Solved Paper 2022

Mathematics (Standard) (TERM-I)

CLASS-X

Time : 90 Minutes **Max. Marks : 40**

General Instructions :

*(i) The question paper contains **50** questions out of which **40** questions are to be attempted. All questions carry equal marks.*

*(ii) The question paper consists of **three** sections – Section A, B and C.*

*(iii) **Section–A** contains of **20** questions. Attempt any **16** questions from **Q. No. 1 to 20**.*

*(iv) **Section–B** also contains **20** questions. Attempt any **16** questions from **Q. No. 21 to 40**.*

*(v) **Section–C** contains of two Case Studies containing **5** questions in each case. Attempt any **4** questions from **Q. No. 41 to 45** and another **4** from **Q. No. 46 to 50**.*

(vi) There is only one correct option for every Multiple Choice Question (MCQ). Marks will not be awarded for answering more than one option.

(vii) There is no negative marking.

Series: JSK/2, Set-4 **Code No. 030/2/4**

SECTION - A

Q. No. 1 to 20 are of 1 mark each. Attempt any 16 from Q. No. 1 to 20.

1. The exponent of 5 in the prime factorisation of 3750 is

(a) 3 **(b)** 4

(c) 5 **(d)** 6

Ans. Option (b) is correct.

Explanation: According to the prime factorisation, 3750 can be written as

$3750 = 5 \times 5 \times 5 \times 5 \times 3 \times 2 = 5^4 \times 3^1 \times 2^1$

It is clear from above, that exponent of 5 in the prime factorisation of 3750 is 4.

2. The graph of a polynomial $P(x)$ cuts the x-axis at 3 points and touches it at 2 other points. The number of zeroes of $P(x)$ is

(a) 1 **(b)** 2

(c) 3 **(d)** 5

Ans. Option (d) is correct.

Explanation: According to the property of the polynomials,

Number of zeroes of $p(x)$ = Number of points at which graph of $p(x)$ intersects the x-axis.

It is mentioned in the question that, the graph intersects x-axis at 3 points and it touches it at 2 further points.

This means that the graph intersects the x-axis at 5 different points.

Therefore, number of zeroes = 5.

3. The values of x and y satisfying the two equations $32x + 33y = 34$, $33x + 32y = 31$ respectively are

(a) –1, 2 **(b)** –1, 4

(c) 1, –2 **(d)** –1, –4

Ans. Option (a) is correct.

Explanation: The given equations are,

$$32x + 33y = 34 \quad ...(i)$$

$$\& \quad 33x + 32y = 31 \quad ...(ii)$$

Subtract eq.(ii) from eq.(i)

$$-x + y = 3$$

or $$y = 3 + x$$

Put this value of y in (i), we get

$$32x + 33(3+x) = 34$$

$$\Rightarrow \quad 32x + 99 + 33x = 34$$

$$\Rightarrow \quad 65x = 34 - 99$$

$$\Rightarrow \quad 65x = -65$$

or $$x = -1$$

Also, $$y = 3 + x$$

$$\Rightarrow \quad y = 3 + (-1)$$

$$= 3 - 1 = 2$$

Hence, the correct solution is $x = -1$ and $y = 2$.

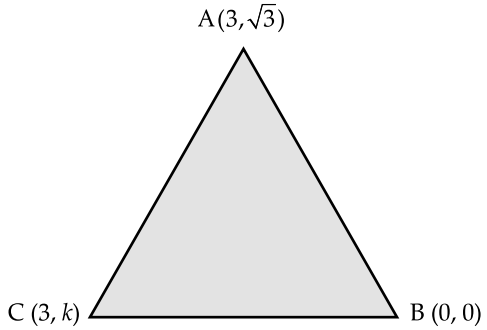
4. If $A(3, \sqrt{3})$, $B(0, 0)$ and $C(3, k)$ are the three vertices of an equilateral triangle ABC, then the value of k is

(a) 2 **(b)** –3

(c) $-\sqrt{3}$ **(d)** $-\sqrt{2}$

Ans. Option (c) is correct.

Explanation: $A(3, \sqrt{3})$, $B(0, 0)$ and $C(3, k)$ are the vertices of the equilateral triangle ABC.



As in the equilateral triangle ABC all sides are equal. Then, apply distance formula for sides AB and BC. According to the distance formula,

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$AB = \sqrt{(3-0)^2 + (\sqrt{3} - 0)^2}$$

$$= \sqrt{9+3} = \sqrt{12} \text{ units}$$

$$BC = \sqrt{(3-0)^2 + (k-0)^2}$$

$$= \sqrt{9 + k^2} \text{ units}$$

Now, $AB = BC$

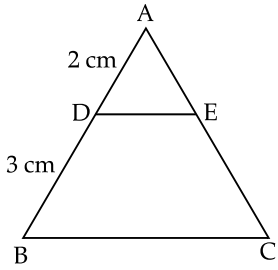
$$\sqrt{12} = \sqrt{9 + k^2}$$

or $12 = 9 + k^2$

or $k^2 = 3$

or $k = \pm\sqrt{3}$

*** 5. In figure, $DE \parallel BC$, $AD = 2$ cm and $BD = 3$ cm, then ar(ΔABC) : ar(ΔADE) is equal to**



(a) 4 : 25 **(b)** 2 : 3
(c) 9 : 4 **(d)** 25 : 4

6. If $\cot\theta = \frac{1}{\sqrt{3}}$, the value of $\sec^2\theta + \text{cosec}^2\theta$ is

(a) 1 **(b)** $\frac{40}{9}$

(c) $\frac{38}{9}$ **(d)** $5\frac{1}{3}$

Ans. Option (d) is correct.

Explanation: It is given that

$$\cot\theta = \frac{1}{\sqrt{3}} = \cot 60^\circ$$

$$\Rightarrow \quad \theta = 60^\circ$$

Substituting the value of θ

$$\sec^2\theta + \text{cosec}^2\theta = \sec^2 60^\circ + \text{cosec}^2 60^\circ$$

$$= (2)^2 + \left(\frac{2}{\sqrt{3}}\right)^2$$

$$= 4 + \frac{4}{3} = \frac{16}{3} = 5\frac{1}{3}$$

7. The area of a quadrant of a circle where the circumference of circle is 176 m, is

(a) 2464 m^2 **(b)** 1232 m^2
(c) 616 m^2 **(d)** 308 m^2

Ans. Option (c) is correct.

Explanation: It is given that circumference of the circle is 176 m

$$\Rightarrow \quad 2\pi r = 176$$

$$\Rightarrow \quad 2 \times \frac{22}{7} \times r = 176$$

$$\Rightarrow \quad r = \frac{176 \times 7}{2 \times 22} = 28 \text{ m}$$

Also, in a quadrant $\theta = 90^\circ$

$$\text{Area of quadrant} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$= \frac{90^\circ}{360^\circ} \times \frac{22}{7} \times 28 \times 28$$

$$= 616 \text{ m}^2$$

8. For an event E, $P(E) + P(\bar{E}) = x$, then the value of $x^3 - 3$ is

(a) –2 **(b)** 2
(c) 1 **(d)** –1

Ans. Option (a) is correct.

Explanation: Given

$$P(E) + P(\bar{E}) = x \quad \text{...(i)}$$

Also, according to the law of probability,

$$P(E) + P(\bar{E}) = 1 \quad \text{...(ii)}$$

From (i) and (ii), we get

$$x = 1$$

Put value of x in $x^3 - 3$, we get

$$x^3 - 3 = (1)^3 - 3 = 1 - 3 = -2$$

9. What is the greatest possible speed at which a girl can walk 95 m and 171 m in an exact number of minutes?

(a) 17 m/min. **(b)** 19 m/min.
(c) 23 m/min. **(d)** 13 m/min.

Ans. Option (b) is correct.

Explanation: As the girl needs to walk 95 m and 171 m at the exact number of minutes.

So, we have to find HCF of 95 and 171.

According to prime factorisation of 95 and 171

$$95 = 5 \times 19$$

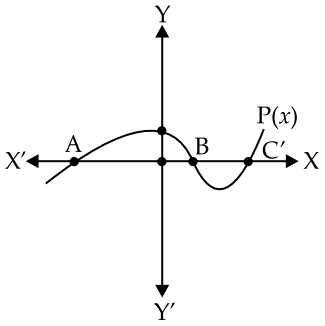
$$171 = 3 \times 3 \times 19$$

$$HCF(95, 171) = 19$$

Hence, greatest possible speed is 19 m/min.

* *Out of Syllabus*

10. In figure, the graph of a polynomial $P(x)$ is shown. The number of zeroes of $P(x)$ is

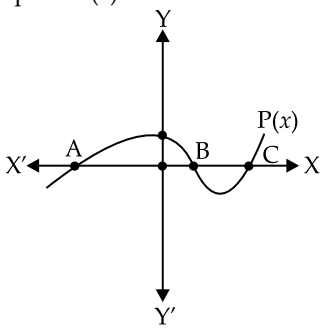


(a) 1 **(b)** 2
(c) 3 **(d)** 4

Ans. Option (c) is correct.

Explanation: According to the property of the polynomials,

Number of zeroes of a $P(x)$ = Number of points at which graph of $P(x)$ intersects the x-axis.



From the figure it is clear that the graph intersects X-axis at three different points. Therefore, the polynomial has 3 zeroes.

11. Two lines are given to be parallel. The equation of one of the lines is $3x - 2y = 5$. The equation of the second line can be

(a) $9x + 8y = 7$ **(b)** $-12x - 8y = 7$
(c) $-12x + 8y = 7$ **(d)** $12x + 8y = 7$

Ans. Option (c) is correct.

Explanation: The given equation is

$$3x - 2y = 5$$

According to the condition that if two lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are parallel

then $$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

Taking option (c) and applying the above condition on it and in the given equations.

or $$\frac{3}{-12} = \frac{-2}{8} \neq \frac{5}{7}$$

12. Three vertices of a parallelogram $ABCD$ are $A(1, 4)$, $B(-2, 3)$ and $C(5, 8)$. The ordinate of the fourth vertex D is

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

Ans. Option (b) is correct.

Explanation: Let $A(1, 4)$ $B(-2, 3)$ $C(5, 8)$ and $D(a, b)$ are the vertices of a parallelogram.

Midpoint of diagonal AC

$$= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$= \left(\frac{1+5}{2}, \frac{4+8}{2}\right)$$

$$= \left(\frac{6}{2}, \frac{12}{2}\right) = (3, 6)$$

Midpoint of diagonal BD

$$= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$= \left(\frac{-2+a}{2}, \frac{3+b}{2}\right)$$

The diagonals of the parallelogram bisect each other. The diagonals share same mid-point.

$$\therefore \quad (3, 6) = \left(\frac{-2+a}{2}, \frac{3+b}{2}\right)$$

On comparing both sides, we get

$$3 = \frac{-2+a}{2} \text{ and } 6 = \frac{3+b}{2}$$

In the question value of ordinate is asked,

$$6 = \frac{3+b}{2}$$

$$12 = 3 + b$$

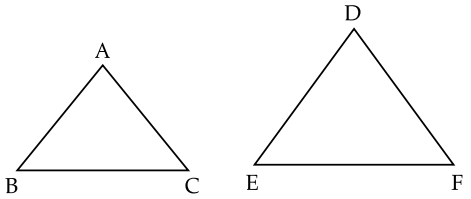
or $$b = 9$$

13. In ΔABC and ΔDEF, $\angle F = \angle C$, $\angle B = \angle E$ and $AB = \frac{1}{2} DE$. Then the two triangles are

(a) Congruent, but not similar
(b) Similar, but not congruent
(c) Neither congruent nor similar
(d) Congruent as well as similar

Ans. Option (b) is correct.

Explanation: According to the definition of similarity of two triangles, "Two triangles are similar when their corresponding angles are equal and the sides are in proportion"



According to the question,

$\angle F = \angle C$ and $\angle B = \angle E$

Since, $$AB = \frac{1}{2} DE$$ [Given]

Also $$\frac{AB}{DE} = \frac{1}{2}$$

Which means the triangles are similar but not congruent.

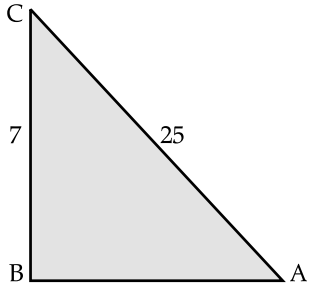
14. In ΔABC right angled at B, $\sin A = \frac{7}{25}$, then the value of $\cos C$ is

(a) $\frac{7}{25}$ **(b)** $\frac{24}{25}$

(c) $\frac{7}{24}$ **(d)** $\frac{24}{7}$

Ans. Option (a) is correct.

Explanation:



$$\sin\theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$$

and $$\cos\theta = \frac{\text{Base}}{\text{Hypotenuse}}$$

$$\sin A = \frac{BC}{AC} = \frac{7}{25}$$

$$\therefore \quad \cos C = \frac{BC}{AC} = \frac{7}{25}$$

15. The minute hand of a clock is 84 cm long. The distance covered by the tip of minute hand from 10:10 am to 10:25 am is

(a) 44 cm **(b)** 88 cm

(c) 132 cm **(d)** 176 cm

Ans. Option (c) is correct.

Explanation: Length of minute hand = Radius of the quadrant/sector so formed = 84 cm.

In 1 minute, minute hand makes an angle of 6^o.

Therefore, in 15 minutes it makes an angle of $15 \times 6^o = 90^o$

Distance covered by the tip of the minute hand

$$= \text{Length of arc}$$

$$= \frac{\theta}{360^o} \times 2\pi r$$

$$= \frac{90^o}{360^o} \times 2 \times \frac{22}{7} \times 84$$

$$= 132 \text{ cm}.$$

16. The probability that the drawn card from a pack of 52 cards is neither an ace nor a spade is

(a) $\frac{9}{13}$ **(b)** $\frac{35}{52}$

(c) $\frac{10}{13}$ **(d)** $\frac{19}{26}$

Ans. Option (a) is correct.

Explanation: Total ace cards = 4 and total spade cards = 13 – 1 = 12 (One card among aces is also a spade)

Cards which are neither ace or spade

$$= 52 - 16 = 36$$

Required probability $= \frac{36}{52} = \frac{9}{13}$

17. Three alarm clocks ring their alarms at regular intervals of 20 min., 25 min. and 30 min. respectively. If they first beep together at 12 noon, at what time will they beep again for the first time?

(a) 4 : 00 pm **(b)** 4 : 30 pm

(c) 5 : 00 pm **(d)** 5 : 30 pm

Ans. Option (c) is correct.

Explanation: Time when they ring together

$$= LCM\ (20, 25, 30)$$

According to prime factorisation,

$$20 = 2 \times 2 \times 5$$

$$25 = 5 \times 5$$

$$30 = 2 \times 3 \times 5$$

$$LCM\ (20, 25, 30) = 2 \times 2 \times 3 \times 5 \times 5 = 300$$

Thus, 3 bells ring together after 300 minutes or 5 hours.

Since, they rang together first at 12 noon, then they ring together again at 5 pm

18. A quadratic polynomial, the product and sum of whose zeroes are 5 and 8 respectively is

(a) $k[x^2 - 8x + 5]$ **(b)** $k[x^2 + 8x + 5]$

(c) $k[x^2 - 5x + 8]$ **(d)** $k[x^2 + 5x + 8]$

Ans. Option (a) is correct.

Explanation: For any quadratic polynomial,

$$ax^2 + bx + c$$

$$\text{Sum of zeroes} = \frac{-b}{a}$$

$$8 = \frac{-b}{a}$$

$$\frac{8}{1} = \frac{-b}{a}$$

or $$b = -8k, a = 1k$$

Also, product of zeroes $= \frac{c}{a}$

$$5 = \frac{c}{a}$$

$$\frac{5}{1} = \frac{c}{a}$$

or $c = 5k, a = 1k$

Polynomial whose sum of zeroes or product of zeroes are given,

Required Polynomial

$$= ax^2 + bx + c$$

$$= kx^2 - 8kx + 5k$$

$$= k(x^2 - 8x + 5)$$

19. Points $A(-1, y)$ and $B(5, 7)$ lie on a circle with centre $O(2, -3y)$. The values of y are

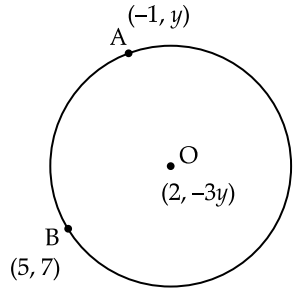
(a) 1, –7 **(b)** –1, 7

(c) 2, 7 **(d)** –2, –7

Ans. Option (b) is correct.

Explanation: As points A and B lie on the circle and O is the centre.

AO and BO will be the radii of the circle.



So, $AO = BO$

$\Rightarrow \sqrt{(2-(-1))^2+(-3y-y)^2}$

$= \sqrt{(2-5)^2+(-3y-7)^2}$

(Applying distance formula on both AO and BO)

$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$\Rightarrow (3)^2 + (-4y)^2 = (-3)^2 + (-3y-7)^2$

$\Rightarrow 9 + 16y^2 = 9 + 9y^2 + 49 + 42y$

$\Rightarrow 16y^2 - 9y^2 - 42y - 49 = 0$

$\Rightarrow 7y^2 - 42y - 49 = 0$

$\Rightarrow 7(y^2 - 6y - 7) = 0$

$\Rightarrow y^2 - 7y + 1y - 7 = 0$

$\Rightarrow y(y-7) + 1(y-7) = 0$

$\Rightarrow (y-7)(y+1) = 0$

$\Rightarrow y = 7, -1$

20. Given that $\sec\theta = \sqrt{2}$, the value of $\frac{1+\tan\theta}{\sin\theta}$ is

(a) $2\sqrt{2}$ **(b)** $\sqrt{2}$

(c) $3\sqrt{2}$ **(d)** 2

Ans. Option (a) is correct.

Explanation: It is given that

$\sec\theta = \sqrt{2}$ ...(i)

Also, $\sec 45^o = \sqrt{2}$ ...(ii)

From (i) and (ii), we get

$\theta = 45^o$

Put value of θ in $\frac{1+\tan\theta}{\sin\theta}$,

$\Rightarrow \frac{1+\tan\theta}{\sin\theta} = \frac{1+\tan 45^o}{\sin 45^o}$

$\Rightarrow = \frac{1+1}{\frac{1}{\sqrt{2}}}$

or $= 2\sqrt{2}$

SECTION - B

Q. No. 21 to 40 are of 1 mark each. Attempt any 16 from Q. 21 to 40.

21. The greatest number which when divides 1251, 9377 and 15628 leaves remainder 1, 2 and 3 respectively is

(a) 575 **(b)** 450

(c) 750 **(d)** 625

Ans. Option (d) is correct.

Explanation: First subtract the remainders from their respective numbers,

$1251 - 1 = 1250$

$9377 - 2 = 9375$

$15628 - 3 = 15625$

According to the prime factorisation,

$1250 = 2 \times 5 \times 5 \times 5 \times 5$

$9375 = 3 \times 5 \times 5 \times 5 \times 5 \times 5$

$15625 = 5 \times 5 \times 5 \times 5 \times 5 \times 5$

HCF(1250, 9375, 15625) $= 5 \times 5 \times 5 \times 5 = 625$

22. Which of the following cannot be the probability of an event?

(a) 0.01 **(b)** 3%

(c) $\frac{16}{17}$ **(d)** $\frac{17}{16}$

Ans. Option (d) is correct.

Explanation: Probability of an event is always a proper fraction.

Also, $0 \le P(E) \le 1$

But $\frac{17}{16} > 1$

Therefore, $\frac{17}{16}$ can never be probability of any event.

23. The diameter of a car wheel is 42 cm. The number of complete revolutions it will make in moving 132 km is

(a) 10^4 **(b)** 10^5

(c) 10^6 **(d)** 10^3

Ans. Option (b) is correct.

Explanation: Diameter of wheel = 42 cm

Radius of the wheel = $\frac{42}{2} = 21$ cm

Distance in 1 revolution

= Circumference of the wheel

$= 2\pi r$

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

= 132 cm

Total distance covered by the wheel

= 132 km

$= 132 \times 100000$ cm

= 13200000 cm

Number of revolutions

$$= \frac{\text{Total distance covered by wheel}}{\text{Distance covered in 1 revolution}}$$

$$= \frac{13200000}{132} = 100000 = 10^5$$

24. If θ is an acute angle and $\tan\theta + \cot\theta = 2$, then the value of $\sin^3\theta + \cos^3\theta$ is

(a) 1 **(b)** $\frac{1}{2}$

(c) $\frac{\sqrt{2}}{2}$ **(d)** $\sqrt{2}$

Ans. Option (c) is correct.

Explanation:

$$\tan\theta + \cot\theta = 2$$

or $$\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = 2$$

or $$\frac{\sin^2\theta + \cos^2\theta}{\cos\theta \sin\theta} = 2$$

or $$\sin^2\theta + \cos^2\theta = 2\sin\theta\cos\theta$$

or $$1 = 2\sin\theta\cos\theta$$

or $$\sin\theta\cos\theta = \frac{1}{2} \quad \text{...(i)}$$

$$(\sin\theta + \cos\theta)^2 = \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta$$

$$= 1 + 2 \times \frac{1}{2}$$

$$= 1 + 1 = 2$$

Therefore,

$$\sin\theta + \cos\theta = \sqrt{2} \quad \text{...(ii)}$$

Now taking,

$$\sin^3\theta + \cos^3\theta = (\sin\theta + \cos\theta)^3 - 3\sin\theta\cos\theta(\sin\theta + \cos\theta)$$

$$= (\sqrt{2})^3 - 3 \times \frac{1}{2} \times \sqrt{2}$$

$$= 2\sqrt{2} - \frac{3}{2}\sqrt{2} = \frac{\sqrt{2}}{2}$$

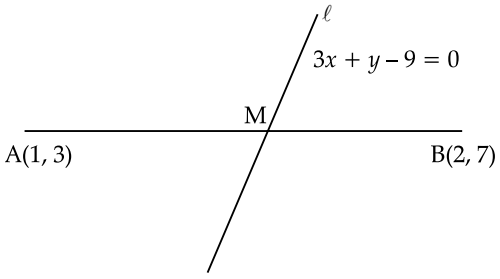
25. The ratio in which the line $3x + y - 9 = 0$ divides the line segment joining the points (1, 3) and (2, 7) is

(a) 3 : 2 **(b)** 2 : 3

(c) 3 : 4 **(d)** 4 : 3

Ans. Option (c) is correct.

Explanation: Let the the point of intersection be $M(x, y)$.



Let the line l divides the line AB in the ratio $k : 1$.

According to the section formula,

$$M(x, y) = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$

$$= \left(\frac{k(2) + 1(1)}{k+1}, \frac{k(7) + 1(3)}{k+1}\right)$$

$$= \left(\frac{2k+1}{k+1}, \frac{7k+3}{k+1}\right)$$

This point M lies on the line l.

Therefore, $3\left(\frac{2k+1}{k+1}\right) + \frac{7k+3}{k+1} - 9 = 0$

or $6k + 3 + 7k + 3 - 9(k+1) = 0$

or $4k - 3 = 0$

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

The ratio is $k : 1$ or 3 : 4.

26. If $x - 1$ is a factor of the polynomial $p(x) = x^3 + ax^2 + 2b$ and $a + b = 4$, then

(a) $a = 5, b = -1$ **(b)** $a = 9, b = -5$

(c) $a = 7, b = -3$ **(d)** $a = 3, b = 1$

Ans. Option (b) is correct.

Explanation: Given,

$$p(x) = x^3 + ax^2 + 2b$$

$$a + b = 4 \quad \text{...(i)}$$

$x - 1$ is a factor of the polynomial $p(x)$,

which means $x = 1$ is a zero of the polynomial $p(x)$.

$\therefore$ $p(1) = 0$

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

or $1 + a + 2b = 0$

or $a + 2b = -1 \quad \text{...(ii)}$

Subtracting (i) from (ii), we get

$$b = -5$$

Substituting the value of b in (i), we get $a = 9$

$\therefore$ $a = 9$ & $b = -5$

27. If a and b are two coprime numbers, then a^3 and b^3 are

(a) Co-prime **(b)** Not co-prime

(c) Even **(d)** Odd

Ans. Option (a) is correct.

Explanation: As a and b are co-prime then a^3 and b^3 are also co-prime.

We can understand above situation with the help of an example.

Let $a = 3$ and $b = 4$

$a^3 = 3^3 = 27$ and $b^3 = 4^3 = 64$

Clearly, $HCF(a, b) = HCF(3, 4) = 1$

Then, $HCF(a^3, b^3) = HCF(27, 64) = 1$

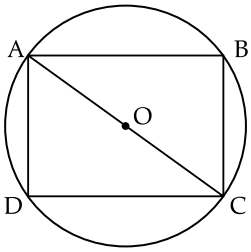
28. The area of a square that can be inscribed in a circle of area $\frac{1408}{7}$ cm^2 is

(a) 321 cm^2 **(b)** 642 cm^2

(c) 128 cm^2 **(d)** 256 cm^2

Ans. Option (c) is correct.

Explanation:



$$\text{Area of circle} = \frac{1408}{7}\ \text{cm}^2$$ [Given]

or $\pi r^2 = \frac{1408}{7}$

or $\frac{22}{7} \times r^2 = \frac{1408}{7}$

or $r^2 = \frac{1408}{7} \times \frac{7}{22}$

or $r = \sqrt{64}$

$= 8$ cm

Diameter of circle $= 2r = 16$ cm

As square is inscribed in the circle, diameter of circle = diagonal of square = 16 cm

$$\text{Area of square} = \frac{(\text{diagonal of square})^2}{2}$$

$$= \frac{16^2}{2} = \frac{256}{2} = 128\ \text{cm}^2$$

29. If $A(4, -2)$, $B(7, -2)$ and $C(7, 9)$ are the vertices of a ΔABC, then ΔABC is

(a) equilateral triangle
(b) isosceles triangle
(c) right angled triangle
(d) isosceles right angled triangle

Ans. Option (c) is correct.

Explanation: $A(4, -2)$, $B(7, -2)$ and $C(7, 9)$ are the vertices of a triangle.

Using distance formula,

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$AB = \sqrt{[7-4]^2 + [-2-(-2)]^2}$$

$$= \sqrt{3^2 + 0} = 3$$

$$BC = \sqrt{[7-7]^2 + [9-(-2)]^2}$$

$$= \sqrt{0 + 11^2} = 11$$

$$AC = \sqrt{[7-4]^2 + [9-(-2)]^2}$$

$$= \sqrt{3^2 + 11^2}$$

$$= \sqrt{9 + 121} = \sqrt{129}$$

Clearly, they are not equilateral or isosceles.

But, $AC^2 = AB^2 + BC^2$

Which mean it is following Pythagoras theorem.

$\therefore \Delta ABC$ is a right angled triangle.

30. If α, β are the zeroes of the quadratic polynomial $p(x) = x^2 - (k+6)x + 2(2k-1)$, then the value of k, if $\alpha + \beta = \frac{1}{2}\alpha\beta$, is

(a) -7 **(b)** 7
(c) -3 **(d)** 3

Ans. Option (b) is correct.

Explanation: $p(x) = x^2 - (k+6)x + 2(2k-1)$ is the given polynomial

Here, $a = 1$, $b = -(k+6)$ & $c = 2(2k-1)$

Sum of zeroes $= \alpha + \beta$

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

$$= k + 6$$

Product of zeroes $= \alpha\beta$

$$= \frac{c}{a}$$

$$= \frac{2(2k-1)}{1} = 2(2k-1)$$

It is given that,

$$\alpha + \beta = \frac{1}{2}\alpha\beta$$

$\Rightarrow \quad k + 6 = \frac{1}{2}2(2k-1)$

$\Rightarrow \quad k + 6 = 2k - 1$

$\Rightarrow \quad -k = -7$

or $\quad k = 7$

31. If n is a natural number, then $2(5^n + 6^n)$ always ends with

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

Ans. Option (d) is correct.

Explanation: Let us take an example of different powers of 5.

As, $5^1 = 5$

$5^2 = 25$

$5^3 = 125$

$5^4 = 625$ .....

It is clear from above example that 5^n will always ends with 5.

Similarly, 6^n will always ends with 6.

So, $5^n + 6^n$ will always ends with $5 + 6 = 11$

Also, $2(5^n + 6^n)$ always ends with $2 \times 11 = 22$ i.e., it will always ends with 2.

32. The line segment joining the points $P(-3, 2)$ and $Q(5, 7)$ is divided by the y-axis in the ratio

(a) 3 : 1 **(b)** 3 : 4
(c) 3 : 2 **(d)** 3 : 5

Ans. Option (d) is correct.

Explanation: Let the point on y-axis which divides the line PQ is $M(0, y)$ and the ratio be $k : 1$.

According to the section formula,

$$M(x, y) = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$

$$M(0, y) = \left(\frac{5k + (-3)}{k+1}, \frac{k(7) + 1(2)}{k+1}\right)$$

On comparing, we get

$$0 = \frac{5k - 3}{k+1}$$

or $\quad 5k - 3 = 0$

or $\quad k = \frac{3}{5}$

33. If $a \cot \theta + b \operatorname{cosec} \theta = p$ and $b \cot \theta + a \operatorname{cosec} \theta = q$, then $p^2 - q^2 =$

(a) $a^2 - b^2$ **(b)** $b^2 - a^2$

(c) $a^2 + b^2$ **(d)** $b - a$

Ans. Option (b) is correct.

Explanation: $a \cot \theta + b \operatorname{cosec} \theta = p$ and $b \cot \theta + a \operatorname{cosec} \theta = q$ are the given equations.

Taking, $p^2 - q^2$

$= (a \cot \theta + b \operatorname{cosec} \theta)^2 - (b \cot \theta + a \operatorname{cosec} \theta)^2$

$= a^2\cot^2 \theta + b^2\operatorname{cosec}^2 \theta + 2ab.\cot \theta.\operatorname{cosec} \theta$

$\quad - b^2\cot^2 \theta - a^2\operatorname{cosec}^2 \theta - 2ab.\cot \theta.\operatorname{cosec} \theta$

$= a^2(\cot^2\theta - \operatorname{cosec}^2\theta) + b^2 (\operatorname{cosec}^2\theta - \cot^2\theta)$

$= a^2(-1) + b^2(1)$

$= b^2 - a^2$ $\quad$ [using, $\operatorname{cosec}^2\theta - \cot^2\theta = 1$]

34. If the perimeter of a circle is half to that of a square, then the ratio of the area of the circle to the area of the square is

(a) 22 : 7 **(b)** 11 : 7

(c) 7 : 11 **(d)** 7 : 22

Ans. Option (d) is correct.

Explanation: Let radius of the circle be r cm and side of the square is a cm.

According to the question, perimeter of the circle is half of perimeter of the square.

$$\Rightarrow \quad 2\pi r = \frac{1}{2}(4a)$$

$$\Rightarrow \quad r = \frac{2a}{2\pi}$$

or $\quad \frac{r}{a} = \frac{1}{\pi}$

$$\frac{\text{Area of the circle}}{\text{Area of the square}} = \frac{\pi r^2}{a^2}$$

$$= \pi \times \frac{1}{\pi^2} = \frac{1}{\pi} \text{ or } \frac{7}{22}$$

35. A dice is rolled twice. The probability that 5 will not come up either time is

(a) $\frac{11}{36}$ **(b)** $\frac{1}{3}$

(c) $\frac{13}{36}$ **(d)** $\frac{25}{36}$

Ans. Option (d) is correct.

Explanation: All possible events are written below:

(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 events = 36

Out of the events in which 5 will not come up either time are (1, 1) (1, 2) (1, 3) (1, 4) (1, 6) (2, 1) (2, 2) (2, 3) (2, 4) (2, 6) (3, 1) (3, 2) (3, 3) (3, 4) (3, 6) (4, 1) (4, 2) (4, 3) (4, 4) (4, 6) (6, 1) (6, 2) (6, 3) (6, 4) (6, 6).

No. of required events in = 25

Required probability = $\frac{25}{36}$

36. The LCM of two numbers is 2400. Which of the following CAN NOT be their HCF?

(a) 300 **(b)** 400

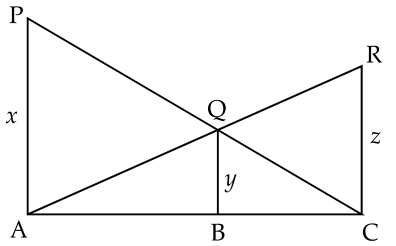
(c) 500 **(d)** 600

Ans. Option (c) is correct.

Explanation: According to the property, HCF of two numbers is also a factor of LCM of same two numbers. Out of all the options, only (c) 500 is not a factor of 2400.

Therefore, 500 cannot be the HCF.

37. In figure, PA, QB and RC are each perpendicular to AC. If $x = 8$ cm and $z = 6$ cm, then y is equal to

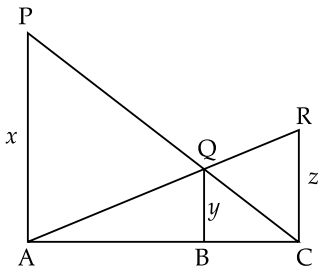


(a) $\frac{56}{7}$ cm **(b)** $\frac{7}{56}$ cm

(c) $\frac{25}{7}$ cm **(d)** $\frac{24}{7}$ cm

Ans. Option (d) is correct.

Explanation:



$$\Rightarrow \quad \frac{BQ}{CR} = \frac{CB}{CA} \qquad \text{[Since, } \Delta CBQ \sim \Delta CAP\text{]}$$

$$\Rightarrow \quad \frac{y}{x} = \frac{BQ}{AP} \qquad \text{...(i)}$$

In ΔACR, we have $BQ \parallel CR$

$$\Rightarrow \quad \frac{BQ}{CR} = \frac{AB}{AC}$$

[Since, $\Delta ABQ \sim \Delta ACR$]

$$\Rightarrow \quad \frac{y}{z} = \frac{AB}{AC} \qquad \text{...(ii)}$$

Adding (i) and (ii), we get

$$\frac{y}{x}+\frac{y}{z} = \frac{CB}{AC}+\frac{AB}{AC} \qquad \left(\because \frac{BQ}{AP}=\frac{CB}{AC}\right)$$

$$\Rightarrow \quad \frac{y}{x}+\frac{y}{z} = \frac{AB+BC}{AC}$$

$$\Rightarrow \quad \frac{y}{x}+\frac{y}{z} = \frac{AC}{AC}$$

$$\Rightarrow \quad \frac{y}{x}+\frac{y}{z} = 1$$

$$\Rightarrow \quad \frac{1}{x}+\frac{1}{z} = \frac{1}{y}$$

Put $x = 8$ and $z = 6$

$$\frac{1}{y} = \frac{1}{8}+\frac{1}{6}$$

$$= \frac{14}{48} = \frac{7}{24}$$

$$\Rightarrow \quad y = \frac{24}{7}$$

38. In a ΔABC, $\angle A = x^o$, $\angle B = (3x - 2)^o$, $\angle C = y^o$. Also $\angle C - \angle B = 9^o$. The sum of the greatest and the smallest angles of this triangle is

(a) 107° **(b)** 135°

(c) 155° **(d)** 145°

Ans. Option (a) is correct.

Explanation: $\angle A = x^o$, $\angle B = 3x - 2^o$ and $\angle C = y^o$

Sum of angles in a triangle is 180^o.

Therefore, $x + 3x - 2 + y = 180^o$

or $4x + y = 182$ ...(i)

Also, $\angle C - \angle B = 9^o$

or $y - (3x - 2) = 9^o$

or $y - 3x = 7^o$ ...(ii)

Subtracting (ii) from (i), we get

$7x = 175$

or $x = 25$

Put $x = 25^o$ in (ii), we get $y = 82^o$

Therefore,

$\angle A = 25^o$, $\angle B = 3x - 2 = 3(25) - 2 = 73^o$

And $\angle C = y^o$

Sum of greatest and smallest angle

$= 82^o + 25^o = 107^o$

39. If $\sec\theta + \tan\theta = p$, then $\tan\theta$ is

(a) $\frac{p^2+1}{2p}$ **(b)** $\frac{p^2-1}{2p}$

(c) $\frac{p^2-1}{p^2+1}$ **(d)** $\frac{p^2+1}{p^2-1}$

Ans. Option (b) is correct.

Explanation: $\sec\theta + \tan\theta = p$ ...(i)

is the given equation.

Since, $1 + \tan^2\theta = \sec^2\theta$

or $\sec\theta = \sqrt{1+\tan^2\theta}$

Put this value in (i), we get

$\sqrt{1+\tan^2\theta} + \tan\theta = p$

or $\sqrt{1+\tan^2\theta} = p - \tan\theta$

Squaring both sides, we get

$1 + \tan^2\theta = p^2 + \tan^2\theta - 2p\tan\theta$

or $1 = p^2 - 2p(\tan\theta)$

or $1 - p^2 = -2p\tan\theta$

or $\tan\theta = \frac{p^2-1}{2p}$

40. The base BC of an equilateral ΔABC lies on the y-axis. The co-ordinates of C are (0, –3). If the origin is the mid-point of the base BC, what are the co-ordinates of A and B?

(a) $A\left(\sqrt{3},0\right)$, $B(0, 3)$

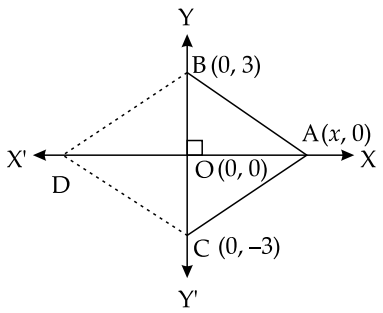
(b) $A(\pm 3\sqrt{3}, 0)$, $B(3, 0)$

(c) $A(\pm 3\sqrt{3}, 0)$, $B(0, 3)$

(d) $A(-\sqrt{3}, 0)$, $B(3, 0)$

Ans. Option (c) is correct.

Explanation:



O is the midpoint of the base BC

i.e., O is the midpoint of B and $C(0, -3)$

Therefore, coordinates of point B is (0, 3)

So, $BC = 6$ units.

Let the coordinates of point A be $(x, 0)$.

Using distance formula,

$$AB = \sqrt{(0-x)^2 + (3-0)^2}$$

$$= \sqrt{x^2 + 9}$$

$$BC = \sqrt{(0-0)^2 + (-3-3)^2}$$

$$= \sqrt{36}$$

Also, $BC = AB$

$$\sqrt{x^2 + 9} = \sqrt{36}$$

$$x^2 = 27$$

or $x = \pm 3\sqrt{3}$

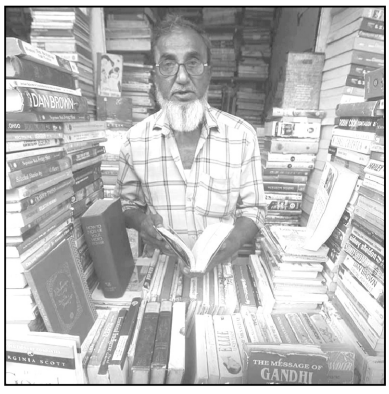
Coordinates of A and B are $\left(\pm 3\sqrt{3}, 0\right)$ and (0, 3) respectively.

SECTION - C

Q. No. 41-45 are based on Case Study-I, you have to answer any (4) four questions. Q. No. 46-50 are based on Case Study-II, you have to answer any (4) four questions.

Case Study-I

A book store shopkeeper gives books on rent for reading. He has variety of books in his store related to fiction, stories and quizzes etc. He takes a fixed charge for the first two days and an additional charge for subsequent day. Amruta paid ₹22 for a book and kept for 6 days; while Radhika paid ₹16 for keeping the book for 4 days.



Assume that the fixed charge be ₹x and additional charge (per day) be ₹y.

Based on the above information, answer any four of the following questions:

41. The situation of amount paid by Radhika, is algebraically represented by

(a) $x - 4y = 16$ **(b)** $x + 4y = 16$

(c) $x - 2y = 16$ **(d)** $x + 2y = 16$

Ans. Option (d) is correct.

Explanation: Let the fixed charge for two days be ₹x and additional charge be ₹y per day.

As Radhika has taken book for 4 days.

It means that Radhika will pay fixed charge for first two days and pays additional charges for next two days.

$$x + 2y = 16$$

42. The situation of amount paid by Amruta, is algebraically represented by

(a) $x - 2y = 11$ **(b)** $x - 2y = 22$

(c) $x + 4y = 22$ **(d)** $x - 4y = 11$

Ans. Option (c) is correct.

Explanation: As the fixed charge for two days be ₹x and additional charge be ₹y per day

It means that Amruta will pay fixed charge for first two days and pays additional charges for next four days.

$$x + 4y = 22$$

43. What are the fixed charges for a book?

(a) ₹9 **(b)** ₹13

(c) ₹10 **(d)** ₹15

Ans. Option (c) is correct.

Explanation:

$$x + 2y = 16 \quad \text{...(i)}$$

$$x + 4y = 22 \quad \text{...(ii)}$$

Subtracting (ii) from (i), we get

$y = 3$ and put this value of x in (i), we get $x = 10$.

Therefore, fixed charge is $x =$ ₹10.

44. What are the additional charges for each subsequent day for a book?

(a) ₹6 **(b)** ₹5

(c) ₹4 **(d)** ₹3

Ans. Option (d) is correct.

Explanation: From solution of Q.43, we get $y = 3$.

Therefore, additional charges is $y =$ ₹3.

45. Which is the total amount paid by both, if both of them have kept the book for 2 more days?

(a) ₹35 **(b)** ₹52

(c) ₹50 **(d)** ₹58

45. Option (c) is correct.

Explanation: For two more days price charged will be

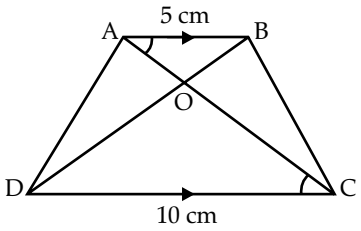
$$2y = 2 \times 3 = 6$$

Total money paid by Amruta and Radhika is $22 + 16 + 6 + 6 =$ ₹50

Case Study-II

A farmer has a field in the shape of trapezium, whose map with scale 1 cm = 20 m, is given below:

The field is divided into four parts by joining the opposite vertices.



Based on the above information, answer any four of the following questions:

46. The two triangular regions *AOB* and *COD*

(a) Similar by AA criterion
(b) Similar by SAS criterion
(c) Similar by RHS criterion
(d) Not similar

Ans. Option (b) is correct.

***47. The ratio of the area of the ΔAOB to the area of ΔCOD, is**

(a) 4 : 1 **(b)** 1 : 4
(c) 1 : 2 **(d)** 2 : 1

48. If the ratio of the perimeter of ΔAOB to the perimeter of ΔCOD of would have been 1 : 4, then

(a) $AB = 2CD$ **(b)** $AB = 4CD$
(c) $CD = 2AB$ **(d)** $CD = 4AB$

Ans. Option (d) is correct.

Explanation:

$$\frac{\text{Perimeter of } \Delta AOB}{\text{Perimeter of } \Delta COD} = \frac{1}{4}$$

Also, $$\frac{\text{Perimeter of } \Delta AOB}{\text{Perimeter of } \Delta COD} = \frac{AB}{CD}$$

$$\Rightarrow \quad \frac{1}{4} = \frac{AB}{CD}$$

$$\Rightarrow \quad CD = 4AB$$

49. If in Δs *AOD* and *BOC*, $\frac{AO}{BC} = \frac{AD}{BO} = \frac{OD}{OC}$, then

(a) $\Delta AOD \sim \Delta BOC$ **(b)** $\Delta AOD \sim \Delta BCO$
(c) $\Delta ADO \sim \Delta BCO$ **(d)** $\Delta ODA \sim \Delta OBC$

Ans. Option (b) is correct.

50. If the ratio of areas of two similar triangles *AOB* and *COD* is 1 : 4, then which of the following statements is true?

(a) The ratio of their perimeters is 3 : 4
(b) The corresponding altitudes have a ratio 1 : 2
(c) The medians have a ratio 1 : 4
(d) The angle bisectors have a ratio 1 : 16

Ans. Option (c) is correct.

❑❑

* *Out of Syllabus*