Sample Question Paper - 2
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. Which of the following rational numbers have terminating decimal? **[1]**

a) $\frac{7}{250}$ b) $\frac{16}{225}$

c) $\frac{5}{18}$ d) $\frac{2}{21}$

2. The area of the triangle formed by x + 3y = 6, 2x – 3y = 12 and the y-axis is **[1]**

a) 15 sq. units b) 18 sq. units

c) 16 sq. units d) 12 sq. units

3. The zeroes of the polynomial x^2 - 3x - m (m + 3) are: **[1]**

a) –m, –(m + 3) b) m, –(m + 3)

c) –m, m + 3 d) m, m + 3

4. The value of k for which the system of equations x + y - 4 = 0 and 2x + ky = 3 has no solution, is: **[1]**

a) 3 b) -2

c) 4 d) 2

5. $\sqrt{\frac{1+\cos A}{1-\cos A}} = ?$ **[1]**

a) cosec A - cot A b) None of these

c) cosec A + cot A d) cosec A cot A

6. What is the largest number that divides each one of 1152 and 1664 exactly? **[1]**

a) 64 b) 256

c) 128 d) 32

7. The zeros of the quadratic polynomial x^2 + 88x + 125 are **[1]**

a) both negative

b) both positive

c) both equal

d) one positive and one negative

8. If x is a positive integer such that the distance between points P (x, 2) and Q (3, - 6) is 10 units, then x = **[1]**

a) 3

b) 9

c) -9

d) -3

9. If α, β are the zeros of the polynomial $p(x) = 4x^2 + 3x + 7$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is equal to **[1]**

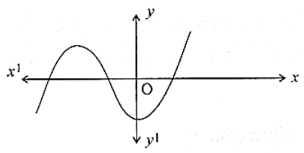
a) $\frac{3}{7}$

b) $-\frac{3}{7}$

c) $-\frac{7}{3}$

d) $\frac{7}{3}$

10. The graph of a polynomial is shown in Figure, then the number of its zeroes is: **[1]**



a) 4

b) 3

c) 1

d) 2

11. A die has its six faces marked 1, 2, 2, 2, 5, 6. The probability of getting 2 is **[1]**

a) $\frac{1}{2}$

b) $\frac{1}{5}$

c) $\frac{1}{4}$

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

12. The decimal expansion of the rational number $\frac{14587}{1250}$ will terminate after **[1]**

a) 4 decimal places

b) 1 decimal place

c) 3 decimal places

d) 2 decimal places

13. A line intersects the y-axis and x-axis at the points P and Q, respectively. If (2, –5) is the mid-point of PQ, then the coordinates of P and Q are, respectively **[1]**

a) (0, – 5) and (2, 0)

b) (0, 4) and (– 10, 0)

c) (0, 10) and (– 4, 0)

d) (0, – 10) and (4, 0)

14. (0, 3), (4, 0) and (– 4, 0) are the vertices of **[1]**

a) a right triangle

b) an isosceles triangle

c) a scalene triangle

d) an equilateral triangle

15. If one zero of the polynomial $f(x) = (k^2 + 4)x^2 + 13x + 4k$ is reciprocal of the other, then k = **[1]**

a) 1

b) −1

c) 2

d) −2

16. If $x = r \sin\theta \cos\phi$, $y = r \sin\theta \sin\phi$ and $z = r \cos\theta$, then **[1]**

a) $x^2 + y^2 + z^2 = r^2$

b) $x^2 - y^2 + z^2 = r^2$

c) $z^2 + y^2 - x^2 = r^2$

d) $x^2 + y^2 - z^2 = r^2$

17. The sum of two numbers is 8. If their sum is four times their difference, then the numbers are **[1]**

a) None of these

b) 7 and 1

c) 6 and 2

d) 5 and 3

18. A die is thrown once. The probability of getting an even number is **[1]**

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

b) $\frac{5}{6}$

c) $\frac{1}{6}$

d) $\frac{1}{2}$

19. 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

20. If the centroid of the triangle formed by (7, x), (y, -6) and (9, 10) is at (6, 3), then (x,y)= **[1]**

a) (5, 4)

b) (5, 2)

c) (-5, -2)

d) (4, 5)

Section B

Attempt any 16 questions

21. If $2^{x+y} = 2^{x-y} = \sqrt{8}$ then the value of y is **[1]**

a) none of these

b) 0

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

d) $\frac{1}{2}$

22. Which of the following is a polynomial? **[1]**

a) $\sqrt{2}x^2 - 3\sqrt{3}x + \sqrt{6}$

b) $x^{3/2} - x + x^{1/2} + 1$

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

d) $\sqrt{x} + \frac{1}{\sqrt{x}}$

23. If the HCF of 65 and 117 is expressible in the form 65m – 117, then the value of ‘m’ is **[1]**

a) 3

b) 1

c) 2

d) 4

24. If sin $\theta = \frac{\sqrt{3}}{2}$ then (cosec θ + cot θ) = ? **[1]**

a) $\sqrt{2}$

b) $(2 + \sqrt{3})$

c) $2\sqrt{3}$

d) $\sqrt{3}$

25. The pair of equations x + 2y + 5 = 0 and –3x – 6y + 1 = 0 have **[1]**

a) a unique solution

b) infinitely many solutions

c) no solution

d) exactly two solutions

26. If α and β are the zeros of $2x^2 + 5x - 9$ then the value of $\alpha\beta$ is **[1]**

a) $\frac{-9}{2}$

b) $\frac{9}{2}$

c) $\frac{5}{2}$

d) $\frac{-5}{2}$

27. If inΔABC and ΔDEF, $\frac{AB}{DE} = \frac{BC}{FD}$,then they will be similar, when **[1]**

a) $\angle B = \angle D.$

b) $\angle A = \angle D.$

c) $\angle A = \angle F$

d) $\angle B = \angle E.$

28. The coordinates of the point which divides the join of (-6, 10) and (3, -8) in the ratio 2 : 7 is **[1]**

a) (4, -6)
b) (-4, 6)
c) (1, -3)
d) (-1, 3)

29. The value of sin 45° + cos 45° is **[1]**

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

30. Given that 2x + 3y = 11, 2x - 4y = -24 and y = mx + 3, then the value of m is **[1]**

a) 2
b) 0
c) m= -1
d) 1

31. If two positive integers p and q can be expressed as p = ab^2 and q = a^3 b; a, b being prime numbers, then LCM (p, q) is **[1]**

a) $a^3 b^3$
b) $a^3 b^2$
c) $a^2 b^2$
d) ab

32. If S is a point on side PQ of a $\triangle$PQR such that PS = QS = RS, then **[1]**

a) $PS^2 + RS^2 = PR^2$
b) $PQ^2 + QR^2 = PS^2$
c) $QS^2 + RS^2 = QR$
d) $PR^2 + QR^2 = PQ^2$

33. $\frac{\sin\theta}{1+\cos\theta}$ is equal to **[1]**

a) $\frac{1-\sin\theta}{\cos\theta}$
b) $\frac{1-\cos\theta}{\cos\theta}$
c) $\frac{1-\cos\theta}{\sin\theta}$
d) $\frac{1+\cos\theta}{\sin\theta}$

34. The points A(9, 0), B(9, 6), C(-9, 6) and D(-9, 0) are the vertices of a **[1]**

a) rhombus
b) trapezium
c) rectangle
d) square

35. From a well shuffled pack of 52 cards, one card is drawn at random. The probability of getting a jack of hearts is **[1]**

a) $\frac{2}{52}$
b) $\frac{6}{52}$
c) $\frac{1}{52}$
d) $\frac{4}{52}$

36. A pair of linear equations which has a unique solution x = 2, y = –3 is **[1]**

a) x – 4y –14 = 0
5x – y + 13 = 0

b) 2x – y = 1
3x + 2y = 0

c) x + y = –1
2x – 3y = –5

d) 2x + 5y = –11
4x + 10y = –22

37. If 3 is the least prime factor of number 'a' and 7 is the least prime factor of number 'b', then the least prime factor of a + b, is **[1]**

a) 3
b) 10

c) 5

d) 2

38. If $2\sin 2\theta = \sqrt{3}$ then θ= ? **[1]**

a) 45°

b) 90°

c) 60°

d) 30°

39. Two dice are thrown simultaneously. The probability that the sum of the numbers appearing on the dice is 1 is **[1]**

a) 3

b) 0

c) 2

d) 1

40. The perimeter of the triangle formed by the points (0, 0), (1, 0) and (0, 1) is **[1]**

a) $2 + \sqrt{2}$

b) 3

c) $\sqrt{2} + 1$

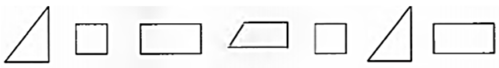
d) $1 \pm \sqrt{2}$

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:

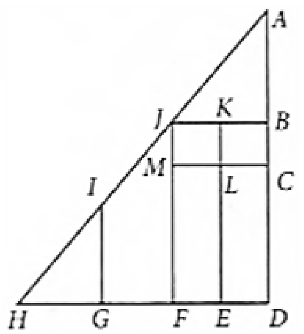
In a classroom, students were playing with some pieces of cardboard as shown below.



All of a sudden, teacher entered into classroom. She told students to arrange all pieces. On seeing this beautiful image, she observed that ΔADH is right angled triangle, which contains

i. right triangles ABJ and IGH.
ii. quadrilateral GFJI
iii. squares JKLM and LCBK
iv. rectangles MLEF and LCDE.

After observation, she ask certain questions to students.



41. If an insect (small ant) walks 24 m from H to F, then walks 6 m to reach at M, then walks 4 m to reach at L and finally crossing K, reached at J. Find the distance between initial and final position of insect. **[1]**

a) 28 m

b) 25 m

c) 27 m

d) 26 m

42. If m, n and r are the sides of right triangle ABJ, then which of the following can be correct? **[1]**

a) $m^2 + n^2 + r^2 = 0$

b) $m^2 + n^2 = 2r^2$

c) none of these

d) $m^2 + n^2 = r^2$

43. If $\triangle ABJ \sim \triangle ADH$, then which similarity criterion is used here? **[1]**

a) SAS

b) AA

c) SSS

d) AAS

44. If $\triangle ABJ = 90°$ and B, J are mid points of sides AD and AH respectively and BJ || DH, then which of the following option is false? **[1]**

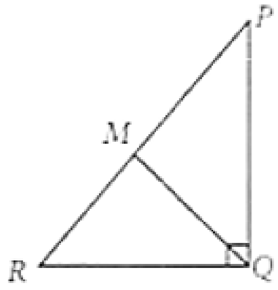
a) $\triangle ABJ \sim \triangle ADH$

b) 2BJ = DH

c) $\frac{AB}{BD} = \frac{AJ}{AH}$

d) $AJ^2 = JB^2 + AB^2$

45. If $\triangle PQR$ is right triangle with QM $\perp$ PR, then which of the following is not correct? **[1]**



a) $PR^2 = PQ + QR$

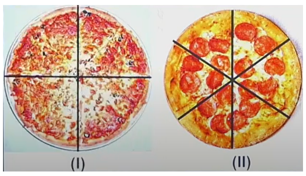
b) $\triangle PMQ \sim \triangle QMR$

c) $\triangle PMQ \sim \triangle PQR$

d) $QR^2 = PR^2 - PQ^2$

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

A group of friends ordered two pizzas for them. One of them was divided into four equal parts while the other in six equal parts. The pizzas were served in pans, exactly the size of the pizza, having a diameter of 35 cm each.



46. The area of the pan covered by one part of pizza-**I** is: **[1]**

a) $962.5\ cm^2$

b) $240.625\ cm^2$

c) $481.25\ cm^2$

d) $120.32\ cm^2$

47. The area of the pan covered by each part of pizza II is: **[1]**

a) $481.25\ cm^2$

b) $240.625\ cm^2$

c) $962.5\ cm^2$

d) $160.42\ cm^2$

48. The circumference of the pan is: **[1]**

a) 110 cm

b) 3850 cm

c) 220 cm

d) 440 cm

49. The ratio of the area of two circles when the ratio of the circumference is 3:1 will be: **[1]**

a) 1:3

b) 9:1

c) 3:1

d) 1:9

50. The area of a sector of a circle with a central angle 20° and radius 2r units is given by: **[1]**

a) $\frac{2}{9}\pi r^2$

b) $\frac{1}{16}\pi r^2$

c) $\frac{1}{18}\pi r^2$

d) $\frac{1}{9}\pi r^2$

Solution

Section A

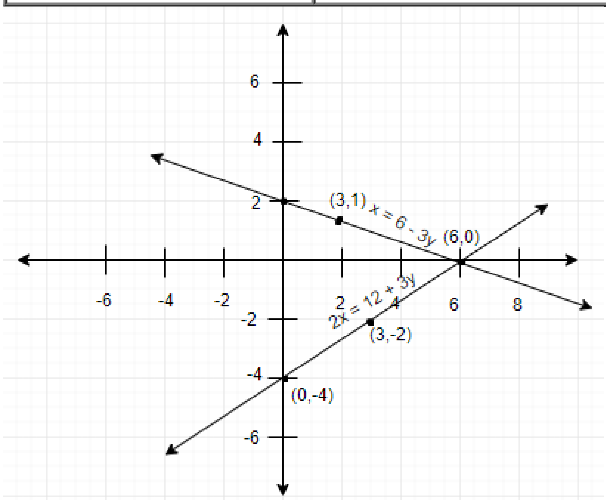
1. **(a)** $\frac{7}{250}$
Explanation: We have;
$\frac{7}{250} = \frac{7}{2^1 \times 5^3}$
Theorem states:
Let $x = \frac{P}{q}$ be a rational number, such that the prime factorization of q is of the form $2^m \times 5^n$, where m and n are non-negative integers.
Then, x has decimal expression which terminates after k places of decimal, where k is the larger of m and n.
Therefore, x has a decimal expression which will have terminating decimal after 3 places of decimal.
Hence $\frac{7}{250}$ will have terminating decimal expansion.

2. **(b)** 18 sq. units
Explanation: Here are the two solutions of each of the given equations. $x + 3y = 6$

x	0	3	6
y	2	1	0

$2x - 3y = 12$

x	0	3	6
y	-4	-2	0



∴ Area of triangle = $\frac{1}{2}$ × Base × Height = $\frac{1}{2} \times 6 \times 6$ = 18 sq. units

3. **(c)** –m, m + 3
Explanation: Given: equation $x^2 - 3x - m(m + 3) = 0$, where m is a constant
The given equation is the form of $ax^2 + bx + c = 0$
∴ a = 1, b = −3, c = −m(m + 3)
We know the roots of the equation can be find out using the formula,
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Substituting the values of a, b, c, we get
$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-m(m+3)}}{2}$
$\Rightarrow x = \frac{3 \pm \sqrt{9 + 4m^2 + 12m}}{2}$
$\Rightarrow x = \frac{3 \pm (2m+3)}{2}$

or $x=\frac{3+(2m+3)}{2}, x=\frac{3-(2m+3)}{2}$
⇒ x = m + 3 and x = −m are the required roots of the equation.

4. **(d)** 2
Explanation: x + y - 4 = 0, 2x + ky - 3 = 0
for no solution
$\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$
$\frac{1}{2}=\frac{1}{k}$
⇒ k = 2

5. **(c)** cosec A + cot A
Explanation: $\sqrt{\frac{1+\cos A}{1-\cos A}}=\sqrt{\frac{(1+\cos A)}{(1-\cos A)}\times\frac{(1+\cos A)}{(1+\cos A)}}=\frac{(1+\cos A)}{\sqrt{1-\cos^2 A}}=\frac{(1+\cos A)}{\sqrt{\sin^2 A}}$
$=\frac{(1+\cos A)}{\sin A}=\left(\frac{1}{\sin A}+\frac{\cos A}{\sin A}\right)=(cosec\ A+\cot A)$

6. **(c)** 128
Explanation: Largest number that divides each one of 1152 and 1664 = HCF (1152, 1664)
We know, 1152 = $2^7\times 3^2$
1164 = $2^7\times 13$
∴ HCF = 2^7 = 128

7. **(a)** both negative
Explanation: Given; $x^2+88x+125=0$
$D=(88)^2-4(1)(125)$
$D=7244$
Now,
$x=\frac{-(88)\pm\sqrt{7244}}{2(1)}$
$\Rightarrow x=\frac{-88+2\sqrt{1811}}{2}$
There roots are $x=-44+\sqrt{1811},-44-\sqrt{1811}$
Which are both negative.

8. **(b)** 9
Explanation: Distance between P(x, 2) and Q(3, -6) = 10 units
$\Rightarrow\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}=10$
$\Rightarrow\sqrt{(3-x)^2+(-6-2)^2}=10$
$\Rightarrow\sqrt{(3-x)^2+(-8)^2}=10$
$\Rightarrow\sqrt{(3-x)^2+64}=10$
Squaring both sides,
$(3 - x)^2 + 64 = 100$
⇒ $9 + x^2 - 6x + 64 - 100 = 0$
⇒ $x^2 - 6x - 27 = 0$
⇒ $x^2 - 9x + 3x - 27 = 0$ $\left\{\begin{array}{r}\because -27=-9\times 3\\ -6=-9+3\end{array}\right\}$
⇒ x(x - 9) + 3(x - 9) = 0
(x - 9) (x + 3) = 0
Either x - 9 = 0, then x = 9 or x + 3 = 0, then x = -3
x is positive integer
Hence x = 9

9. **(b)** $-\frac{3}{7}$
Explanation: Since α and β are the zeros of the quadratic polynomial $p(x)=4x^2+3x+7$
$\alpha+\beta=\frac{-\text{ Coefficient of }x}{\text{Coefficient of }x^2}=\frac{-3}{4}$

$\alpha\beta = \frac{\text{Constant term}}{\text{coefficient of } x^2} = \frac{7}{4}$

Now, $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\beta+\alpha}{\alpha\beta} = \frac{\frac{-3}{4}}{\frac{7}{4}} = \frac{-3}{4} \times \frac{4}{7} = \frac{-3}{7}$

Thus, the value of $\frac{1}{a} + \frac{1}{\beta}$ is $\frac{-3}{7}$.

10. **(b)** 3

Explanation: The graph of given polynomial cuts the x-axis at 3 distinct points.
therefore, No. of zeroes are 3.

11. **(a)** $\frac{1}{2}$

Explanation: Number of possible outcomes = 3
Number of total outcomes = 6
∴ Required Probability = $\frac{3}{6} = \frac{1}{2}$

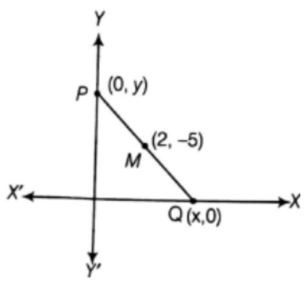
12. **(a)** 4 decimal places

Explanation: $\frac{14587}{1250} = \frac{14587}{2\times5^4}$

Here, in the denominator of the given fraction the highest power of prime factor 5 is 4, therefore, the decimal expansion of the rational number $\frac{14587}{1250}$ will terminate after 4 decimal places.

13. **(d)** (0, – 10) and (4, 0)

Explanation:
Let the coordinates of P (0, y) and Q (x, 0).
So, the mid - point of P (0, y) and Q (x, 0) = M
Coordinates of M = $\left(\frac{0+x}{2}, \frac{y+0}{2}\right)$
∴ Mid - point of a line segment having points (x_1, y_1) and (x_2, y_2)
= $\left(\frac{(x_1+x_2)}{2}, \frac{(y_1+y_2)}{2}\right)$
Given,
Mid - point of PQ is (2, - 5)

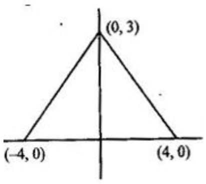


$\therefore 2 = \frac{x+0}{2}$ = 4 = x + 0
x = 4
$-5 = \frac{y+0}{2}$ = - 10 = y + 0
- 10 = y
So,
x = 4 and y = - 10
Thus, the coordinates of P and Q are (0, - 10) and (4, 0)

14. **(b)** an isosceles triangle

Explanation: Let vertices of a triangle ABC are A (0, 3), B$(-4, 0)$ and C (4, 0).
∴ AB = $\sqrt{(-4-0)^2 + (0-3)^2}$
= $\sqrt{16+9}$ = $\sqrt{25}$ = 5 units
BC = $\sqrt{(4+4)^2 + (0-0)^2}$ = $\sqrt{64+0}$ = $\sqrt{64}$ = 8 units
AC = $\sqrt{(4-0)^2 + (0-3)^2}$ = $\sqrt{16+9}$ = $\sqrt{25}$ = 5 units

Since, two sides are equal, therefore, ABC is an isosceles triangle.



15. **(c)** 2

Explanation: We are given $f(x) = \left(k^2+4\right)x^2 + 13x + 4k$ then

$\alpha + \beta = \frac{-\text{ Coefficient of } x}{\text{Coefficient of } x^2}$

$= \frac{-13}{k^2+4}$

$\alpha \times \beta = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$

$= \frac{4k}{k^2+4}$

One root of the polynomial is reciprocal of the other. Then, we have

$\alpha \times \beta = 1$

$\Rightarrow \quad \frac{4k}{k^2+4} = 1$

$\Rightarrow \quad (k-2)^2 = 0$

$\Rightarrow \quad k^2 - 4k + 4 = 0$

$\Rightarrow \quad k = 2$

16. **(a)** $x^2 + y^2 + z^2 = r^2$

Explanation: $x = r\sin\theta\cos\phi \Rightarrow \frac{x}{r} = \sin\theta\cos\phi$ ...(i)

$y = r\sin\theta\sin\phi \Rightarrow \frac{y}{r} = \sin\theta\sin\phi$ ...(ii)

$z = r\cos\theta \Rightarrow \frac{z}{r} = \cos\theta$ ...(iii)

Squaring and adding (i) and (ii)

$\frac{x^2}{r^2} + \frac{y^2}{r^2} = \sin^2\theta\cos^2\phi + \sin^2\theta\sin^2\phi$

$= \sin^2\theta\left(\cos^2\phi + \sin^2\phi\right)$

$= \sin^2\theta \times 1 \quad \left\{\sin^2\theta + \cos^2\theta = 1\right\}$

$= \sin^2\theta$

Now adding (iii) in it

$\frac{x^2}{r^2} + \frac{y^2}{r^2} + \frac{z^2}{r^2} = \sin^2\theta + \cos^2\theta = 1$

Hence $\frac{x^2}{r^2} + \frac{y^2}{r^2} + \frac{z^2}{r^2} = 1$

$\Rightarrow \frac{x^2+y^2+z^2}{r^2} = 1$

$\Rightarrow x^2 + y^2 + z^2 = r^2$

17. **(d)** 5 and 3

Explanation: x + y = 8

x = 8 - y ... (i)

x + y = 4(x - y) ... (ii)

Substitute (i) in (ii)

8 = 4x - 4y

2 = x - y

2 = 8 - y - y

2y = 8 - 2

y = 3

therefore, x = 8 - 3 = 5

Hence, Numbers are 5 and 3

18. **(d)** $\frac{1}{2}$

Explanation: Number of all possible outcomes = 6.

Even numbers are 2,4, 6. Their number is 3.

$\therefore$ P (getting an even number) = $\frac{3}{6} = \frac{1}{2}$

19. **(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

20. **(b)** (5, 2)

Explanation: Centroid of (7, x), (y, -6) and (9, 10) is (6, 3)

$\therefore \frac{x_1+x_2+x_3}{3} = 6 \Rightarrow \frac{7+y+9}{3} = 6$

$\Rightarrow$ 16 + y = 18

$\Rightarrow$ y = 18 - 16 = 2

and $\frac{y_1+y_2+y_3}{3} = 3 \Rightarrow \frac{x-6+10}{3} = 3$

$\Rightarrow$ x + 4 = 9 $\Rightarrow$ 9 - 4 = 5

$\therefore$ (x, y) = (5, 2)

Section B

21. **(b)** 0

Explanation: $2^{x+y} = 2^{x-y} = 2^{3/2} \Rightarrow$ x + y = $\frac{3}{2}$ and x - y = $\frac{3}{2}$. So, by adding above two equations we get and x= y = 0

22. **(a)** $\sqrt{2}x^2 - 3\sqrt{3}x + \sqrt{6}$

Explanation: Clearly, $\sqrt{2}x^2 - 3\sqrt{3}x + \sqrt{6}$ is a polynomial.

23. **(c)** 2

Explanation: First, find the HCF of 65 and 117

117 = 65 $\times$ 1 + 52

65 = 52 $\times$ 1 + 13

52 = 13 $\times$ 4 + 0 (zero remainder)

Therefore, HCF (117 , 65) is 13

Now,

$\therefore$ 65m – 117 = 13

$\Rightarrow$ 65m = 13 + 117

$\Rightarrow$ 65m = 130

$\Rightarrow$ m = 2

24. **(d)** $\sqrt{3}$

Explanation: Given: $\sin\theta = \frac{\sqrt{3}}{2}$ and cosec $\theta = \frac{2}{\sqrt{3}}$

$\text{cosec}^2 \theta$ - $\cot^2 \theta$ = 1

$\Rightarrow \cot^2 \theta = \text{cosec}^2\theta - 1$

$\Rightarrow \cot^2 \theta = \frac{4}{3} - 1$ [Given]

$\Rightarrow \cot \theta = \frac{1}{\sqrt{3}}$

$\therefore$ cosec θ + cot θ = $\frac{2}{\sqrt{3}} + \frac{1}{\sqrt{3}}$

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

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

$= \sqrt{3}$

25. **(c)** no solution

Explanation: Given, equations are

x + 2y + 5 = 0, and

- 3x - 6y + 1 = 0.

Comparing the equations with general form:

$a_1x + b_1y + c_1 = 0$

$a_2x + b_2y + c_2 = 0$

Here, $a_1 = 1, b_1 = 2, c_1 = 5$

And $a_2 = -3, b_2 = -6, c_2 = 1$

Taking the ratio of coefficients to compare

$\frac{a_1}{a_2} = \frac{-1}{3}, \frac{b_1}{b_2} = \frac{-1}{3}, \frac{c_1}{c_2} = \frac{5}{1}$

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

This represents a pair of parallel lines.

Hence, the pair of equations has no solution.

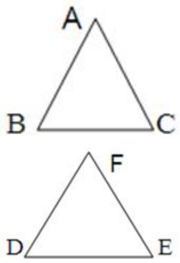
26. **(a)** $\frac{-9}{2}$

Explanation: For $ax^2 + bx + c$, we have $\alpha\beta = \frac{c}{a}$

For $2x^2 + 5x - 9$, we have $\alpha\beta = \frac{-9}{2}$

27. **(a)** $\angle B = \angle D.$

Explanation: In ΔABC and ΔDEF, $\frac{AB}{DE} = \frac{BC}{FD}$,then if, $\angle B = \angle D$ (the included angles) are equal then the triangles are similar



28. **(b)** (-4, 6)

Explanation: Given: $(x_1, y_1) = (-6, 10), (x_2, y_2) = (3, -8)$

and $m_1 : m_2 = 2 : 7$

$\therefore x = \frac{m_1x_2+m_2x_1}{m_1+m_2}$

$= \frac{2\times3+7\times(-6)}{2+7} = \frac{6-42}{9} = \frac{-36}{9}$ -4

And $y = \frac{m_1y_2+m_2y_1}{m_1+m_2} = \frac{2\times(-8)+7\times10}{2+7} = \frac{-16+70}{9} = \frac{54}{9} = 6$

Therefore, the required coordinates are (-4, 6)

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

Explanation: Given: $\sin 45^\circ + \cos 45^\circ$

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

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

30. **(c)** m= -1

Explanation: Given: 2x + 3y = 11 ... (i)

2x - 4y = -24 ... (ii)

Subtracting eq. (ii) from eq. (i), we get

7y = 35

$\Rightarrow$ y = 5
Putting the value of y in eq. (i), we get
$2x + 3 \times 5 = 11$
$\Rightarrow 2x = -4$
$\Rightarrow x = -2$
Now, y = mx + 3
$\Rightarrow 5 = m \times (-2) + 3$
$\Rightarrow 2m = 3 - 5$
m = -1

31. **(b)** $a^3 b^2$

Explanation: Let $p = ab^2 = a \times b \times b$

And $q = a^3b = a \times a \times a \times b$

$\Rightarrow$ LCM of p and q = LCM $(ab^2, a^3b) = a \times b \times b \times a \times a = a^3b^2$
[Since, LCM is the product of the greatest power of each prime factor involved in the number]

32. **(d)** $PR^2 + QR^2 = PQ^2$
Explanation: Given, in $\triangle PQR$
PS = QS = RS ....(i)
In $\triangle PSR$, PS = RS [fromEq. (i)]
$\Rightarrow \angle 1 = \angle 2$ ....(ii)
Similarly, in $\triangle RSQ$,
$\Rightarrow \angle 3 = \angle 4$ ....(iii)
[corresponding angles of equal sides are equal]

Now, in $\triangle PQR$, sum of angles = 180^o

$\Rightarrow \angle P + \angle Q + \angle R = 180^o$

$\Rightarrow \angle 2 + \angle 4 + \angle 1 + \angle 3 = 180^o$

$\Rightarrow \angle 1 + \angle 3 + \angle 1 + \angle 3 = 180^o$

$\Rightarrow 2(\angle 1 + \angle 3) = 180^o$

$\Rightarrow \angle 1 + \angle 3 = \frac{180^\circ}{2} = 90^o$

$\therefore \angle R = 90^o$
In $\triangle PQR$ by Pythagoras theorem,

$PR^2 + QR^2 = PQ^2$.

33. **(c)** $\frac{1-\cos\theta}{\sin\theta}$

Explanation: We have, $\frac{\sin\theta}{1+\cos\theta} = \frac{\sin\theta(1-\cos\theta)}{(1+\cos\theta)(1-\cos\theta)}$
$= \frac{\sin\theta(1-\cos\theta)}{1-\cos^2\theta} = \frac{\sin\theta(1-\cos\theta)}{\sin^2\theta}$
$= \frac{1-\cos\theta}{\sin\theta}$

34. **(c)** rectangle
Explanation: A (9, 0), B(9, 6), C(- 9, 6) and D(- 9, 0) are the given vertices.
Then,

$AB^2 = (9 - 9)^2 + (6 - 0)^2$

$= (0)^2 + (6)^2 = 0 + 36 = 36$ units

$BC^2 = (- 9 - 9)^2 + (6 - 6)^2$

$= (-18)^2 + (0)^2 = 324 + 0 = 324$ units

$CD^2 = (- 9 + 9)^2 + (0 - 6)^2 = (0)^2 + (-6)^2 = 0 + 3 = 36$ units

$DA^2 = (- 9 - 9)^2 + (0 - 0)^2 = (- 18)^2 + (0)^2 = 324 + 0 = 324$ units
Therefore, we have:

$AB^2 = CD^2$ and $BC^2 = DA^2$
Now, the diagonals are:

AC^2 = (- 9 - 9)^2 + (6 - 0)^2 = (- 18)^2 + (6)^2 = 324 + 36 = 360 units

BD^2 = (- 9 - 9)^2 + (0 - 6)^2 = (- 18)^2 + (- 6)^2 = 324 + 36 = 360 units

Therefore,

$AC^2 = BD^2$

Hence, *ABCD* is a rectangle.

35. **(c)** $\frac{1}{52}$

Explanation: Number of jacks of Heart in a pack of 52 cards = 1

Number of possible outcomes = 1

Number of Total outcomes = 52

∴ Required Probability = $\frac{1}{52}$

36. **(d)** 2x + 5y = –11

4x + 10y = –22

Explanation: If x = 2 and y = - 3 is a unique solution of any pair of equation, then these values must satisfy that pair of equations.

Putting the values in the equations for every option and checking it -

LHS = 2x + 5y = 2(2+(- 3) = 4 + (- 15) = - 11 = RHS

and

LHS = 4x + 10y = 4(2) +10(- 3) = 8 + (- 30) = - 22 = RHS

It satisfies the pair of linear equation and hence is the unique solution for the equation.

37. **(d)** 2

Explanation: Since 7 + 3 = 10

The least prime factor of a + b has to be 2; unless a + b is a prime number greater than 2.

Suppose a + b is a prime number greater than 2. Then a + b must be an odd number

and one of 'a' or 'b' must be an even number.

Suppose that 'a' is even. Then the least prime factor of a is 2; which is not 3 or 7. So 'a' can not be an even number nor can b be an even number. Hence a + b can not be a prime number greater than 2 if the least prime factor of a is 3 and b is 7.

Thus the answer is 2.

38. **(d)** 30°

Explanation: We have, $2\sin 2\theta = \sqrt{3} \Rightarrow \sin 2\theta = \frac{\sqrt{3}}{2} = \sin 60^\circ$

$\Rightarrow 2\theta = 60^\circ$

$\Rightarrow \theta = 30^\circ$

39. **(b)** 0

Explanation: Elementary events are

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

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

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

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

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

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

∴ Number of Total outcomes = 36

And Number of possible outcomes (sum of numbers appearing on die is 1) = 0

∴ Required Probability = $\frac{0}{36} = 0$

40. **(a)** $2 + \sqrt{2}$

Explanation: Let the vertices of $\triangle \mathrm{ABC}$ be A(0, 0), B(1, 0) and C(0, 1)

Now length of AB $= \sqrt{(1-0)^2 + (0-0)^2}$

$= \sqrt{(1)^2 + 0^2} = \sqrt{1^2} = 1$

Length of AC $= \sqrt{(0-0)^2 + (1-0)^2} = \sqrt{0^2 + (1)^2}$

$= \sqrt{1^2} = 1$

and length of BC $= \sqrt{(0-1)^2+(1-0)^2}$
$= \sqrt{(1)^2+(1)^2} = \sqrt{1+1} = \sqrt{2}$
Perimeter of $\triangle \mathrm{ABC}$ = Sum of sides
$= 1+1+\sqrt{2} = 2+\sqrt{2}$

Section C

41. **(d)** 26 m
Explanation: As JKLM is a square.
$\therefore$ ML = JM = 4 m
So, JF = 6 + 4 = 10 m
Required distance between initial and final position of insect = HJ
= $\sqrt{(HF)^2+(JF)^2}$
= $\sqrt{(24)^2+(10)^2}$
= $\sqrt{676}$ = 26 m

42. **(d)** $m^2 + n^2 = r^2$
Explanation: By Pythagoras, $n^2 + m^2 = r^2$

43. **(b)** AA
Explanation: In ΔABJ and ΔADH
$\angle B = \angle D$ = 90^o
$\angle A = \angle A$ (common)
$\therefore$ By AA similarity criterion, $\triangle ABJ \sim \triangle ADH.$

44. **(c)** $\frac{AB}{BD} = \frac{AJ}{AH}$
Explanation: Since, ΔABJ $\sim \triangle$ADH [By AA similarity criterion]
$\therefore \frac{AB}{AD} = \frac{AJ}{AH}$

45. **(a)** PR^2 = PQ + QR
Explanation: Since, $PR^2 = PQ^2 + QR^2$ [By Pythagoras theorem]

46. **(b)** 240.625 cm^2
Explanation: 240.625 cm^2

47. **(d)** 160.42 cm^2
Explanation: 160.42 cm^2

48. **(a)** 110 cm
Explanation: 110 cm

49. **(b)** 9:1
Explanation: 9:1

50. **(a)** $\frac{2}{9}\pi r^2$
Explanation: $\frac{2}{9}\pi r^2$