Solved Paper, 2021-22

MATHEMATICS (STANDARD)

Term-I, Set-4

Series : JSK/2

Question Paper Code No. 030/2/4

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

General Instructions :

(i) *The question paper contains **50** questions out of which **40** questions are to be attenpted. 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.*

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

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

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

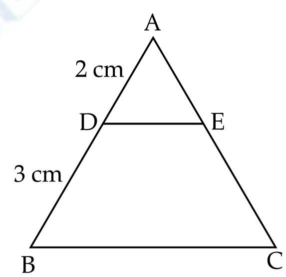
(c) 1, –2 **(d)** –1, –4

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)** $-\sqrt{2}$

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)** $5\frac{1}{3}$

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

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

(a) –2 (b) 2

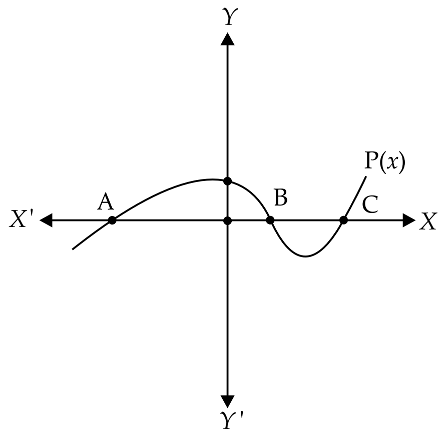
(c) 1 (d) –1

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.

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

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)** $12x + 8y = 7$

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

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

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)** $\frac{24}{7}$

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

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)** $\frac{19}{26}$

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

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)** $k[x^2 + 5x + 8]$

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

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

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

22. Which of the following cannot be the probability of an event?
(a) 0.01 **(b)** 3%
(c) $\frac{16}{17}$ **(d)** $\frac{17}{16}$

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

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)** $\sqrt{2}$

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

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)** $a = 3, b = 1$

27. If a and b are two coprime numbers, then a^3 and b^3 are
(a) Coprime **(b)** Not coprime
(c) Even **(d)** Odd

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

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

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

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

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

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)** $b - a$

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

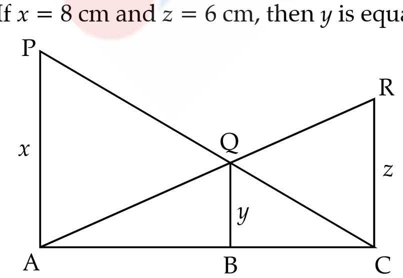
35. A dice is rolled twice. The probability that 5 will not come up either time is

(a) $\frac{11}{36}$ **(b)** $\frac{1}{3}$
(c) $\frac{13}{36}$ **(d)** $\frac{25}{36}$

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

37. In figure, PQ, 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

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

(a) 107° **(b)** 135°
(c) 155° **(d)** 145°

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

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?

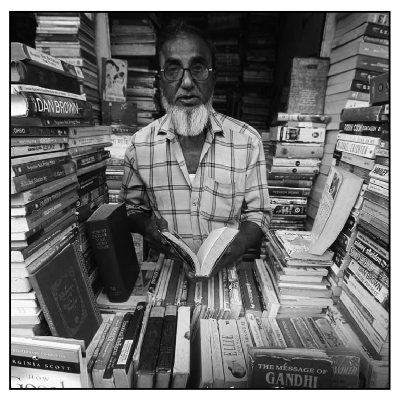
(a) $A(\sqrt{3}, 0)$, $B(0, 3)$ **(b)** $A(\pm 3\sqrt{3}, 0)$, $B(3, 0)$
(c) $A(\pm 3\sqrt{3}, 0)$, $B(0, 3)$ **(d)** $A(-\sqrt{3}, 0)$, $B(3, 0)$

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)** $x + 2y = 16$

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)** $x - 4y = 11$

43. What are the fixed charges for a book?

(a) ₹9 **(b)** ₹13
(c) ₹10 **(d)** ₹15

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

(a) ₹6 **(b)** ₹5
(c) ₹4 **(d)** ₹3

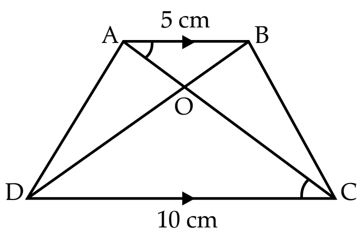
45. Which is the total amount paid by both, if both of them have kept the book for 2 more days?

(a) ₹35 **(b)** ₹52
(c) ₹50 **(d)** ₹58

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

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)** $CD = 4AB$

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)** $\Delta ODA \sim \Delta OBC$

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

❑❑❑

Solutions

SECTION-A

1. **(b)** 4

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. **(d)** 5

Explanation: According to the property of the polynomials,

Number of zeroes = Number of points at which graph 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. **(a)** –1, 2

Explanation: The given equations are,

$$32x + 33y = 34 \quad \text{...(i)}$$
& $$33x + 32y = 31 \quad \text{...(ii)}$$

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

$$-x + y = 3$$

or $y = 3 + x$

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

$$32x + 33(3+x) = 34$$
$$\Rightarrow 32x + 99 + 33x = 34$$
$$\Rightarrow 65x = 34 - 99$$
$$\Rightarrow 65x = -65$$

or $x = -1$

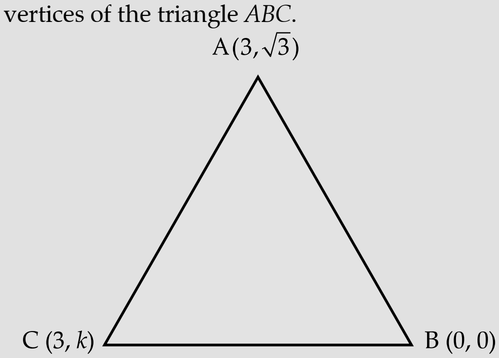
Also, $y = 3 + x$

$$\Rightarrow y = 3 + (-1) = 3 - 1 = 2$$

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

4. **(c)** $\sqrt{3}$

Explanation: $A(3, \sqrt{3})$, $B(0, 0)$ and $C(3, k)$ are the vertices of the 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, $AB = BC$

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

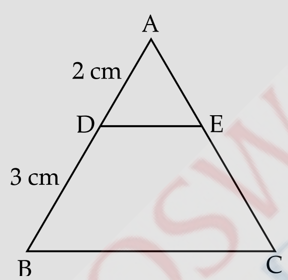
or $12 = 9 + k^2$

or $k^2 = 3$

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

5. **(d)** 25 : 4

Explanation:



First we need to prove that ΔABC & ΔADE are similar.

$\angle ADE = \angle ABC$ [Corresponding angles]

$\angle A = \angle A$ [Common]

By, AA similarity rule $\Delta ABC \sim \Delta ADE$

According to the theorem, "Ratio of area of similar triangles is equal to the square of the ratio of corresponding sides."

$$\therefore \quad \frac{ar(\Delta ABC)}{ar(ADE)} = \frac{AB^2}{AD^2}$$

$$= \frac{(2+3)^2}{(2)^2} = \frac{5^2}{2^2} = \frac{25}{4}$$

6. **(d)** $5\frac{1}{3}$

Explanation: It is given that

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

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

Substituting the value of θ

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

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

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

7. **(c)** 616 m^2

Explanation: It is given that circumference of the circle is 176 cm^2

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

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

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

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

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

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

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

8. **(a)** –2

Explanation: Given

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

Also, according to the law of probability,

$P(E) + P(\bar{E}) = 1$ ...(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. **(b)** 19 m/min.

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

$95 = 5 \times 19$

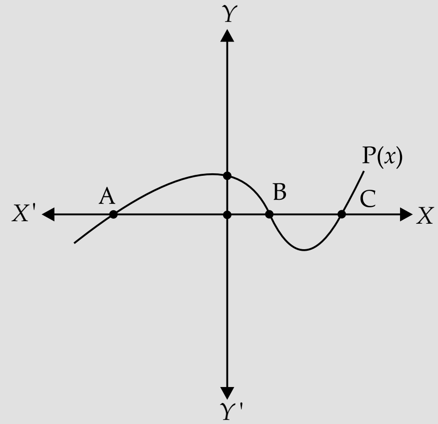
$171 = 3 \times 3 \times 19$

HCF(95, 171) = 19

Hence, greatest possible speed is 19 m/min.

10. **(c)** 3

Explanation: According to the property of the polynomials,
Number of zeroes = Number of points at which graph 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. (c) $-12x + 8y = 7$

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 equation.

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

12. (b) 9

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.

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

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,

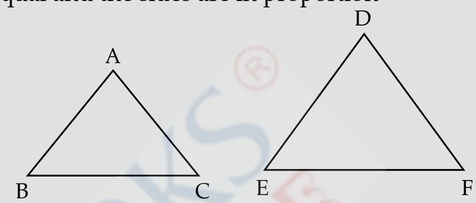
$$6 = \frac{3+b}{2}$$

$$12 = 3 + b$$

or $$b = 9$$

13. (b) Similar, but not congruent

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,

$$\angle F = \angle C \text{ and } \angle B = \angle E$$

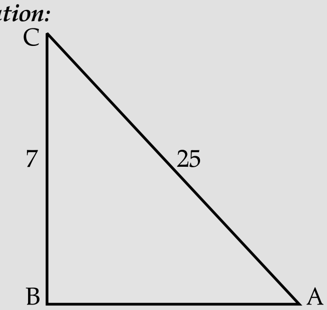
Since, $$AB = \frac{1}{2} DE$$ [Given]

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

Which means the triangles are similar but not congruent.

14. (a) $\frac{7}{25}$

Explanation:



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

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

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

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

15. (c) 132 cm

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. **(a)** $\frac{9}{13}$

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

$$= 52 - 16 = 36$$

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

17. **(c)** 5 : 00 pm

Explanation: Time when they ring together

= LCM (20, 25, 30)

According to prime factorisation,

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

$$25 = 5 \times 5$$

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

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

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

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

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

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

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

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

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

$$\text{Required Polynomial} = ax^2 + bx + c$$

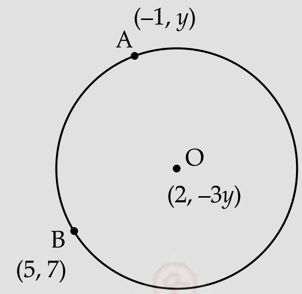
$$= kx^2 - 8kx + 5k$$

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

19. **(b)** –1, 7

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)

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

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

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

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

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

$$\Rightarrow 7(y^2 - 6y - 49) = 0$$

$$\Rightarrow y^2 - 7y + 1y - 49 = 0$$

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

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

$$\Rightarrow y = 7, -1$$

20. **(a)** $2\sqrt{2}$

Explanation: It is given that

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

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

21. **(d)** 625

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

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. **(b)** 10^5

Explanation: Diameter of wheel = 42 cm

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

Distance in 1 revolution
= Circumference of the wheel
= $2\pi r$
= $2 \times \frac{22}{7} \times 3$
= 132 cm

Total distance covered by the wheel
= 132 km = 132 × 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. **(c)** $\frac{\sqrt{2}}{2}$

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 $\sin\theta\cos\theta = \frac{1}{2}$ ...(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,

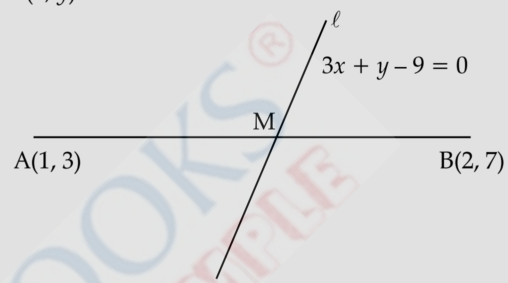
$\sin\theta + \cos\theta = \sqrt{2}$ ...(ii)

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. **(c)** 3 : 4

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



Let the line λ 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 λ.

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

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 $p(x)$.

∴ $p(1) = 0$

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

or $1 + a + 2b = 0$

or $a + 2b = -1$ ...(ii)

Subtracting (i) from (ii), we get

$$b = -5$$

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

∴ $a = 9$ & $b = -5$

27. **(a)** Coprime

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 $b = 4$

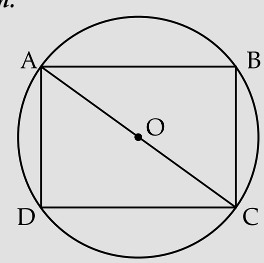
$$a^3 = 3^3 = 27 \text{ and } b^3 = 4^3 = 64$$

Clearly, $\text{HCF}(a, b) = \text{HCF}(3, 4) = 1$

Then, $\text{HCF}(a^3, b^3) = \text{HCF}(27, 64) = 1$

28. **(c)** 128 cm^2

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 $r = \sqrt{64}$

$= 8 \text{ cm}$

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. **(c)** right angled triangle

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.

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

Which mean it is following Pythagoras theorem.

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

30. **(b)** 7

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,

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

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

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

$\Rightarrow -k = -7$

or $k = 7$

31. **(d)** 2

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 end with 5.

Similarly, 6^n will always end with 6.

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

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

32. **(d)** 3 : 5

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 $5k - 3 = 0$

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

33. (b) $b^2 - a^2$

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

Taking, $p^2 - q^2$

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

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

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

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

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

34. (d) 7 : 22

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.

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

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

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

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

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

35. (d) $\frac{25}{36}$

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. (c) 500

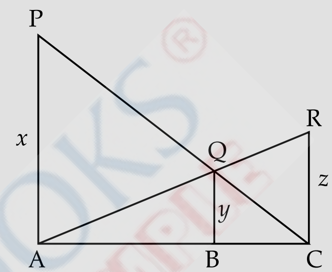
Explanation: According to the property, HCF of two numbers is also a factor of LCM of same two numbers.

Out of all the options, only (C) 500 is not a factor of 2400.

Therefore, 500 cannot be the HCF.

37. (d) $\frac{24}{7}$ cm

Explanation:



$\Rightarrow \quad \frac{BQ}{AP} = \frac{CB}{CA}$

[Since, $\Delta CBQ \sim \Delta CAP$]

$\Rightarrow \quad \frac{y}{x} = \frac{BQ}{CR}$ ...(i)

In ΔACR, we have $BQ \parallel CR$

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

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

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

Adding (i) and (ii), we get

$$\frac{y}{x} + \frac{y}{z} = \frac{CB}{AC} + \frac{AB}{AC}$$

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

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

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

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

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. **(a)** 107^{o}

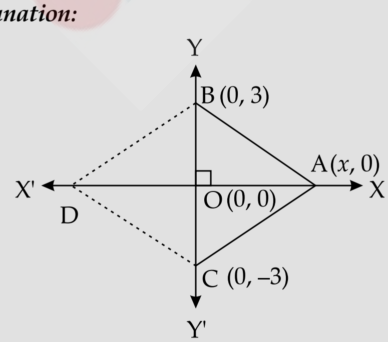
Explanation: $\angle A = x^{o}$, $\angle B = 3x - 2^{o}$ and $\angle C = y^{o}$
Sum of angles in a triangle is 180^{o}.
Therefore, $x + 3x - 2 + y = 180^{o}$
or $4x + y = 182$ ...(i)
Also, $\angle C - \angle B = 90^{o}$
or $y - (3x - 2) = 90^{o}$
or $y - 3x = 70^{o}$ ...(ii)
Subtracting (ii) from (i), we get
$7x = 175$
or $x = 250$
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. **(b)** $\dfrac{p^2 - 1}{2p}$

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

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

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

Case Study-I

41. **(d)** $x + 2y = 16$

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. **(c)** $x + 4y = 22$

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. **(c)** ₹10

Explanation:
$x + 2y = 16$ ...(i)
$x + 4y = 22$ ...(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. **(d)** ₹3

Explanation: From solution of Q.43, we get $y = 3$.
Therefore, additional charges is $y =$ ₹3.

45. **(c)** ₹50

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

46. **(b)** Similar by SAS criterion

47. **(b)** 1 : 4

> ***Explanation:*** According to the theorem, "Ratio of area of similar triangles is equal to the square of the ratio of corresponding sides".
>
> $$\frac{ar(\Delta AOB)}{ar(COD)} = \frac{(AB)^2}{(CD)^2}$$
>
> $$= \frac{25}{100} = 1 : 4$$

48. **(d)** $CD = 4AB$

> ***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. **(b)** $\Delta AOD \sim \Delta BCO$

50. **(c)** The medians have a ratio 1 : 4

❑❑❑

Term – I

OMR SHEET

Booklet Series
A

Use English Numbers / Letters only. Use Blue / Black Ball Point Pen to write in box.

Booklet Series

Ⓐ Ⓑ Ⓒ Ⓓ

Subject

Roll Number

0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9

Name

Test Date

Student's Signature

Invigilator's Signature

Certified that all the entries In this section have been properly filled by the student

Proper Marking

The OMR Sheet will be computer checked Fill the circles completely and dark enough for proper detection, Use ballpen (black or blue) for marking.

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Avoid Improper Marking

Partially Filled

Lightly Filled

Test Center Code

0	0
1	1
2	2
3	3
4	4
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9	9

IMPORTANT

The candidate should check that the Test Book Series printed on the OMR Sheet is the same as printed on the Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the invigilator for replacement of both the Test Booklet and the Answer Sheet.

Darken the circle for each question.

Q.No.	Response	Q.No.	Response	Q.No.	Response	Q.No.	Response
01	Ⓐ Ⓑ Ⓒ Ⓓ	16	Ⓐ Ⓑ Ⓒ Ⓓ	31	Ⓐ Ⓑ Ⓒ Ⓓ	46	Ⓐ Ⓑ Ⓒ Ⓓ
02	Ⓐ Ⓑ Ⓒ Ⓓ	17	Ⓐ Ⓑ Ⓒ Ⓓ	32	Ⓐ Ⓑ Ⓒ Ⓓ	47	Ⓐ Ⓑ Ⓒ Ⓓ
03	Ⓐ Ⓑ Ⓒ Ⓓ	18	Ⓐ Ⓑ Ⓒ Ⓓ	33	Ⓐ Ⓑ Ⓒ Ⓓ	48	Ⓐ Ⓑ Ⓒ Ⓓ
04	Ⓐ Ⓑ Ⓒ Ⓓ	19	Ⓐ Ⓑ Ⓒ Ⓓ	34	Ⓐ Ⓑ Ⓒ Ⓓ	49	Ⓐ Ⓑ Ⓒ Ⓓ
05	Ⓐ Ⓑ Ⓒ Ⓓ	20	Ⓐ Ⓑ Ⓒ Ⓓ	35	Ⓐ Ⓑ Ⓒ Ⓓ	50	Ⓐ Ⓑ Ⓒ Ⓓ
06	Ⓐ Ⓑ Ⓒ Ⓓ	21	Ⓐ Ⓑ Ⓒ Ⓓ	36	Ⓐ Ⓑ Ⓒ Ⓓ	51	Ⓐ Ⓑ Ⓒ Ⓓ
07	Ⓐ Ⓑ Ⓒ Ⓓ	22	Ⓐ Ⓑ Ⓒ Ⓓ	37	Ⓐ Ⓑ Ⓒ Ⓓ	52	Ⓐ Ⓑ Ⓒ Ⓓ
08	Ⓐ Ⓑ Ⓒ Ⓓ	23	Ⓐ Ⓑ Ⓒ Ⓓ	38	Ⓐ Ⓑ Ⓒ Ⓓ	53	Ⓐ Ⓑ Ⓒ Ⓓ
09	Ⓐ Ⓑ Ⓒ Ⓓ	24	Ⓐ Ⓑ Ⓒ Ⓓ	39	Ⓐ Ⓑ Ⓒ Ⓓ	54	Ⓐ Ⓑ Ⓒ Ⓓ
10	Ⓐ Ⓑ Ⓒ Ⓓ	25	Ⓐ Ⓑ Ⓒ Ⓓ	40	Ⓐ Ⓑ Ⓒ Ⓓ	55	Ⓐ Ⓑ Ⓒ Ⓓ
11	Ⓐ Ⓑ Ⓒ Ⓓ	26	Ⓐ Ⓑ Ⓒ Ⓓ	41	Ⓐ Ⓑ Ⓒ Ⓓ	56	Ⓐ Ⓑ Ⓒ Ⓓ
12	Ⓐ Ⓑ Ⓒ Ⓓ	27	Ⓐ Ⓑ Ⓒ Ⓓ	42	Ⓐ Ⓑ Ⓒ Ⓓ	57	Ⓐ Ⓑ Ⓒ Ⓓ
13	Ⓐ Ⓑ Ⓒ Ⓓ	28	Ⓐ Ⓑ Ⓒ Ⓓ	43	Ⓐ Ⓑ Ⓒ Ⓓ	58	Ⓐ Ⓑ Ⓒ Ⓓ
14	Ⓐ Ⓑ Ⓒ Ⓓ	29	Ⓐ Ⓑ Ⓒ Ⓓ	44	Ⓐ Ⓑ Ⓒ Ⓓ	59	Ⓐ Ⓑ Ⓒ Ⓓ
15	Ⓐ Ⓑ Ⓒ Ⓓ	30	Ⓐ Ⓑ Ⓒ Ⓓ	45	Ⓐ Ⓑ Ⓒ Ⓓ	60	Ⓐ Ⓑ Ⓒ Ⓓ