Sample Question Paper - 4
Class – X Session -2021-22
TERM 1
Subject- Mathematics (Standard) 041

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 40**

General Instructions:

1. The question paper contains three parts A, B and C.
2. Section A consists of 20 questions of 1 mark each. Attempt any 16 questions.
3. Section B consists of 20 questions of 1 mark each. Attempt any 16 questions.
4. Section C consists of 10 questions based on two Case Studies. Attempt any 8 questions.
5. There is no negative marking.

Section A

Attempt any 16 questions

1. The largest number which divides 70 and 125, leaving remainders 5 and 8, respectively, is **[1]**

 a) 875 b) 65

 c) 13 d) 1750

2. If the system of equations **[1]**
 $3x + y = 1$ and
 $(2k - 1) x + (k - 1) y = 2k + 1$
 is inconsistent, then k =

 a) -1 b) 1

 c) 2 d) 0

3. In $\triangle ABC$, it is given that AB = 9 cm, BC = 6 cm and CA = 7.5 cm. Also, $\triangle DEF$ is given such that EF = 8 cm and $\triangle DEF \sim \triangle ABC$. Then, perimeter of $\triangle DEF$ is **[1]**

 a) 30 cm b) 22.5 cm

 c) 27 cm d) 25 cm

4. If $29x + 37y = 103$ and $37x + 29y = 95$ then **[1]**

 a) x = 3, y = 2 b) x = 2, y = 1

 c) x = 2, y = 3 d) x = 1, y = 2

5. If $8 \tan x = 15$, then $\sin x - \cos x$ is equal to **[1]**

 a) $\frac{17}{7}$ b) $\frac{8}{17}$

 c) $\frac{7}{17}$ d) $\frac{1}{17}$

6. The least positive integer divisible by 20 and 24 is **[1]**

 a) 480 b) 240

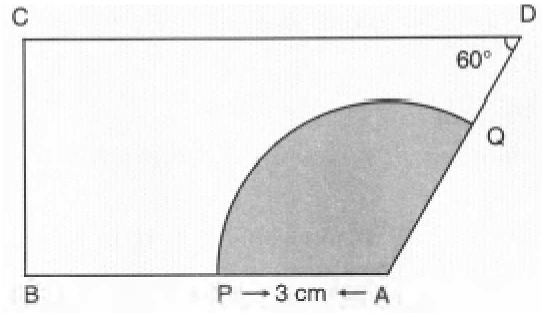
c) 360 d) 120

7. If -2 and 3 are the zeros of the quadratic polynomial $x^2 + (a + 1)x + b$ then **[1]**

a) a = 2, b = 6 b) a = 2, b = -6

c) a = -2, b = -6 d) a = -2, b = 6

8. In Fig, the area of the shaded region is **[1]**



a) 9π cm^2 b) 6π cm^2

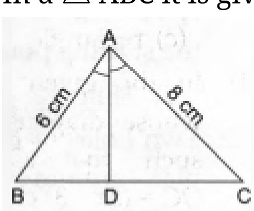
c) 7π cm^2 d) 3π cm^2

9. A quadratic polynomial whose product and sum of zeroes are $\frac{1}{3}$ and $\sqrt{2}$ respectively is **[1]**

a) $3x^2 - x + 3\sqrt{2}x$ b) $3x^2 - 3\sqrt{2}x + 1$

c) $3x^2 + x - 3\sqrt{2}x$ d) $3x^2 + 3\sqrt{2}x + 1$

10. In a $\triangle$ ABC it is given that AB = 6 cm, AC = 8 cm and AD is the bisector of $\angle$A. Then, BD : DC = ? **[1]**



a) 3 : 4 b) 9 :16

c) $\sqrt{3} : 2$ d) 4 : 3

11. A card is selected at random from a well shuffled deck of 52 playing cards. The probability of its being a face card is **[1]**

a) $\frac{3}{26}$ b) $\frac{3}{13}$

c) $\frac{1}{26}$ d) $\frac{4}{13}$

12. $7 \times 11 \times 13 + 13$ is a/an: **[1]**

a) odd number but not composite b) square number

c) prime number d) composite number

13. The circumference of a circle is 100 cm. The side of a square inscribed in the circle is **[1]**

a) $\frac{50}{\pi}$ b) $50\sqrt{2}$

c) $\frac{100}{\pi\sqrt{2}}$ d) $\frac{50\sqrt{2}}{\pi}$

14. If the sum of the areas of two circles with radii r_1 and r_2 is equal to the area of a circle of radius r, then $r_1^2 + r_2^2$ **[1]**

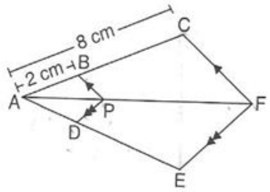
a) r^2

b) $<r^2$

c) None of these

d) $>r^2$

15. In the given figure if $BP||CF$, $DP||EF$, then AD : DE is equal to **[1]**



a) 1 : 3

b) 1 : 4

c) 3 : 4

d) 2 : 3

16. If cot A + $\frac{1}{\cot A}$ = 2 then cot^{2}A + $\frac{1}{\cot^2 A}$ = **[1]**

a) 1

b) -1

c) 2

d) 0

17. The sum of the numerator and denominator of a fraction is 18. If the denominator is increased by 2, the fraction reduces to $\frac{1}{3}$. The fraction is **[1]**

a) $\frac{-7}{11}$

b) $\frac{5}{13}$

c) $\frac{-5}{13}$

d) $\frac{7}{11}$

18. A bag contains 3 red, 5 black and 7 white balls. A ball is drawn from the bag at random. The probability that the ball drawn is not black, is: **[1]**

a) $\frac{5}{10}$

b) $\frac{2}{3}$

c) $\frac{1}{3}$

d) $\frac{9}{15}$

19. The HCF of two consecutive numbers is **[1]**

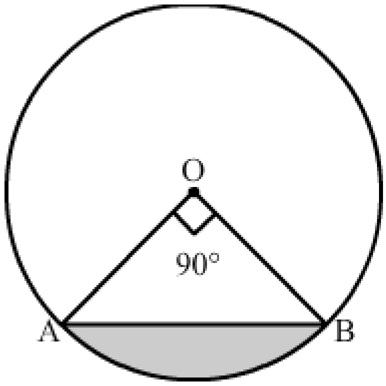
a) 2

b) 0

c) 3

d) 1

20. In fig, the shaded area is (radius = 10cm) **[1]**



a) 25 (π – 2) cm^2

b) 5 (π−2) cm^2

c) 25 (π+2) cm^2

d) 50 (π−2) cm^2

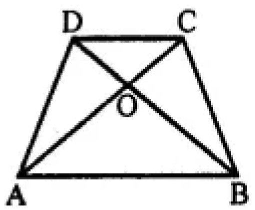
Section B

Attempt any 16 questions

21. The graphs of the equations 2x + 3y - 2 = 0 and x - 2y - 8 = 0 are two lines which are [1]

a) perpendicular to each other
b) parallel
c) intersecting exactly at one point
d) coincident

22. In the given figure, ABCD is a trapezium whose diagonals AC and BD intersect at O such that OA = (3x - 1) cm, OB = (2x +1) cm, OC = (5x - 3) cm and OD = (6x - 5) cm. Then, x = ? [1]



a) 4
b) 2
c) 3.5
d) 3

23. If $a = 2^3 \times 3, b = 2 \times 3 \times 5, c = 3^n \times 5$ and LCM (a, b, c) $= 2^3 \times 3^2 \times 5$, then n = [1]

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

24. If a cot θ + b cosec θ = p and b cot θ + a cosec θ = q, then $p^2 - q^2$ = [1]

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

25. In a $\triangle$ABC, $\angle$C = 3$\angle$B = 2($\angle$A + $\angle$B), then $\angle$B = ? [1]

a) 60°
b) 40°
c) 80^o
d) 20°

26. The lengths of the diagonals of a rhombus are 16 cm and 12 cm. Then, the length of the side of the rhombus is [1]

a) 9 cm
b) 10 cm
c) 8 cm
d) 20 cm

27. $\triangle$ABC $\sim$ $\triangle$DEF such that ar ($\triangle$ABC) = 36 cm^2 and ar ($\triangle$DEF) = 49 cm^2. Then, the ratio of their corresponding sides is [1]

a) 7 : 6
b) $\sqrt{6} : \sqrt{7}$
c) 36 : 49
d) 6 : 7

28. The coordinates of the mid-point of the line segment joining the points (-2, 3) and (4, -5) are [1]

a) (0, 0)
b) (-1, 1)
c) (1, -1)
d) (-2, 4)

29. If sec θ + tan θ = x, then sec θ = [1]

a) $\frac{x^2+1}{x}$
b) $\frac{x^2-1}{2x}$
c) $\frac{x^2-1}{x}$
d) $\frac{x^2+1}{2x}$

30. Half the perimeter of a rectangular garden, whose length is 4m more than its width is 36m. The area of the garden is **[1]**

a) $320\ m^2$
b) $300\ m^2$
c) $400\ m^2$
d) $360\ m^2$

31. The number $(\sqrt{3}+\sqrt{5})^2$ is **[1]**

a) an irrational number
b) an integer
c) a rational number
d) not a real number

32. The decimal expansion of the rational number $\frac{37}{2^2\times5}$ will terminate after **[1]**

a) two decimal places
b) one decimal place
c) four decimal places
d) three decimal places

33. $\cos^2 30^\circ \cos^2 45^\circ + 4\sec^2 60^\circ + \frac{1}{2}\cos^2 90^\circ - 2\tan^2 60^\circ$ = ? **[1]**

a) $\frac{75}{8}$
b) $\frac{73}{8}$
c) $\frac{83}{8}$
d) $\frac{81}{8}$

34. If the perimeter of a circle is equal to that of a square, then the ratio of their areas is **[1]**

a) 22 : 7
b) 14 : 11
c) 11 : 14
d) 7 : 22

35. Two dice are thrown simultaneously. The probability of getting a doublet is **[1]**

a) $\frac{1}{6}$
b) $\frac{1}{3}$
c) $\frac{2}{3}$
d) $\frac{1}{4}$

36. The sum of the digits of a two digit number is 9. Nine times this number is twice the number obtained by reversing the digits, then the number is **[1]**

a) 72
b) 27
c) 18
d) 81

37. If a = $(2^2 \times 3^3 \times 5^4)$ and b = $(2^3 \times 3^2 \times 5)$ then HCF (a, b) = ? **[1]**

a) 360
b) 90
c) 180
d) 540

38. If $2\cos 3\theta = 1$ then θ= ? **[1]**

a) 30°
b) 10°
c) 15°
d) 20°

39. A letter is chosen at random from the word ASSASSINATION. The probability that it is a vowel is **[1]**

a) $\frac{6}{13}$
b) $\frac{7}{13}$
c) $\frac{6}{31}$
d) $\frac{3}{13}$

40. Point $P\left(\frac{a}{8},4\right)$ is the mid-point of the line segment joining the points A(- 5, 2) and B(4, 6). The **[1]**

value of **a** is:

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

Section C

Attempt any 8 questions

Question No. 41 to 45 are based on the given text. Read the text carefully and answer the questions:

Ankit's father gave him some money to buy avocado from the market at the rate of p(x) = x^2 - 24x + 128. Let α, β are the zeroes of p(x).

41. Find the value of α and β, where $\alpha < \beta$. **[1]**

a) 8, 16
b) 4, 9
c) 8, 15
d) -8, -16

42. Find the value of $\alpha + \beta + \alpha\beta$. **[1]**

a) 158
b) 152
c) 151
d) 155

43. The value of p(2) is **[1]**

a) 81
b) 83
c) 80
d) 84

44. If α and β are zeroes of x^2 + x - 2, then $\frac{1}{\alpha} + \frac{1}{\beta}$ = **[1]**

a) $\frac{1}{3}$
b) $\frac{1}{2}$
c) $\frac{1}{5}$
d) $\frac{1}{4}$

45. If sum of zeroes of q(x) = kx^2 + 2x + 3k is equal to their product, then k = **[1]**

a) $\frac{-2}{3}$
b) $\frac{1}{3}$
c) $\frac{-1}{3}$
d) $\frac{2}{3}$

Question No. 46 to 50 are based on the given text. Read the text carefully and answer the questions:

Students of residential society undertake to work for the campaign **Say no to Plastics**. Group A took the region under the coordinates (3, 3), (6, y), (x, 7) and (5, 6) and group B took the region under the coordinates (1, 3), (2, 6), (5, 7) and (4, 4).

46. If region covered by group A forms a parallelogram, where the coordinates are taken in the given order, then **[1]**

a) x = 8, y = 4
b) x = 2, y = 4
c) x = 4, y = 8
d) x - 4, y = 2

47. Perimeter of the region covered by group A is **[1]**

a) $(\sqrt{10}+\sqrt{13})$ units
b) none of these
c) $\sqrt{13}$ units
d) $\sqrt{10}$ units

48. If the coordinates of region covered by group B, taken in the same order forms a quadrilateral, then the length of each of its diagonals is **[1]**

a) $3\sqrt{2}$ units, $2\sqrt{2}$ units
b) $4\sqrt{2}$ units, $2\sqrt{2}$ units
c) $3\sqrt{2}$ units, $2\sqrt{2}$ units
d) none of these

49. If region covered by group B forms a rhombus, where the coordinates are taken in given order, then the perimeter of this region is **[1]**

a) $2\sqrt{10}$ units
b) $\sqrt{10}$ units
c) $4\sqrt{10}$ units
d) $3\sqrt{10}$

50. The coordinates of the point which divides the join of points P(x_1, y_1) and Q(x_2, y_2) internally in the ratio m : n is **[1]**

a) $\left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}\right)$
b) $\left(\frac{mx_2+ny_2}{m+n}, \frac{mx_1+ny_1}{m+n}\right)$
c) none of these
d) $\left(\frac{mx_1+ny_1}{m+n}, \frac{mx_2+ny_2}{m+n}\right)$

Solution

Section A

1. **(c)** 13

   Explanation: Since, it is given that 5 and 8 are the remainders of 70 and 125 respectively. On subtracting these remainders from the numbers we get 65 = (70-5) and 117 = (125-8), which is divisible by the required number.
   Now, required number = HCF (65,117) [for the largest number]
   According to Euclid's division algorithm,
   b = a $\times$ q + r, 0 ≤ r < a [$\because$dividend = divisor $\times$ quotient + remainder]
   $\Rightarrow$ 117 = 65 × 1 + 52
   $\Rightarrow$ 65 = 52 × 1 + 13
   $\Rightarrow$ 52 = 13 × 4 + 0
   $\Rightarrow$ HCF = 13
   Hence, 13 is the largest number which divides 70 and 125, leaving remainders 5 and 8

2. **(c)** 2

   Explanation: The given system of equations is inconsistent,
   3x + y = 1
   (2k - 1)x + (k - 1)y = 2k + 1
   If the system of equations is inconsistent, we have
   $\frac{3}{2k-1} = \frac{1}{k-1} = \frac{1}{2k+1}$
   Take,
   $\frac{3}{2k-1} = \frac{1}{k-1}$
   $\Rightarrow 3k - 3 = 2k - 1$
   $\Rightarrow k = 2$

3. **(a)** 30 cm

   Explanation: $\triangle$DEF $\sim$ $\triangle$ABC
   $\therefore \frac{\text{DE}}{\text{AB}} = \frac{\text{EF}}{\text{BC}} = \frac{\text{DF}}{\text{AC}} = \frac{\text{DE+EF+DF}}{\text{AB+BC+AC}}$
   $\Rightarrow \frac{\text{DE}}{9} = \frac{8}{6} = \frac{\text{DF}}{7.5}$
   $\frac{DE}{9} = \frac{8}{6} \Rightarrow DE = \frac{8\times9}{6} = 12\text{cm}$
   $\frac{\text{DF}}{7.5} = \frac{8}{6} \Rightarrow \text{DF} = \frac{7.5\times8}{6} = 10\text{cm}$
   Perimeter of $\triangle$DEF = DE + EF + DF
   = 12 + 8 + 10 = 30 cm

4. **(d)** x = 1, y = 2

   Explanation: 29x + 37y=103 ....(i)
   37x+29y=95 ....(ii)
   Adding (i) and (ii), we get 66 (x + y) = 198 $\Rightarrow$ x + y = 3.
   Subtracting (ii) from (i), we get 8 (y - x) = 8 $\Rightarrow$ y - x = 1.
   Solve above equations we get
   x = 1, y = 2

5. **(c)** $\frac{7}{17}$

   Explanation: 8 tan x = 15 $\Rightarrow \tan x = \frac{15}{8} = \frac{\text{Perpendicular}}{\text{Base}}$
   By Pythagoras Theorem,
   (Hyp.)^2 = (Base}^{2} + (Perp.)^2
   = $(8)^2 + (15)^2$
   = 64 + 225 = 289 = (17)^2
   $\therefore$ Hyp. = 17 units

$\therefore$ sin x = $\frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{15}{17}$

cos x = $\frac{\text{Base}}{\text{Hypotenuse}} = \frac{8}{17}$

sin x - cos x = $\frac{15}{17} - \frac{8}{17} = \frac{15-8}{17}$

$= \frac{7}{17}$

6. **(d)** 120

   Explanation: Least positive integer divisible by 20 and 24 is LCM of (20, 24).

   20 = $2^2 \times 5$

   24 = $2^3 \times 3$

   $\therefore$ LCM (20, 24) = $2^3 \times 3 \times 5$ = 120

   Thus 120 is divisible by 20 and 24.

7. **(c)** a = -2, b = -6

   Explanation: $\alpha + \beta = 3 + (-2) = 1$ and $\alpha\beta = 3 \times (-2) = -6$

   $\therefore$ -(a + 1) = 1

   $\Rightarrow$ a + 1 = -1 $\Rightarrow$ a = -2

   Also, b = -6

8. **(d)** 3π cm^2

   Explanation: In the figure,

   $\angle C = \angle B = 90^\circ$ and $\angle D = 60^\circ$

   $\therefore \angle A + \angle B + \angle C + \angle D = 360^\circ$

   $\angle A + 90^\circ + 90^\circ + 60^\circ = 360^\circ$

   $\therefore \angle A = 120^\circ$

   Area of shaded region $= \frac{\theta}{360} \times \pi r^2$

   $= \frac{120}{360} \times \pi \times 3^2$

   $= \frac{1}{3} \times \pi \times 9$

   $= 3\pi$

   Therefore, area of the shaded region is 3π cm^2.

9. **(b)** $3x^2 - 3\sqrt{2}x + 1$

   Explanation: Given: $\alpha + \beta = \frac{\sqrt{2}}{1} = \frac{-(-\sqrt{2})}{1} = \frac{-(-3\sqrt{2})}{3}$

   And $\alpha\beta = \frac{c}{a} = \frac{1}{3}$ On comparing, we get, a = 3, b = $-3\sqrt{2}$, c = 1

   Putting these values in the general form of a quadratic polynomial $ax^2 + bx + c$,

   we have $3x^2 - 3\sqrt{2} + 1$

10. **(a)** 3 : 4

    Explanation: $\frac{BD}{DC} = \frac{AB}{AC} = \frac{6}{8} = \frac{3}{4}$ [by angle-bisector theorem]

11. **(b)** $\frac{3}{13}$

    Explanation: Face Cards are = 4 kings + 4 queens + 4 jacks = 12

    Number of possible outcomes = 12

    Number of Total outcomes = 52

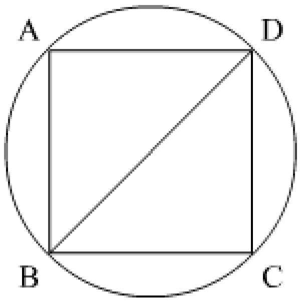
    $\therefore$ Required Probability = $\frac{12}{52} = \frac{3}{13}$

12. **(d)** composite number

    Explanation: We have 7 $\times$ 11 $\times$ 13 + 13 = 13 (77 + 1) = 13 $\times$ 78. Since the given number has 2 more factors other than 1 and itself, therefore it is a composite number.

13. **(c)** $\frac{100}{\pi\sqrt{2}}$

    Explanation:



We have given the circumference of the circle that is 100 cm.
If d is the diameter of the circle, then its circumference will be πd.
$\therefore \pi d = 100$
$\therefore d = \frac{100}{\pi}$
We obtained diameter of the circle which is also the diagonal of the square ABCD.
Now, side of a square is;
Diagonal = $\sqrt{2} \times$ side
Therefore, side = $\frac{Diagonal}{\sqrt{2}} = \frac{\frac{100}{\pi}}{\sqrt{2}}$
Therefore, side of the inscribed square is $\frac{100}{\pi\sqrt{2}}$cm.

14. **(a)** r^2
Explanation: We have given area of the circle of radius r_1 + area of the circle of radius r_2 = area of the circle of radius r.
Therefore, we have,
$\pi r_1^2 + \pi r_2^2 = \pi r^2$
Cancelling π, we get
$r_1^2 + r_2^2 = r^2$
Therefore, $r_1^2 + r_2^2 = r^2$.

15. **(a)** 1 : 3
Explanation: Since BP$\|$CF,
Then, $\frac{AP}{PF} = \frac{AB}{BC}$ [Using Thales Theorem]
$\Rightarrow \frac{AP}{PF} = \frac{2}{6} = \frac{1}{3}$
Again, since DP$\|$ EF,
Then, $\frac{AP}{PF} = \frac{AD}{DE}$ [Using Thales Theorem]
$\Rightarrow \frac{AD}{DE} = \frac{1}{3}$
$\Rightarrow$ AD : DE = 1 : 3

16. **(c)** 2
Explanation: Given: cot A + $\frac{1}{\cot A}$ = 2
Squaring both sides, we get
$\Rightarrow \cot^2 A + \frac{1}{\cot^2 A} + 2 \times \cot A \times \frac{1}{\cot A} = 4$
$\Rightarrow \cot^2 A + \frac{1}{\cot^2 A} = 2$

17. **(b)** $\frac{5}{13}$
Explanation: Let the fraction be $\frac{x}{y}$.
According to question
x + y = 18 ... (i)
And $\frac{x}{y+2} = \frac{1}{3}$
$\Rightarrow$ 3x = y + 2
$\Rightarrow$ 3x - y = 2 ... (ii)
On solving eq. (i) and eq. (ii), we get
x = 5, y = 13
Therefore, the fraction is $\frac{5}{13}$

18. **(b)** $\frac{2}{3}$
Explanation: Total no of balls = 3 + 5 + 7
= 15
Favourable cases (not black) = 10 [3 red + 7 white]
Probability = $\frac{favourable \quad outcomes}{total \quad outcomes}$
So, here P(not black) = $\frac{10}{15}$ = $\frac{2}{3}$
Therefore the probability that the ball is drawn is not black is $\frac{2}{3}$

19. **(d)** 1
Explanation: The HCF of two consecutive numbers is always 1. (e.g. HCF of 24, 25 is 1).

20. **(a)** 25 (π - 2) cm^2
Explanation: Area of the shaded region is-
$= \left[\frac{\pi\theta}{360} - \sin\frac{\theta}{2}\cos\frac{\theta}{2}\right](r)^2$
$= \left(\frac{\pi}{4} - \frac{1}{2}\right)(10)^2$
$= 25(\pi - 2)\text{cm}^2$

Section B

21. **(c)** intersecting exactly at one point
Explanation: We have,
2x + 3y – 2 = 0
And, x – 2y – 8 = 0
Here, a_1 = 2, b_1 = 3 and c_1 = – 2
And, a_2 = 1, b_2 = – 2 and c_2 = – 8
$\therefore \frac{a1}{a2} = \frac{2}{1}, \frac{b1}{b2} = \frac{3}{-2}$ and $\frac{c_1}{c_2} = \frac{-2}{-8} = \frac{1}{4}$
Clearly, $\frac{a1}{a2} \neq \frac{b1}{b2}$
Hence, the given system has a unique solution and the lines intersect exactly at one point.

22. **(b)** 2
Explanation: In the given figure,
ABCD is a trapezium and its diagonals AC
and BD intersect at O.
and OA = (3x – 1) cm OB = (2x + 1) cm, OC and OD = (6x – 5) cm
Now, $\frac{AO}{OC} = \frac{BO}{OD}$
(Diagonals of a trapezium divides each other proportionally)
$\Rightarrow \frac{3x-1}{5x-3} = \frac{2x+1}{6x-5}$
$\Rightarrow (3x-1)(6x-5) = (2x+1)(5x-3)$
$\Rightarrow 18x^2 - 10x^2 - 21x + 6x - 5x + 5 + 3 = 0$
$\Rightarrow 8x^2 - 20x + 8 = 0$
$\Rightarrow 2x^2 - 5x + 2 = 0$
$\Rightarrow 2x^2 - x - 4x + 2 = 0$
$\Rightarrow x(2x-1) - 2(2x-1) = 0$
$\Rightarrow (2x-1)(x-2) = 0$
Either 2x - 1 = 0, then x = $\frac{1}{2}$ but it does not satisfy
or x - 2 = 0, then x = 2
$\therefore$ x = 2

23. **(d)** 2
Explanation: LCM (a, b, c) $= 2^3 \times 3^2 \times 5$ .... (I)
we have to find the value of n
Also we have
$a = 2^3 \times 3$
$b = 2 \times 3 \times 5$

$c = 3^n \times 5$
We know that the while evaluating LCM, we take greater exponent of the prime numbers in the factorisation of the number.
Therefore, by applying this rule and taking $n \geq 1$ we get the LCM as
LCM (a, b, c) = $2^3 \times 3^n \times 5$ ..... (II)
On comparing (I) and (II) sides, we get:
$2^3 \times 3^2 \times 5 = 2^3 \times 3^n \times 5$
n = 2

24. **(c)** $b^2 - a^2$
Explanation: Given,
a cot θ + b cosec θ = p
b cot θ + a cosec θ = q
Squaring and subtracting above equations, we get
$p^2 - q^2 = (a \cot\theta + b \operatorname{cosec}\theta)^2 - (b \cot\theta + a \operatorname{cosec}\theta)^2$
$= a^2 \cot^2\theta + b^2 \operatorname{cosec}^2\theta + 2ab \cot\theta \operatorname{cosec}\theta - (b^2 \cot^2\theta + a^2 \operatorname{cosec}^2\theta + 2ab \cot\theta \operatorname{cosec}\theta)$
$= a^2 \cot^2\theta + b^2 \operatorname{cosec}^2\theta + 2ab \cot\theta \operatorname{cosec}\theta - b^2 \cot^2\theta - a^2 \operatorname{cosec}^2\theta - 2ab \cot\theta \operatorname{cosec}\theta$
$= a^2 (\cot^2\theta - \operatorname{cosec}^2\theta) + b^2 (\operatorname{cosec}^2\theta - \cot^2\theta)$
$= -a^2 (\operatorname{cosec}^2\theta - \cot^2\theta) + b^2 (\operatorname{cosec}^2\theta - \cot^2\theta)$
$= -a^2 \times 1 + b^2 \times 1$
$= b^2 - a^2$

25. **(b)** 40°
Explanation: Let C = 3B = 2(A + B) = x°.
Then, C = x°, B = $\left(\frac{x}{3}\right)^\circ$ and (A + B) = $\left(\frac{x}{2}\right)^o$
(A + B) + C = 180° $\Rightarrow \frac{x}{2}$ + x = 180 $\Rightarrow$ 3x = 360 $\Rightarrow$ x = 120.
$\therefore \angle B = \left(\frac{120}{3}\right)^\circ = 40^\circ$

26. **(b)** 10 cm
Explanation: One diagonal is 16 and another 12 then half of both length is 8 and 6.diagonal of rhombus bisect at 90^o
Hence, by pythagoras theorem we have
$8^2 + 6^2 = h^2$
64 + 36 = 100
Side = 10.

27. **(d)** 6 : 7
Explanation: $\triangle$ABC $\sim$ $\triangle$DEF
ar ($\triangle$ABC) = 36 cm² and ar ($\triangle$DEF) = 49 cm²
i.e. areas ABC and DEF 36 49
Ratio in their corresponding sides = $\sqrt{36}$: $\sqrt{49}$ = 6 : 7

28. **(c)** (1, -1)
Explanation: Let the coordinates of midpoint C(x, y) of the line segment joining the points A(-2, 3) and B(4, -5)
$\therefore$ x = $\frac{x_1+x_2}{2}$ = $\frac{-2+4}{2} = \frac{2}{2}$ = 1
And y = $\frac{y_1+y_2}{2}$ = $\frac{3-5}{2} = \frac{-2}{2}$ = -1
Therefore, the coordinates of mid-point C are (1, -1)

29. **(d)** $\frac{x^2+1}{2x}$
Explanation: Given, $\sec\theta + \tan\theta = x$
We know that, $\sec^2\theta - \tan^2\theta = 1$
$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$
$\Rightarrow x(\sec\theta - \tan\theta) = 1$

$\sec\theta - \tan\theta = \frac{1}{x}$
Now $\sec\theta + \tan\theta = x$
Adding we get,
$2\sec\theta = \frac{1}{x} + x = \frac{1+x^2}{x}$
$\sec\theta = \frac{1+x^2}{2x}$

30. **(a)** 320 m^2
Explanation: Let the width be x
then length be x + 4
According to the question,
l + b = 36
x + (x + 4) = 36
2x + 4 = 36
2x = 36-4
2x = 32
x = 16.
Hence, The length of the garden will be 20 m and width will be 16 m.
Area = length $\times$ breath = 20 $\times$ 16 = 320 m^2

31. **(a)** an irrational number
Explanation: $\left(\sqrt{3}+\sqrt{5}\right)^2$ = $\left(\sqrt{3}\right)^2 + \left(\sqrt{5}\right)^2 + 2\times\sqrt{3}\times\sqrt{5}$
= $3 + 5 + 2\sqrt{15}$
= $8 + 2\sqrt{15}$
Here, $\sqrt{15} = \sqrt{3}\times\sqrt{5}$
Since $\sqrt{3}$ and $\sqrt{5}$ both are an irrational number. Therefore, $\left(\sqrt{3}+\sqrt{5}\right)^2$ is an irrational number.

32. **(a)** two decimal places
Explanation: $\frac{37}{2^2\times5} = \frac{37\times5}{2^2\times5^2} = \frac{185}{100} = 1.85$
So, the decimal expansion of the rational number will terminate after two decimal places.

33. **(c)** $\frac{83}{8}$
Explanation: $\cos^2 30^\circ \cos^2 45^\circ + 4\sec^2 60^\circ + \frac{1}{2}\cos^2 90^\circ - 2\tan^2 60^\circ$
$= \left(\frac{\sqrt{3}}{2}\right)^2 \cdot \left(\frac{1}{\sqrt{2}}\right)^2 + (4\times 2^2) + (\frac{1}{2}\times 0^2) - 2\times(\sqrt{3})^2$
$= (\frac{3}{4}\times\frac{1}{2}) + 16 + 0 - 6 = \frac{3}{8} + 10 = \frac{83}{8}$

34. **(b)** 14 : 11
Explanation: Let the radius of the circle be r and side of the square be a. Then, according to question,
$2\pi r = 4a \Rightarrow a = \frac{2\pi r}{4} = \frac{\pi r}{2}$
Now, ratio of their areas,
$\frac{\pi r^2}{\left(\frac{\pi r}{2}\right)^2}$
= $\frac{\pi r^2\times4}{\pi^2 r^2}$
= $\frac{14}{11}$
$\Rightarrow \pi r^2 : a^2 = 14 : 11$

35. **(a)** $\frac{1}{6}$
Explanation: Doublet means getting same number on both dice simultaneously
Doublets = (1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)
Number of possible outcomes = 6
Total number of ways to throw a dice = 36
Probability of getting a doublet = $\frac{6}{36} = \frac{1}{6}$

36. **(c)** 18
Explanation: Let unit digit = x , Tens digit = y , therefore original no will be 10y + x

Sum of digits are 9 So that x + y = 9 ... (i)
nine times this number is twice the number obtained by reversing the order of the digits 9(10y + x) = 2(10x + y)
90y + 9x = 20 x + 2y
88y - 11x = 0
Divide by 11 we get 8y - x = 0 ... (ii)
Adding equations (i) and (ii), we get
9y = 9
y = $\frac{9}{9}$ = 1
Putting this value in equation 1 we get
x + y = 9
x + 1 = 9
x = 8
Therefore the number is 10(1) + 8 = 18

37. **(c)** 180

Explanation: It is given that: a = $(2^2 \times 3^3 \times 5^4)$ and b = $(2^3 \times 3^2 \times 5)$

$\therefore$ HCF (a, b) = Product of smallest power of each common prime factor in the numbers = $2^2 \times 3^2 \times 5$ = 180

38. **(d)** 20°

Explanation: $2\cos 3\theta = 1 \Rightarrow \cos 3\theta = \frac{1}{2} = \cos 60^\circ \Rightarrow 3\theta = 60^\circ \Rightarrow \theta = 20^\circ$

39. **(a)** $\frac{6}{13}$

Explanation: Vowels present in the given word are A, A, I, A, I, O = 6
Number of possible outcomes = {A, A, I, A, I, O} = 6
Number of total outcomes = 13
Required Probability = $\frac{6}{13}$

40. **(a)** -4

Explanation: We have given that the mid point of A(-5, 2), B(4, 6) is p = ($\frac{a}{8}$, 4)
the mid point of A(-5, 2), B(4, 6) = ($\frac{-1}{2}$, 4)
so $\frac{a}{8}$ = $\frac{-1}{2}$
2a = -8
a = $\frac{-8}{2}$
a = -4

Section C

41. **(a)** 8, 16

Explanation: Given, α and β are the zeroes of p(x) = x^2 - 24x + 128
Putting p(x) = 0, we get
x^2 - 8x - 16x + 128 = 0
$\Rightarrow$ x(x - 8) - 16(x - 8) = 0
$\Rightarrow$ (x - 8)(x - 16) = 0 $\Rightarrow$ x = 8 or x = 16
$\therefore \alpha$ = 8, β = 16

42. **(b)** 152

Explanation: $\alpha + \beta + \alpha\beta$ = 8 + 16 + (8)(16) = 24 + 128 = 152

43. **(d)** 84

Explanation: p(2) = 2^2 - 24(2) + 128 = 4 - 48 + 128 = 84

44. **(b)** $\frac{1}{2}$

Explanation: Since α and β are zeroes of x^2 + x - 2
$\therefore \alpha + \beta$ = -1 and $\alpha\beta$ = -2
Now, $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\beta+\alpha}{\alpha\beta} = \frac{-1}{-2} = \frac{1}{2}$

45. **(a)** $\frac{-2}{3}$

Explanation: Sum of zeroes = $\frac{-2}{k}$

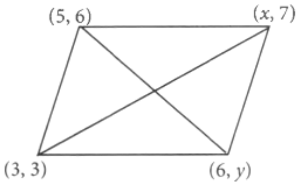
Product of zeroes = $\frac{3k}{k}$ = 3

According to question, we have $\frac{-2}{k}$ = 3

$\Rightarrow$ k = $\frac{-2}{3}$

46. **(a)** x = 8, y = 4

Explanation: Since the diagonals of a parallelogram bisect each other.



$\therefore$ By mid-point formula, we have

$\left(\frac{x+3}{2}, \frac{3+7}{2}\right) = \left(\frac{5+6}{2}, \frac{6+y}{2}\right)$

$\Rightarrow$ x + 3 = 11 and y + 6 = 10 $\Rightarrow$ x = 8 and y = 4

47. **(b)** none of these

Explanation: Distance between (3, 3) and (6, 4)

= $\sqrt{(6-3)^2+(4-3)^2}$ = $\sqrt{9+1} = \sqrt{10}$ units

And distance between (6, 4) and (8, 7)

= $\sqrt{(8-6)^2+(7-4)^2}$ = $\sqrt{4+9} = \sqrt{13}$ units

Now, required perimeter = $2(\sqrt{10}+\sqrt{13})$ units

48. **(a)** $3\sqrt{2}$ units, $2\sqrt{2}$ units

Explanation: Let A(1, 3), B(2, 6), C(5, 7) and D(4,4) be the given points. Then length of diagonal

AC = $\sqrt{(5-1)^2+(7-3)^2} = \sqrt{16+16}$

= $\sqrt{32} = 4\sqrt{2}$ units

and BD = $\sqrt{(4-2)^2+(4-6)^2} = \sqrt{4+4}$

= $\sqrt{8} = 2\sqrt{2}$ units

49. **(c)** $4\sqrt{10}$ units

Explanation: Length of one of the sides

= $\sqrt{(2-1)^2+(6-3)^2}$ = $\sqrt{1+9} = \sqrt{10}$ units

$\therefore$ Perimeter = $4\sqrt{10}$ units

50. **(a)** $\left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}\right)$

Explanation: $\left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}\right)$