during 8<sup>th</sup> year is  $(a + 7d)$

$$= 5000 + 2(2200)$$

$$= 20400$$

(iii) Find the production during first 3 years.

Sol. Production during first 3 years

$$= 5000 + 7200 + 9400$$

$$= 21600$$

(iv) In which year, the production is ₹ 29,200.

Sol.  $N = 12$

Explanation:  $a_n = 29,200$

$$a + (n-1)d = 29,200$$

$$(x-1)2,900 = 29,200 - 5,000$$

$$2,200n - 2,200 = 24,200$$

$$2200n = 26,400$$

$$n = \frac{26,400}{2,200}$$

$$n = 12$$

(v) Find the difference of the production during 7<sup>th</sup> year and 4<sup>th</sup> year.

Sol. Difference =  $18200 - 11600 = 6600$

Q. 13. Your friend Veer wants to participate in a 200 m race. He can currently run that distance in 51 seconds and with each day of practice it takes him 2 seconds less. He wants to do in 31 seconds.

[CBSE QB, 2021]



(i) Which of the following terms are in AP for the given situation

- (a) 51, 53, 55.... (b) 51, 49, 47....  
(c) -51, -53, -55.... (d) 51, 55, 59...

Sol. Correct option: (b).

Explanation:  $a = 51$

$$d = -2$$

$$AP = 51, 49, 47 \dots$$

(ii) What is the minimum number of days he needs to practice till his goal is achieved?

- (a) 10 (b) 12  
(c) 11 (d) 9

Sol. Correct option: (c).

Explanation: Goal = 31 second

$$n = \text{number of days}$$

$$\therefore a_n = 31$$

$$a + (n-1)d = 31$$

$$51 + (n-1)(-2) = 31$$

$$51 - 2n + 2 = 31$$

$$-2n = 31 - 53$$

$$-2n = -22$$

$$n = 11$$

(iii) Which of the following term is not in the AP of the above given situation

- (a) 41 (b) 30  
(c) 37 (d) 39

Sol. Correct option: (b).

(iv) If  $n^{\text{th}}$  term of an AP is given by

$a_n = 2n + 3$  then common difference of an AP is

- (a) 2 (b) 3  
(c) 5 (d) 1

Sol. Correct option: (a).

(v) The value of  $x$ , for which  $2x, x + 10, 3x + 2$  are three consecutive terms of an AP

- (a) 6 (b) -6  
(c) 18 (d) -18

Sol. Correct option: (a).

Explanation: Since,  $2x, x + 10, 3x + 2$  are in AP, this common difference will remain same.

$$x + 10 - 2x = (3x + 2) - (x + 10)$$

$$10 - x = 2x - 8$$

$$\overline{-2x = 18}$$

$$x = 6$$

Q. 14. Your elder brother wants to buy a car and plans to take loan from a bank for his car. He repays his total loan of ₹ 1,18,000 by paying every month starting with the first instalment of ₹ 1000. If he increases the instalment by ₹ 100 every month, answer the following:

[CBSE QB, 2021]



(i) The amount paid by him in 30<sup>th</sup> installment is

- |          |          |
|----------|----------|
| (a) 3900 | (b) 3500 |
| (c) 3700 | (d) 3600 |

Sol. Correct option: (a).

**Explanation:**  $a = 1000$

$$d = 100$$

$$\begin{aligned}a_{80} &= a + (n - 1)d \\&= 1000 + (30 - 1)100 \\&= 1000 + 2900 \\&= 3900\end{aligned}$$

(ii) The amount paid by him in the 30 installments is

- |           |           |
|-----------|-----------|
| (a) 37000 | (b) 73500 |
| (c) 75300 | (d) 75000 |

Sol. Correct option: (b).

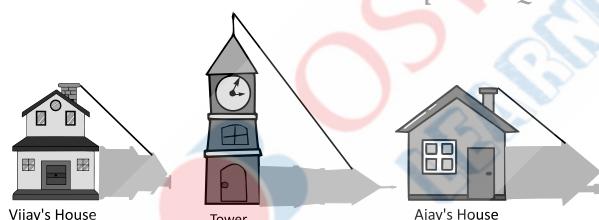
**Explanation:** Sum of 30 installments

$$\begin{aligned}&= \frac{n}{2} [2a + (n - 1)d] \\&= \frac{30}{2} [2 \times 1000 + (30 - 1)100] \\&= 15[2000 + 2900] \\&= 15 \times 4900\end{aligned}$$

#### Q. 15. SIMILAR TRIANGLES

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 is 20 m when Vijay's house casts a shadow 10 m 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.

[CBSE - QB 2021]



(i) What is the height of the tower?

- |           |           |
|-----------|-----------|
| (a) 20 m  | (b) 50 m  |
| (c) 100 m | (d) 200 m |

Sol. Correct Option: (c)

**Explanation:** When two corresponding angles of two triangles are similar, then ratio of sides are equal.

$$\frac{\text{Height of Vijay's house}}{\text{Length of Shadow}} = \frac{\text{Height of tower}}{\text{length of shadow}}$$

$$\frac{20 \text{ m}}{10 \text{ m}} = \frac{\text{Height of tower}}{50 \text{ m}}$$

$$\begin{aligned}\text{Height of tower} &= \frac{20 \times 50}{10} = \frac{1000}{10} \\&= 100 \text{ m.}\end{aligned}$$

(ii) What will be the length of the shadow of the tower when Vijay's house casts a shadow of 12 m?

$$= 73500$$

Total Amount paid in 30 installments = ₹ 73500

(iii) What amount does he still have to pay after 30th installment ?

- |           |           |
|-----------|-----------|
| (a) 45500 | (b) 49000 |
| (c) 44500 | (d) 54000 |

Sol. Correct option: (c).

(iv) If total installments are 40 then amount paid in the last installment ?

- |          |          |
|----------|----------|
| (a) 4900 | (b) 3900 |
| (c) 5900 | (d) 9400 |

Sol. Correct option: (a).

**Explanation:** Amount paid in 40<sup>th</sup> installment,  $a_{40}$

$$\begin{aligned}&= a + (n - 1)d \\&= 1000 + (40 - 1)100 \\&= 1000 + 3900 \\&= 4900\end{aligned}$$

(v) The ratio of the 1<sup>st</sup> installment to the last installment is

- |             |             |
|-------------|-------------|
| (a) 1 : 49  | (b) 10 : 49 |
| (c) 10 : 39 | (d) 39 : 10 |

Sol. Correct option: (b).

- |          |          |
|----------|----------|
| (a) 75 m | (b) 50 m |
| (c) 45 m | (d) 60 m |

Sol. Correct Option: (d)

(iii) What is the height of Ajay's house?

- |          |          |
|----------|----------|
| (a) 30 m | (b) 40 m |
| (c) 50 m | (d) 20 m |

Sol. Correct Option: (b)

**Explanation:**

$$\frac{\text{Height of Vijay's house}}{\text{Length of Shadow}} = \frac{\text{Height of Vijay's house}}{\text{Length of Shadow}}$$

$$\frac{20 \text{ m}}{10 \text{ m}} = \frac{\text{Height of Vijay's house}}{20 \text{ m}}$$

$$\begin{aligned}\text{Height of Ajay's house} &= \frac{20 \text{ m} \times 20 \text{ m}}{10 \text{ m}} \\&= 40 \text{ m.}\end{aligned}$$

(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  |

Sol. Correct Option: (a)

(v) When the tower casts a shadow of 40 m, same time what will be the length of the shadow of Vijay's house?

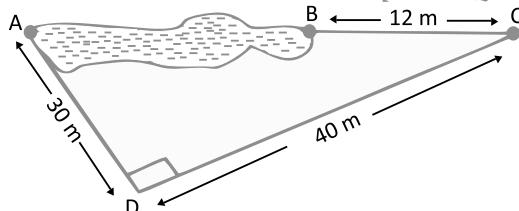
- |          |          |
|----------|----------|
| (a) 15 m | (b) 32 m |
| (c) 16 m | (d) 8 m  |

Sol. Correct Option: (d)

Q. 16. 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 at 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 is a distance of 30 m from D such that  $\angle ADC = 90^\circ$ .

[CBSE - QB 2021]



- (i) Which property of geometry will be used to find the distance AC?
- Similarity of triangles
  - Thales Theorem
  - Pythagoras Theorem
  - Area of similar triangles

Sol. Correct Option: (c)

- (ii) What is the distance AC?

- 50 m
- 12 m
- 100 m
- 70 m

Sol. Correct Option: (a)

**Explanation:** According to the pythagoras,

$$\begin{aligned} AC^2 &= AD^2 + CD^2 \\ AC^2 &= (30 \text{ m})^2 + (40 \text{ m})^2 \\ AC^2 &= 900 + 1600 \\ AC^2 &= 2500 \\ AC &= 50 \text{ m} \end{aligned}$$

- (iii) Which of the following does not form a Pythagoras triplet?

- (7, 24, 25)
- (15, 8, 17)
- (5, 12, 13)
- (21, 20, 28)

Sol. Correct Option: (d)

- (iv) Find the length AB?

- 12 m
- 38 m
- 50 m
- 100 m

Sol. Correct Option: (b)

**Explanation:**  $AC = 50 \text{ m}$

$$BC = 12 \text{ m}$$

$$AC = AB + BC$$

$$50 \text{ m} = AB + 12 \text{ m}$$

$$AB = 50 \text{ m} - 12 \text{ m}$$

$$AB = 38 \text{ m}$$

- (v) Find the length of the rope used.

- 120 m
- 70 m
- 82 m
- 22 m

Sol. Correct Option: (c)

**Explanation:**

$$\begin{aligned} \text{Length of Rope} &= BC + CD + DA \\ &= 12 \text{ m} + 40 \text{ m} + 30 \text{ m} \\ &= 82 \text{ m} \end{aligned}$$

Q. 17.

### SCALE FACTOR

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 resizing, 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 above 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.

[CBSE - QB 2021]

- (i) If the length of the model is 11 cm, then the overall length of the engine in the photograph above, including the couplings(mechanism used to connect) is:

- 22 cm
- 220 cm
- 220 m
- 22 m

Sol. Correct Option: (a)

- (ii) What will affect the similarity of any two polygons?

- They are flipped horizontally
- They are dilated by a scale factor
- They are translated down
- They are not the mirror image of one another.

Sol. Correct Option: (d)

- (iii) What is the actual width of the door if the width of the door in photograph is 0.35 cm?

- 0.7 m
- 0.7 cm
- 0.07 cm
- 0.07 m

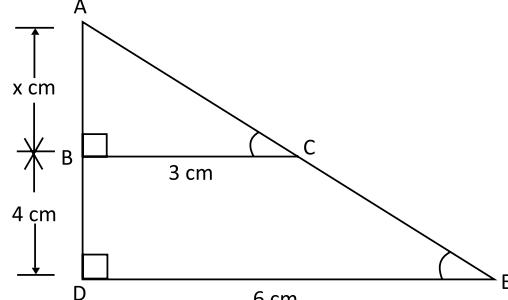
Sol. Correct Option: (a)

- (iv) If two similar triangles have a scale factor 5:3 which statement regarding the two triangles is true?

- The ratio of their perimeters is 15:1
- Their altitudes have a ratio 25:15
- Their medians have a ratio 10:4
- Their angle bisectors have a ratio 11:5

Sol. Correct Option: (b)

- (v) The length of AB in the given figure:



- (a) 8 cm  
(c) 4 cm

- (b) 6 cm  
(d) 10 cm

Sol. Correct Option: (c)

**Explanation:** Since,  $\triangle ABC$  and  $\triangle ADE$  are similar, then their ratio of corresponding sides are equal.

$$\frac{AB}{BC} = \frac{AB+BD}{DE}$$

$$\frac{x}{3 \text{ cm}} = \frac{(x+4) \text{ cm}}{6 \text{ cm}}$$

$$6x = 3(x+4)$$

$$6x = 3x + 12$$

$$6x - 3x = 12$$

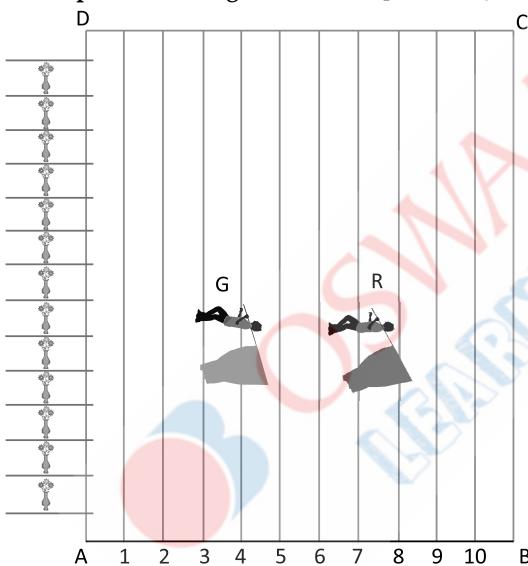
$$3x = 12$$

$$x = 4$$

Hence,  $AB = 4 \text{ cm}$ .

**Q. 18.** 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  $1/4^{\text{th}}$  the distance AD on the 2<sup>nd</sup> line and posts a green flag. Preet runs  $1/5^{\text{th}}$  distance AD on the eighth line and posts a red flag.

[CBSE - QB 2021]



(i) Find the position of green flag

- (a) (2, 25)  
(c) (25, 2)
- (b) (2, 0.25)  
(d) (0, -25)

Sol. Correct option: (a).

(ii) Find the position of red flag

- (a) (8, 0)  
(c) (8, 20)
- (b) (20, 8)  
(d) (8, 0.2)

Sol. Correct option: (c).

(iii) What is the distance between both the flags ?

- (a)  $\sqrt{41}$   
(b)  $\sqrt{61}$
- (c)  $\sqrt{51}$

Sol. Correct option: (c).

**Explanation:** Position of Green flag = (2, 25)

Position of Red flag = (8, 20)

Distance between both the flags

$$\begin{aligned}\sqrt{(8-2)^2 + (20-25)^2} &= \sqrt{6^2 + (-5)^2} \\ &= \sqrt{36 + 25} \\ &= \sqrt{61}\end{aligned}$$

(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  
(c) (2, 8.5)
- (b) (10, 22)  
(d) (2.5, 20)

Sol. Correct option: (a).

**Explanation:** Position of blue flag

Mid-point of line segment joining the green and red flags

$$\begin{aligned}&= \left( \frac{2+8}{2}, \frac{25+20}{2} \right) \\ &= (5, 22.5)\end{aligned}$$

(v) If Joy has to post a flag at one-fourth 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)  
(c) (2.25, 8.5)
- (b) (0.5, 12.5)  
(d) (25, 20)

Sol. Correct option: (a).

**Explanation:** Position of Joy's flag

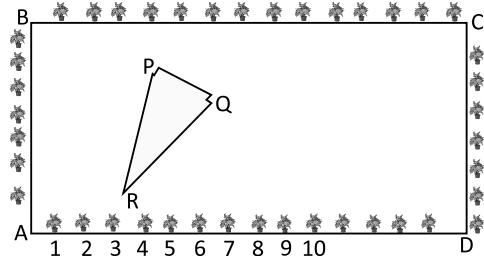
= Mid-point of line segment joining green and blue flags

$$= \left[ \frac{2+5}{2}, \frac{25+22.5}{2} \right]$$

$$= [3.5, 23.75] \sim [3.5, 24]$$

**Q. 19.** The class X students school in Krishnagar have been allotted a rectangular plot of land for their gardening activity. Saplings of Gulmohar are planted on the boundary at a distance of 1 m from each other. There is triangular grassy lawn in the plot as shown in the figure. The students are to sow seeds of flowering plants on the remaining area of the plot.

[CBSE - QB 2021]



(i) Taking A as origin, find the coordinates of P.

- (a) (4, 6)  
(c) (0, 6)
- (b) (6, 4)  
(d) (4, 0)

Sol. Correct option: (a).

(ii) What will be the coordinates of R, if C is the origin ?

- (a) (8, 6)      (b) (3, 10)  
 (c) (10, 3)      (d) (0, 6)

**Sol.** Correct option: (c).

**(iii) What will be the coordinates of Q, if C is the origin ?**

- (a) (6, 13)      (b) (-6, 13)  
 (c) (-13, 6)      (d) (13, 6)

**Sol.** Correct option: (d).

**(iv) Calculate the area of the triangles if A is the origin.**

- (a) 4.5      (b) 6  
 (c) 8      (d) 6.25

**Sol.** Correct option: (a).

**Explanation:** Coordinates of  $P = (4, 6)$

Coordinates of  $Q = (3, 2)$

Coordinates of  $R = (6, 5)$

$$\begin{aligned}\text{Area of triangle } PQR &= \frac{1}{2} [x_1(y_2 - y_3) + x_2(y_3 - y_1) \\&\quad + x_3(y_1 - y_2)] \\&= \frac{1}{2} [4(-3) + 3(-1) + 6(4)] \\&= \frac{1}{2} [-12 + (-3) + 24] \\&= \frac{1}{2} [-12 + 21] \\&= \frac{1}{2}[9] \\&= 4.5 \text{ sq. units.}\end{aligned}$$

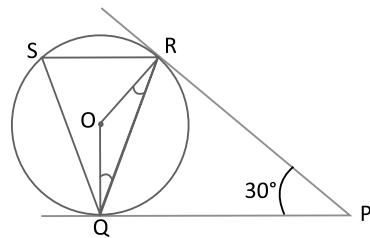
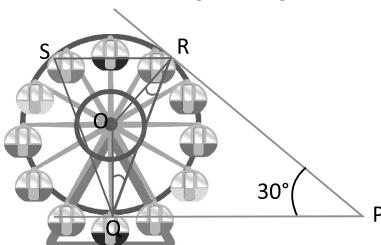
**(v) Calculate the area of the triangles if C is the origin.**

- (a) 8      (b) 5  
 (c) 6.25      (d) 4.5

**Sol.** Correct option: (d).

**Q. 20. A Ferris wheel (or a big wheel in the United Kingdom) is an amusement ride consisting of a rotating upright wheel with multiple passenger-carrying components (commonly referred to as passenger cars, cabins, tubs, capsules, gondolas, or pods) attached to the rim in such a way that as the wheel turns, they are kept upright, usually by gravity.**

After taking a ride in Ferris wheel, Aarti came out from the crowd and was observing her friends who were enjoying the ride. She was curious about the different angles and measures that the wheel will form. She forms the figure as given below.



[CBSE - QB 2021]

**(i) In the given figure find  $\angle ROQ$ .**

- (a) 60      (b) 100  
 (c) 150      (d) 90

**Sol.** Correct option: (c).

**(ii) Find  $\angle RQP$ .**

- (a) 75      (b) 60  
 (c) 30      (d) 90

**Sol.** Correct option: (a).

**(iii) Find  $\angle RSQ$ .**

- (a) 60      (b) 75  
 (c) 100      (d) 30

**Sol.** Correct option: (b).

**(iv) Find  $\angle ORP$ .**

- (a) 90      (b) 70  
 (c) 100      (d) 60

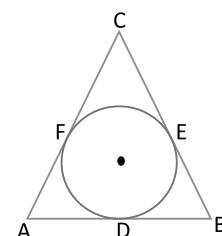
**Sol.** Correct option: (a).

**Explanation:**  $\angle ORP = 90^\circ$

Because, radius of circle is perpendicular to tangent.

**Q. 21. Varun has been selected by his School to design logo for Sports Day T-shirts for students and staff. The logo design is as given in the figure and he is working on the fonts and different colours according to the theme. In given figure, a circle with centre O is inscribed in a  $\triangle ABC$ , such that it touches the sides AB, BC and CA at points D, E and F respectively. The lengths of sides AB, BC and CA are 12 cm, 8 cm and 10 cm respectively.**

[CBSE - QB 2021]



(i) Find the length of AD.

- |       |       |
|-------|-------|
| (a) 7 | (b) 8 |
| (c) 5 | (d) 9 |

Sol. Correct option: (a).

(ii) Find the Length of BE.

- |       |       |
|-------|-------|
| (a) 8 | (b) 5 |
| (c) 2 | (d) 9 |

Sol. Correct option: (b).

(iii) Find the length of CF.

- |       |       |
|-------|-------|
| (a) 9 | (b) 5 |
| (c) 2 | (d) 3 |

Sol. Correct option: (d).

(iv) If radius of the circle is 4 cm, find the area of  $\Delta OAB$ .

- |        |        |
|--------|--------|
| (a) 20 | (b) 36 |
| (c) 24 | (d) 48 |

Sol. Correct option: (c).

(v) Find area of  $\Delta ABC$

- |         |        |
|---------|--------|
| (a) 50  | (b) 60 |
| (c) 100 | (d) 90 |

Sol. Correct option: (b).

**Q. 22.** A group of students of class X visited India Gate on an education trip. The teacher and students had interest in history as well. The teacher narrated that India Gate, official name Delhi Memorial, originally called All-India War Memorial, monumental sandstone arch in New Delhi, dedicated to the troops of British India who died in wars fought between 1914 and 1919. The teacher also said that India Gate, which is located at the eastern end of the Rajpath (formerly called the Kings way), is about 138 feet (42 metres) in height.

[CBSE - QB 2021]



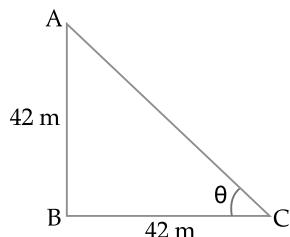
(i) What is the angle of elevation if they are standing at a distance of 42 m away from the monument?

- |                |                |
|----------------|----------------|
| (a) $30^\circ$ | (b) $45^\circ$ |
| (c) $60^\circ$ | (d) $0^\circ$  |

Sol. Correct option: (b).

**Explanation:** Height of Indian gate = 42 m

Distance between students and Indian gate = 42 cm



Now,

$$\tan \theta = \frac{AB}{BC}$$

$$\tan \theta = \frac{42}{42}$$

$$\tan \theta = 1$$

$$\tan \theta = \tan 45^\circ$$

$$\theta = 45^\circ$$

Hence, angle of elevation =  $45^\circ$

(ii) They want to see the tower at an angle of  $60^\circ$ . So, they want to know the distance where they should stand and hence find the distance.

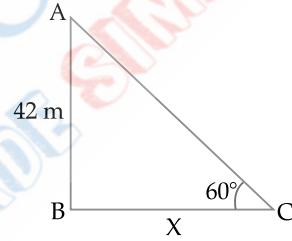
- |             |             |
|-------------|-------------|
| (a) 25.24 m | (b) 20.12 m |
| (c) 42 m    | (d) 24.64 m |

Sol. Correct option: (a).

**Explanation:** Height of India gate = 42 cm

$$\text{Angle} = 60^\circ$$

Let the distance between students and India gate =  $x$  m.



Now,

$$\tan \theta = \frac{AB}{BC}$$

$$\tan 60^\circ = \frac{42}{x}$$

$$\sqrt{3} = \frac{42}{x}$$

$$x = \frac{42}{\sqrt{3}}$$

$$= \frac{42 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}}$$

$$= \frac{42\sqrt{3}}{3}$$

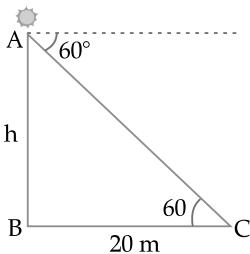
$$= 14\sqrt{3} \text{ m} = 25.24 \text{ m}$$

(iii) If the altitude of the Sun is at  $60^\circ$ , then the height of the vertical tower that will cast a shadow of length 20 m is

- |                             |                             |
|-----------------------------|-----------------------------|
| (a) $20\sqrt{3}$ m          | (b) $\frac{20}{\sqrt{3}}$ m |
| (c) $\frac{15}{\sqrt{3}}$ m | (d) $15\sqrt{3}$ m          |

Sol. Correct option: (a).

**Explanation:**



Let, the height of tower =  $h$

$$\text{Now, } \tan \theta = \frac{AB}{BC}$$

$$\tan 60^\circ = \frac{h}{20}$$

$$\sqrt{3} = \frac{h}{20}$$

$$h = 20\sqrt{3}$$

- (iv) The ratio of the length of a rod and its shadow is 1 : 1. The angle of elevation of the Sun is

- (a)  $30^\circ$       (b)  $45^\circ$   
 (c)  $60^\circ$       (d)  $90^\circ$

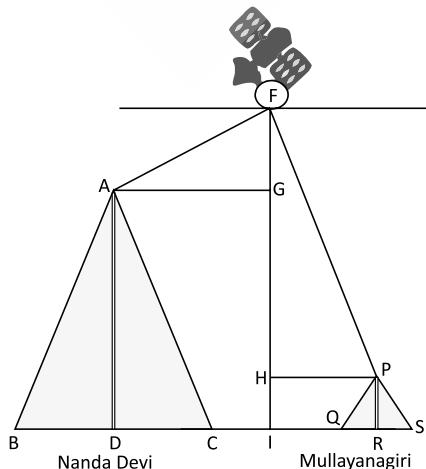
Sol. Correct option: (b).

- (v) The angle formed by the line of sight with the horizontal when the object viewed is below the horizontal level is

- (a) corresponding angle  
 (b) angle of elevation  
 (c) angle of depression  
 (d) complete angle

Sol. Correct option: (a).

- Q. 23.** A Satellite flying at height  $h$  is watching the top of the two tallest mountains in Uttarakhand and Karnataka, them being Nanda Devi (height 7,816 m) and Mullayanagiri (height 1,930 m). The angles of depression from the satellite, to the top of Nanda Devi and Mullayanagiri are  $30^\circ$  and  $60^\circ$  respectively. If the distance between the peaks of two mountains is 1937 km, and the satellite is vertically above the midpoint of the distance between the two mountains. [CBSE - QB 2021]

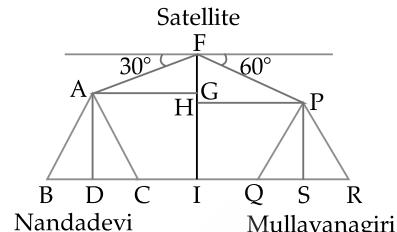


- (i) The distance of the satellite from the top of Nanda Devi is

- (a) 1118.36 km      (b) 577.52 km  
 (c) 1937 km      (d) 1025.36 km

Sol. Correct option: (a).

**Explanation:**



Now,

$$AG = \frac{1937}{2} \text{ km}$$

$$\cos \theta = \frac{AG}{AF}$$

$$\cos 30^\circ = \frac{2}{AF}$$

$$\frac{\sqrt{3}}{2} = \frac{1937}{2AF}$$

$$AF = \frac{1937}{\sqrt{3}}$$

$$AF = 1118.36 \text{ km}$$

- (ii) The distance of the satellite from the top of Mullayanagiri is

- (a) 1139.4 km      (b) 577.52 km  
 (c) 1937 km      (d) 1025.36 km

Sol. Correct option: (c).

**Explanation:** For  $\triangle FPH$ ,

$$\cos \theta = \frac{PH}{FP}$$

$$\cos 60^\circ = \frac{1937}{2FP}$$

$$\frac{1}{2} = \frac{1937}{2FP}$$

$$FP = 1937 \text{ km}$$

- (iii) The distance of the satellite from the ground is

- (a) 1139.4 km      (b) 577.52 km  
 (c) 1937 km      (d) 1025.36 km

Sol. Correct option: (b).

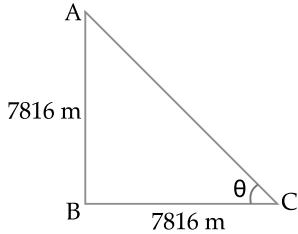
- (iv) What is the angle of elevation if a man is standing at a distance of 7816 m from Nanda Devi ?

- (a)  $30^\circ$       (b)  $45^\circ$   
 (c)  $60^\circ$       (d)  $0^\circ$

Sol. Correct option: (b).

**Explanation:** Height of Nanda Devi Mountain = 7816 m

Distance between man and mountain = 7816 m.



$$\tan \theta = \frac{AB}{BC}$$

$$\tan \theta = \frac{7816}{7816}$$

$$\tan \theta = 1$$

$$\tan \theta = \tan 45^\circ$$

$$\theta = 45^\circ$$

(v) If a mile stone very far away from, makes  $45^\circ$  to the top of Mullanyangiri mountain. So, find the distance of this mile stone form the mountain.

- (a) 1118.327 km      (b) 566.976 km  
 (c) 1937 km      (d) 1025.36 km

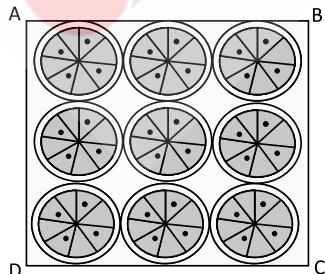
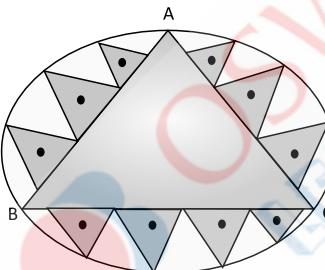
Sol. Correct option: (c).

#### Q. 24. AREAS RELATED TO CIRCLES

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. [CBSE - QB 2021]

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.

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

Sol. Correct option: (b).

(ii) The altitude of the equilateral triangle is

- (a) 8 cm      (b) 12 cm  
 (c) 48 cm      (d) 52 cm

Sol. Correct option: (c).

Refer Design II:

(iii) The area of square is

- (a)  $1264 \text{ cm}^2$       (b)  $1764 \text{ cm}^2$   
 (c)  $1830 \text{ cm}^2$       (d)  $1944 \text{ cm}^2$

Sol. Correct option: (b).

Explanation:

$$\text{radius} = 7 \text{ cm}$$

$$\text{diameter} = 2 \times 7 \text{ cm}$$

$$= 14 \text{ cm}$$

$$\begin{aligned}\text{side of square} &= 14 \text{ cm} + 14 \text{ cm} + 14 \text{ cm} \\ &= 42 \text{ cm.}\end{aligned}$$

$$\begin{aligned}\text{Area of square} &= \text{side}^2 \\ &= (42 \text{ cm})^2 \\ &= 1764 \text{ cm}^2\end{aligned}$$

(iv) Area of each circular design is

- (a)  $124 \text{ cm}^2$       (b)  $132 \text{ cm}^2$   
 (c)  $144 \text{ cm}^2$       (d)  $154 \text{ cm}^2$

Sol. Correct option: (d).

Explanation:

$$\text{radius} = 7 \text{ cm}$$

Area of each circular design

$$= \pi r^2$$

$$= \frac{22}{7} \times 7 \times 7$$

$$= 154 \text{ cm}^2$$

(v) Area of the remaining portion of the square ABCD is

- (a)  $378 \text{ cm}^2$       (b)  $260 \text{ cm}^2$   
 (c)  $340 \text{ cm}^2$       (d)  $278 \text{ cm}^2$

Sol. Correct option: (a).

Explanation:

Area of 9 circular design

$$= 9 \times \pi r^2$$

$$= 9 \times \frac{22}{7} \times 7 \times 7$$

$$= 1386 \text{ cm}^2$$

$$\text{Area of square} = 1764 \text{ cm}^2$$

Area of remaining portion of square ABCD

$$\begin{aligned}&= \text{Area of square} - \text{Area of 9} \\ &\quad \text{circular design} \\ &= 1764 \text{ cm}^2 - 1386 \text{ cm}^2 \\ &= 378 \text{ cm}^2\end{aligned}$$

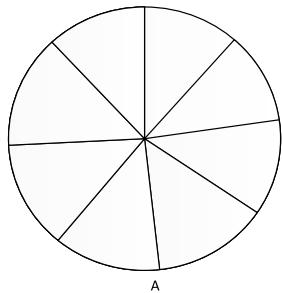
#### Q. 25.

#### A Brooch

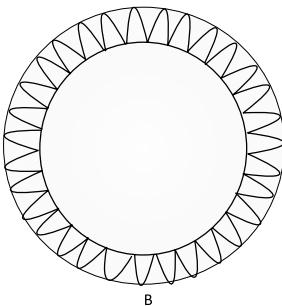
A brooch is a small piece of jewellery which has a pin at the back so it can be fastened on a dress, blouse or coat.

Designs of some brooch are shown below. Observe them carefully.

[CBSE - QB 2021]



A



B



**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 i.e. Gold and silver. Outer part is made with Gold. The circumference of silver part is 44 mm and the gold part is 3 mm wide everywhere.

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 |

**Sol.** Correct option: (b).

**Explanation:**

$$\text{Diameter} = 28 \text{ mm}$$

$$\text{radius} = 14 \text{ mm}$$

$$\begin{aligned}\text{Total length of wire} &= \text{length of 4 diameter} \\ &\quad + \text{circumference of circle.} \\ &= 4 \times 28 + 2\pi r^2 \\ &= 112 + 2 \times \frac{22}{7} \times 14 \\ &= 112 + 88 \\ &= 200 \text{ mm}\end{aligned}$$

(ii) The area of each sector of the brooch is

(a)  $44 \text{ mm}^2$

(c)  $77 \text{ mm}^2$

(b)  $52 \text{ mm}^2$

(d)  $68 \text{ mm}^2$

**Sol.** Correct option: (c).

**Explanation:**

Area of each sector of Brooch

$$\begin{aligned}&= \frac{1}{8} \times \text{Area of Brooch} \\ &= \frac{1}{8} \times \pi r^2 \\ &= \frac{1}{8} \times \frac{22}{7} \times 14 \times 14 \\ &= 77 \text{ mm}^2\end{aligned}$$

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 |

**Sol.** Correct option: (d).

(iv) The difference of areas of golden and silver parts is

- |             |             |
|-------------|-------------|
| (a) $18\pi$ | (b) $44\pi$ |
| (c) $51\pi$ | (d) $64\pi$ |

**Sol.** Correct option: (c).

(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 mm?

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

**Sol.** Correct option: (c).

**Explanation:**

Circumference of silver part of Brooch

$$= 44 \text{ cm}$$

$$2\pi r = 44 \text{ mm}$$

$$2 \times \frac{22}{7} \times r = 44$$

$$r = 7 \text{ mm.}$$

radius of whole Brooch

$$\begin{aligned}&= 7 \text{ mm} + 8 \text{ mm} \\ &= 10 \text{ mm.}\end{aligned}$$

Circumference of outer edge

$$\begin{aligned}&= 2\pi r \\ &= 2 \times \frac{22}{7} \times 10 \\ &= \frac{440}{7} \text{ mm}\end{aligned}$$

let the number of revolutions =  $n$

Now, According to question,

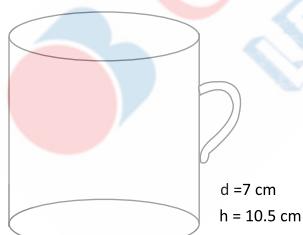
$$n \cdot 2\pi r = 80\pi$$

$$n \cdot \frac{440}{7} = 80\pi$$

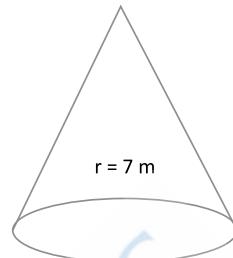
$$n \cdot \frac{440}{7} = 80 \times \frac{22}{7}$$

$$n = 4$$

**Q. 26.** Adventure camps are the perfect place for the children to practice decision making for themselves without parents and teachers guiding their every move. Some students of a school reached for adventure at Sakleshpur. At the camp, the waiters served some students with a welcome drink in a cylindrical glass and some students in a hemispherical cup whose dimensions are shown below. After that they went for a jungle trek. The jungle trek was enjoyable but tiring. As dusk fell, it was time to take shelter. Each group of four students was given a canvas of area  $551 \text{ m}^2$ . Each group had to make a conical tent to accommodate all the four students. Assuming that all the stitching and wasting incurred while cutting, would amount to  $1 \text{ m}^2$ , the students put the tents. The radius of the tent is 7 m.



$$\text{Area} = 551 \text{ m}^2$$



(i) The volume of cylindrical cup is

- (a)  $295.75 \text{ cm}^3$
- (b)  $7415.5 \text{ cm}^3$
- (c)  $384.88 \text{ cm}^3$
- (d)  $404.25 \text{ cm}^3$

Sol. Correct option: (d).

Explanation:

$$\text{diameter} = 7 \text{ cm}$$

$$\text{radius} = 3.5 \text{ cm}$$

$$\text{height} = 10.5 \text{ cm}$$

Volume of cylindrical cup

$$\begin{aligned} &= \pi r^2 h \\ &= \frac{22}{7} \times 3.5 \times 3.5 \times 10.5 \\ &= 404.25 \text{ cm}^3 \end{aligned}$$

(ii) The volume of hemispherical cup is

- (a)  $179.67 \text{ cm}^3$
- (b)  $89.83 \text{ cm}^3$
- (c)  $172.25 \text{ cm}^3$
- (d)  $210.60 \text{ cm}^3$

Sol. Correct option: (b).

(iii) Which container had more juice and by how much?

- (a) Hemispherical cup,  $195 \text{ cm}^3$
- (b) Cylindrical glass,  $207 \text{ cm}^3$
- (c) Hemispherical cup,  $280.85 \text{ cm}^3$
- (d) Cylindrical glass,  $314.42 \text{ cm}^3$

Sol. Correct option: (d).

(iv) The height of the conical tent prepared to accommodate four students is

- (a) 18 m
- (b) 10 m
- (c) 24 m
- (d) 14 m

Sol. Correct option: (c).

Explanation:

$$\text{Radius} = 7 \text{ m}$$

$$\text{Area of conical tent} = 551 \text{ m}^2 - 1 \text{ m}^2$$

$$= 550 \text{ m}^2$$

$$\pi r l = 551$$

$$\frac{22}{7} \times 7 \sqrt{r^2 + h^2} = 550$$

$$\frac{22}{7} \times 7 \sqrt{7^2 + h^2} = 550$$

$$\sqrt{7^2 + h^2} = \frac{550}{22}$$

$$\sqrt{7^2 + h^2} = \frac{50}{2}$$

$$\sqrt{7^2 + h^2} = 25$$

$$7^2 + h^2 = (25)^2$$

$$h^2 = 625 - 49$$

$$h^2 = 576$$

$$h = \sqrt{576}$$

$$= 24 \text{ m}$$

(v) How much space on the ground is occupied by each student in the conical tent

(a)  $54 \text{ m}^2$

(b)  $38.5 \text{ m}^2$

(c)  $86 \text{ m}^2$

(d)  $24 \text{ m}^2$

Sol. Correct option: (b).

**Explanation:**

Area of Base of conical tent =  $\pi r^2$

$$= \frac{22}{7} \times 7 \times 7$$

$$= 154 \text{ m}^2$$

Area of occupied by each

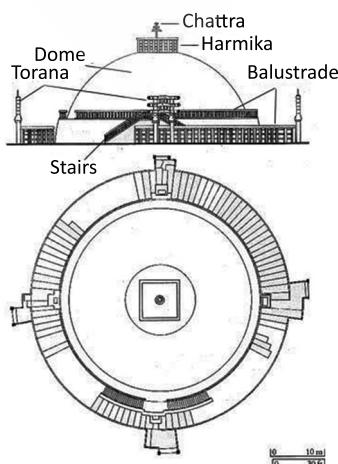
$$\text{student} = \frac{1}{4} \times 154 \text{ m}^2$$

$$= 38.5 \text{ m}^2$$

Q. 27. A The Great Stupa at Sanchi is one of the oldest stone structures in India, and an important monument of Indian Architecture. It was originally commissioned by the emperor Ashoka in the 3rd century BCE. Its nucleus was a simple hemispherical brick structure built over the relics of the Buddha. It is a perfect example of combination of solid figures. A big hemispherical dome with a cuboidal structure mounted on it.

$$\left( \text{Take } \pi = \frac{22}{7} \right)$$

[CBSE - QB 2021]



(i) Calculate the volume of the hemispherical dome if the height of the dome is 21 m:

(a) 1940 cu. m      (b) 2000 cu. m

(c) 15000 cu. m      (d) 19000 cu. m

Sol. Correct option: (a).

**Explanation:**

height of hemispherical dome = Radius of hemispherical dome = 21 m.

$$\text{Volume of dome} = \frac{2}{3} \pi r^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times 21 \times 21 \times 21$$

$$= 19,404 \text{ m}^3$$

(ii) The formula to find the Volume of Sphere is:

(a)  $\frac{2}{3} \pi r^3$       (b)  $\frac{4}{3} \pi r^3$

(c)  $4\pi r^2$       (d)  $2\pi r^2$

Sol. Correct option: (b).

(iii) The cloth require to cover the hemispherical dome if the radius of its base is 14 m is:

(a) 1222 sq.m      (b) 1232 sq.m

(c) 1200 sq.m      (d) 1400 sq.m

Sol. Correct option: (b).

(iv) The total surface area of the combined figure i.e. hemispherical dome with radius 14 m and cuboidal shaped top with dimensions 8 m × 6 m × 4 m is

(a) 1200 sq. m      (b) 1232 sq. m

(c) 1392 sq.m      (d) 1932 sq. m

Sol. Correct option: (c).

**Explanation:**

Total surface Area of Combined figure

$$= 2\pi r^2 + 2(lb + bh + hl) - lb$$

$$= 2 \times \frac{22}{7} \times 14 \times 4 + 2(8 \times 6 + 6 \times 4 + 4 \times 8) - 8 \times 6 \text{ m}^2$$

$$= [1232 + 208 - 48] \text{ m}^2$$

$$= 1392 \text{ m}^2$$

(v) The volume of the cuboidal shaped top is with dimensions mentioned in question 4.

(a) 182.45 m<sup>3</sup>      (b) 282.45 m<sup>3</sup>

(c) 292 m<sup>3</sup>      (d) 192 m<sup>3</sup>

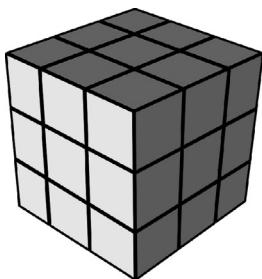
**Sol.** Correct option: (d).

**Explanation:**

$$\begin{aligned}\text{Volume of the cuboidal shaped top} \\ &= l \times b \times h \\ &= 8 \text{ m} \times 6 \text{ m} \times 4 \text{ m} \\ &= 192 \text{ m}^3.\end{aligned}$$

**Q. 28.** On a Sunday, your Parents took you to a fair. You could see lot of toys displayed, and you wanted them to buy a RUBIK's cube and strawberry ice-cream for you. [CBSE - QB 2021]

Observe the figures and answer the questions:



**Q. 29.**

#### COVID-19 Pandemic

The COVID-19 pandemic, also known as coronavirus pandemic, is an ongoing pandemic of coronavirus disease caused by the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) among humans.



The following tables shows the age distribution of case admitted during a day in two different hospitals

[CBSE - QB 2021]

Table 1

Age (in years)	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
No. of cases	6	11	21	23	14	5

Table 1

Age (in years)	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
No. of cases	8	16	10	42	24	12

Refer to table 1

(i) The average age for which maximum cases occurred is

- (a) 32.24                  (b) 34.36                  (c) 36.82                  (d) 42.24

**Sol.** Correct option: (c).

(i) The length of the diagonal if each edge measures 6 cm is

- (a)  $3\sqrt{3}$                   (b)  $3\sqrt{6}$   
(c)  $\sqrt{12}$                   (d)  $6\sqrt{3}$

**Sol.** Correct option: (d).

(ii) Volume of the solid figure if the length of the edge is 7 cm is:

- (a)  $256 \text{ cm}^3$                   (b)  $196 \text{ cm}^3$   
(c)  $343 \text{ cm}^3$                   (d)  $434 \text{ cm}^3$

**Sol.** Correct option: (c).

(iii) What is the curved surface area of hemisphere (ice cream) if the base radius is 7 cm ?

- (a)  $309 \text{ cm}^2$                   (b)  $308 \text{ cm}^2$   
(c)  $803 \text{ cm}^2$                   (d)  $903 \text{ cm}^2$

**Sol.** Correct option: (b).

(iv) Slant height of a cone if the radius is 7 cm and the height is 24 cm \_\_\_\_\_

- (a) 26 cm                  (b) 25 cm  
(c) 52 cm                  (d) 62 cm

**Sol.** Correct option: (b).

(v) The total surface area of cone with hemispherical ice cream is

- (a)  $858 \text{ cm}^2$                   (b)  $885 \text{ cm}^2$   
(c)  $588 \text{ cm}^2$                   (d)  $855 \text{ cm}^2$

**Sol.** Correct option: (a).

**Explanation:** Since, highest frequency is 23.

So, modal class is 35 – 45.

$$\text{Now, } \text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

Here,  $l = 35$ ,  $h = 10$ ,  $f_1 = 23$ ,  $f_0 = 21$ ,  $f_2 = 14$ ,

$$\begin{aligned}\Rightarrow \text{Mode} &= 35 + \frac{23 - 21}{46 - 21 - 14} \times 10 \\ &= 35 + \frac{2}{11} \times 10 \\ &= 35 + \frac{20}{11} \\ &= 35 + 1.81 \\ &= 36.818 \approx 36.82\end{aligned}$$

(ii) The upper limit of modal class is

- (a) 15      (b) 25      (c) 35      (d) 45

Sol. Correct option: (d).

(iii) The mean of the given data is

- (a) 26.2      (b) 32.4      (c) 33.5      (d) 35.4

Sol. Correct option: (d).

**Explanation:**

Age (in years)	Class marks ( $x_i$ )	frequency ( $f_i$ )	Deviation $d_i = (x_i - a)$	$f_i d_i$
5 – 15	10	6	-3	-15
15 – 25	20	11	6	66
25 – 35	30	21	16	336
35 – 45	40	23	26	598
45 – 55	50	14 $\rightarrow a$	1	18
55 – 65	60	5	46	230
		$\sum f_i = n = 80$		$\sum f_i d_i = 1,716$

$$\begin{aligned}\text{Now, } \text{Mean } (\bar{x}) &= a + \frac{\sum f_i d_i}{\sum f_i} \\ &= 14 + \frac{1716}{80} \\ &= 14 + 21.45 \\ &= 35.45\end{aligned}$$

Refer to the table above

(iv) The mode of the given data is

- (a) 41.4      (b) 48.2      (c) 55.3      (d) 64.6

Sol. Correct option: (a).

(v) The median of the given data is

- (a) 32.7      (b) 40.2      (c) 42.3      (d) 48.6

Sol. Correct option: (b).

**Explanation:**

Age (in years)	frequency ( $f_i$ ) (No. of cases)	C.f.
5 – 15	8	8
15 – 25	16	24

25 – 35	10	34
35 – 45	42 (frequency)	76 (Nearest to $\frac{n}{2}$ )
45 – 55	24	100
55 – 65	12	112
	$\sum f_i = n = 112$	

Now,  $\frac{n}{2} = \frac{112}{2} = 56.$

$l = 35$  (lower limit of median class)

$Cf = 34$  (Preceding to median class)

$$\begin{aligned} \text{Here, } \text{Median} &= l + \left( \frac{\frac{n}{2} - cf}{f} \right) \times h \\ &= 35 + \left( \frac{56 - 34}{42} \right) \times 10 \\ &= 35 + \left( \frac{22}{42} \right) \times 10 \\ &= 35 + \left( \frac{11}{21} \right) \times 10 \\ &= 35 + \frac{110}{21} \\ &= 40.25v \end{aligned}$$

Q. 30.

#### Electricity Energy Consumption

Electricity energy consumption is the form of energy consumption that uses electric energy. Global electricity consumption continues to increase faster than world population, leading to an increase in the average amount of electricity consumed per person (per capita electricity consumption).

Tariff	: LT - Residential	Bill Number	: 384756
Type of Supply	: Single Passes	Connected lead	: 3 kW
Mater Reading Date	: 31-11-13	Mater Reading	: 65700
Previous Reading Date	: 31-10-13	Previous Mater Reading	: 65500
Units consumed : 289			

A survey is conducted for 56 families of a Colony A. The following tables gives the weekly consumption of electricity of these families.

Weekly consumption (in units)	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of families	16	12	18	6	4	0

Table 1

Weekly consumption (in units)	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of families	0	5	10	20	40	5

Refer to data received from Colony A

(i) The median weekly consumption is

- (a) 12 units      (b) 16 units      (c) 20 units      (d) None of these

**Sol.** Correct option: (c).

**Explanation:**

Weekly consumption (in units)	frequency ( $f_i$ ) (No. of families)	C.f.
0-10	8	16
10-20 (Median class)	12 (frequency)	28 (Nearest to $\frac{n}{2}$ )
20-30	18	46
30-40	6	52
40-50	4	56
50-60	0	56
	$\sum f_i = n = 56$	

Now,  $\frac{n}{2} = \frac{56}{2} = 28$

$l = 10, Cf = 16, f = 12, h = 10$

$$\begin{aligned} \text{Here, } \text{Median} &= l + \left( \frac{\frac{n}{2} - cf}{f} \right) \times h \\ &= 10 + \left( \frac{28 - 16}{12} \right) \times 10 \\ &= 10 + \left( \frac{12}{12} \right) \times 10 \\ &= 10 + 10 \\ &= 20 \end{aligned}$$

Hence, median weekly consumption = 20 units.

**(ii) The mean weekly consumption is**

- (a) 19.64 units      (b) 22.5 units      (c) 26 units      (d) None of these

**Sol.** Correct option: (a).

**(iii) The modal class of the above data is I**

- (a) 0-10      (b) 10-20      (c) 20-30      (d) 30-40

**Sol.** Correct option: (c).

Refer to data received from Colony B

**(iv) The modal weekly consumption is**

- (a) 38.2 units      (b) 43.6 units      (c) 26 units      (d) 32 units

**Sol.** Correct option: (b).

**(v) The mean weekly consumption is**

- (a) 15.65 units      (b) 32.8 units      (c) 38.75 units      (d) 48 units

**Sol.** Correct option: (c).

**Q. 31.** On a weekend Rani was playing cards with her family. The deck has 52 cards. If her brother drew one card. [CBSE - QB 2021]



**(i) Find the probability of getting a king of red colour.**

- (a)  $\frac{1}{26}$       (b)  $\frac{1}{13}$   
 (c)  $\frac{1}{52}$       (d)  $\frac{1}{4}$

**Sol.** Correct option: (a).

**Explanation:**

No. of cards of a king of red colour = 2

Total no. of cards = 52

Probability of getting a king of red colour

$$= \frac{\text{No. of king of red colour}}{\text{Total number of cards}}$$

$$= \frac{2}{52} = \frac{1}{26}$$

(ii) Find the probability of getting a face card.

(a)  $\frac{1}{26}$

(b)  $\frac{1}{13}$

(c)  $\frac{2}{13}$

(d)  $\frac{3}{13}$

Sol. Correct option: (d).

(iii) Find the probability of getting a jack of hearts.

(a)  $\frac{1}{26}$

(b)  $\frac{1}{52}$

(c)  $\frac{3}{52}$

(d)  $\frac{3}{26}$

Sol. Correct option: (b).

(iv) Find the probability of getting a red face card.

(a)  $\frac{3}{13}$

(b)  $\frac{1}{13}$

(c)  $\frac{1}{52}$

(d)  $\frac{1}{4}$

Sol. Correct option: (a).

**Explanation:**

No. of face card = 13

Total no of cards = 52

Probability of getting a face card

$$= \frac{\text{No. of face cards}}{\text{Total no. of cards}}$$

$$= \frac{12}{52} = \frac{3}{13}$$

(v) Find the probability of getting a spade.

(a)  $\frac{1}{26}$

(b)  $\frac{1}{13}$

(c)  $\frac{1}{52}$

(d)  $\frac{1}{4}$

Sol. Correct option: (d).

No. of face card = 13

Total no of cards = 52

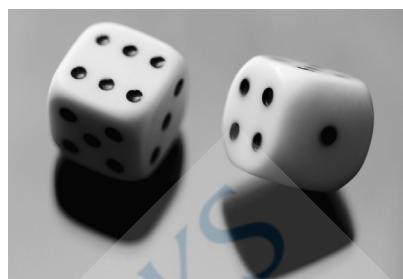
Probability of getting a face card

$$= \frac{\text{No. of face cards}}{\text{Total no. of cards}}$$

$$= \frac{13}{52} = \frac{1}{4}$$

**Q. 32 Rahul and Ravi planned to play Business (board game) in which they were supposed to use two dice.**

[CBSE - QB 2021]



(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

Sol. Correct option: (b).

**Explanation:**

The outcomes when two dice are thrown together are:

= (1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6)

(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6)

(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)

(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6)

(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)

(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)

Total outcomes = 36

No. of outcomes when the sum is 8 = 5

$$\text{Probability} = \frac{5}{36}$$

(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

Sol. Correct option: (d).

**Explanation:**

No. of outcomes when the sum is 13 = 0

Total outcomes = 36

$$\text{Probability} = \frac{0}{36} = 0$$

- (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

Sol. Correct option: (a).

**Explanation:**

No. of outcomes when the sum is less than or equal to 12 = 36

Total outcomes = 36

$$\text{probability} = \frac{36}{36} = 1$$

- (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

Sol. Correct option: (c).

- (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)  $\frac{5}{18}$

Sol. Correct option: (d).

