Sample Question Paper - 5
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. On dividing a positive integer n by 9, we get 7 as remainder. What will be the remainder if (3n - 1) is divided by 9? **[1]**

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

2. The area of the triangle formed by the line $\frac{x}{a}+\frac{y}{b}=1$ with the co – ordinate axis is **[1]**

   a) $2ab$ ab sq. units b) $\frac{1}{4}ab$ sq. units
   c) ab ab sq. units d) $\frac{1}{2}ab$ sq. units

3. The line segments joining the midpoints of the sides of a triangle form four triangles, each of which is **[1]**

   a) an isosceles triangle b) an equilateral triangle
   c) similar to the original triangle d) congruent to the original triangle

4. The difference between two numbers is 26 and one number is three times the other. The numbers are **[1]**

   a) 39 and 13 b) 30 and 10
   c) 36 and 12 d) 36 and 10

5. If 3x = cosec θ and $\frac{3}{x}=\cot\theta$ then $3\left(x^2-\frac{1}{x^2}\right)$ = ? **[1]**

   a) $\frac{1}{9}$ b) $\frac{1}{81}$
   c) $\frac{1}{27}$ d) $\frac{1}{3}$

6. If $n=2^3\times3^4\times5^4\times7$, then the number of consecutive zeros in n, where n is a natural number, is **[1]**

a) 2 | b) 3

c) 7 | d) 4

7. The zeros of the polynomial $7x^2 - \frac{11x}{3} - \frac{2}{3}$ are **[1]**

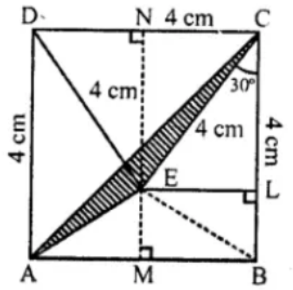
a) None of these

b) $\frac{2}{7}, \frac{-1}{3}$

c) $\frac{-2}{3}, \frac{1}{7}$

d) $\frac{2}{3}, \frac{-1}{7}$

8. ABCD is a square of side 4 cm. If E is a point in the interior of the square such that $\triangle CED$ is equilateral, then area of $\triangle ACE$ is **[1]**



a) $2(\sqrt{3}-1)\text{cm}^2$

b) $8(\sqrt{3}-1)\text{cm}^2$

c) $6(\sqrt{3}-1)\text{cm}^2$

d) $4(\sqrt{3}-1)\text{cm}^2$

9. The largest power of x in p(x) is the ________ of the polynomial. **[1]**

a) zero

b) root

c) none of these

d) degree

10. In the equilateral triangle ABC if $AD \perp BC$, then AD^2 is equal to **[1]**

a) $3CD^2$

b) $2CD^2$

c) $4CD^2$

d) CD^2

11. In a single throw of a pair of dice, the probability of getting the sum a perfect square is **[1]**

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

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

c) $\frac{1}{18}$

d) $\frac{7}{36}$

12. If p_1 and p_2 are two odd prime numbers such that $p_1 > p_2$, then $p_1^2 - p_2^2$ is **[1]**

a) an even number

b) an odd prime number

c) an odd number

d) a prime number

13. If area of a circle inscribed in an equilateral triangle is 48π square units, then perimeter of the triangle is **[1]**

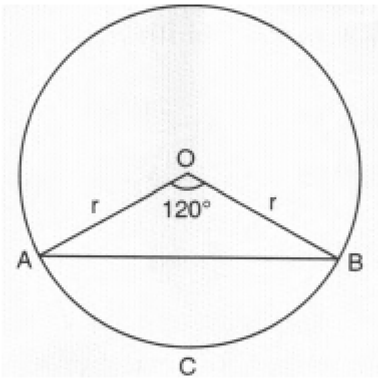
a) $48\sqrt{3}$ units

b) $17\sqrt{3}$ units

c) 36 units

d) 72 units

14. In Fig, the area of segment ACB is **[1]**



a) $\left(\frac{\pi}{3}+\frac{\sqrt{3}}{2}\right) r^{2}$

b) $\left(\frac{\pi}{3}-\frac{\sqrt{2}}{3}\right) r^{2}$

c) $\left(\frac{\pi}{3}-\frac{\sqrt{3}}{4}\right) r^{2}$

d) $\left(\frac{\pi}{3}-\frac{\sqrt{3}}{2}\right) r^{2}$

15. In a $\Delta PQR, \angle Q=90^{0}, PQ=5\ cm,\ QR=12 cm.$ If $QS \perp PR$, then QS is equal to **[1]**

a) $\frac{60}{13} cm.$

b) $\frac{12}{5} cm.$

c) $\frac{13}{5} cm.$

d) $\frac{80}{13} cm.$

16. If $\cos A+\cos^{2} A=1$, then $\sin^{2} A+\sin^{4} A$ = **[1]**

a) – 1

b) 1

c) 0

d) 2

17. The value of k so that the system of equations 3x - 4y - 7 = 0 and 6x - ky - 5 = 0 have a unique solution is **[1]**

a) k $\neq$ -8

b) k $\neq$ 4

c) k $\neq$ -4

d) k $\neq$ 8

18. Someone is asked to take a number from 1 to 100. The probability that it is a prime is **[1]**

a) $\frac{1}{40}$

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

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

d) $\frac{6}{25}$

19. If the sum of LCM and HCF of two numbers is 1260 and their LCM is 900 more than their HCF, then the product of two numbers is **[1]**

a) 205400

b) 203400

c) 194400

d) 198400

20. The areas of two concentric circles are 1386 cm^2 and 962.5 cm^2. The width of the ring is **[1]**

a) 2.8 cm

b) 3.8 cm

c) 3.5 cm

d) 4.2 cm

Section B

Attempt any 16 questions

21. If 2x - 3 y = 7 and (a + b) x - (a + b - 3) y = 4a + b represent coincident lines, then a and b satisfy the equation **[1]**

a) a - 5b = 0

b) 5a - b = 0

c) a + 5b = 0

d) 5a + b = 0

22. A vertical pole 6 m long casts a shadow of length 3.6 m on the ground. What is the height of a tower which casts a shadow of length 18 m at the same time? **[1]**

a) 30 m
b) 10.8 m
c) 28.8 m
d) 32.4 m

23. The LCM of two numbers is 1200. Which of the following cannot be their HCF? **[1]**

a) 500
b) 200
c) 600
d) 400

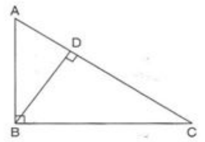
24. If tanθ = $\frac{m}{n}$, then $\frac{m\sin\theta - n\cos\theta}{m\sin\theta + n\cos\theta}$ = **[1]**

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

25. If x = -y and y > 0, which of the following is wrong? **[1]**

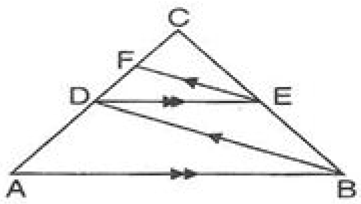
a) xy < 0
b) x + y = 0
c) $\frac{1}{x} - \frac{1}{y} = 0$
d) $x^2y > 0$

26. ABC is a right triangle right angled at B. BD is the altitude through B. If the value of the triangle of sides BD = 4 cm and AD = 3 cm then AC is equal to **[1]**



a) $\frac{12}{5}cm$
b) $\frac{25}{3}cm$
c) $\frac{13}{3}cm$
d) $\frac{20}{3}cm$

27. We have, $AB||DE$ and $BD||EF$.Then, **[1]**

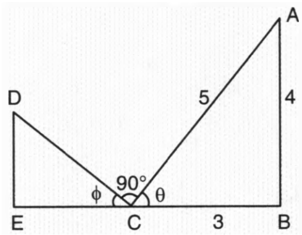


a) $BC^2 = AB\ .\ CE$
b) $AC^2 = BC\ .\ DC$
c) $AB^2 = AC\ .\ DE$
d) $DC^2 = CF \times AC$

28. The distance between (at^2, 2at) and $\left(\frac{a}{t^2}, \frac{-2a}{t}\right)$ is **[1]**

a) $a\left(t^2 + \frac{1}{t^2}\right)$ units
b) $a\left(t - \frac{1}{t}\right)^2$ units
c) $a\left(t + \frac{1}{t}\right)^2$
d) $\left(t + \frac{1}{t}\right)^2$ units

29. In the given figure, the value of cosϕ is **[1]**



a) $\frac{5}{3}$

b) $\frac{3}{5}$

c) $\frac{4}{5}$

d) $\frac{5}{4}$

30. If $\frac{3}{x+y}+\frac{2}{x-y}=2$ and $\frac{9}{x+y}-\frac{4}{x-y}=1$ then **[1]**

a) $x=\frac{1}{2}, y=\frac{3}{2}$

b) $x=\frac{5}{2}, y=\frac{1}{2}$

c) $x=\frac{1}{2}, y=\frac{5}{2}$

d) $x=\frac{3}{2}, y=\frac{1}{2}$

31. Which of the following numbers have the non-terminating repeating decimal expansion? **[1]**

a) $\frac{117}{6^2\times5^3}$

b) $\frac{6}{15}$

c) $\frac{21}{280}$

d) $\frac{77}{210}$

32. If two positive integers m and n can be expressed as m = x^2y^5 and n = x^3y^2, where x and y are prime numbers, then HCF(m, n) = **[1]**

a) x^2y^2

b) x^2y^3

c) x^3y^2

d) x^3y^3

33. If $\frac{x\csc^2 30^\circ \sec^2 45^\circ}{8\cos^2 45^\circ \sin^2 60^\circ}=\tan^2 60^\circ-\tan^2 30^\circ$, then x = **[1]**

a) 0

b) 2

c) -1

d) 1

34. If the area of a sector of a circle bounded by an arc of length 5π cm is equal to 20π cm^2, then find it's radius **[1]**

a) 10 cm

b) 16 cm

c) 12 cm

d) 8 cm

35. A coin is tossed thrice. The probability of getting at least two tails is **[1]**

a) $\frac{4}{5}$

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

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

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

36. 5 years hence, the age of a man shall be 3 times the age of his son while 5 years earlier the age of the man was 7 times the age of his son. The present age of the man is **[1]**

a) 50 years

b) 45 years

c) 47 years

d) 40 years

37. A rational number can be expressed as a non-terminating repeating decimal if the denominator has the factors **[1]**

a) none of these

b) other than 2 or 5 only

c) 2 or 5 only

d) 2 or 3 only

38. $\frac{\sin\theta}{1+\cos\theta}$ 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) $\frac{1+\cos\theta}{\sin\theta}$

39. 1000 tickets of a lottery were sold and there are 5 prizes on these tickets. If Ramesh has purchased one lottery ticket, the probability of winning a prize is **[1]**

a) $\frac{1}{100}$

b) $\frac{5}{100}$

c) $\frac{1}{200}$

d) $\frac{1}{1000}$

40. The base of an equilateral triangle ABC lies on the y-axis. The coordinates of the point C is (0, – 3). If origin is the midpoint of BC, then the coordinates of B are **[1]**

a) (3, 0)

b) (0, – 3)

c) (– 3, 0)

d) (0, 3)

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:

Shruti is very good in painting. So she thought of exhibiting her paintings in which she want to display her later painting which is in the form of a graph of a polynomial as shown below:

41. The number of zeroes of the polynomial represented by the graph is **[1]**

a) 1

b) 3

c) 2

d) can't be determined

42. The sum of zeroes of the polynomial represented by the graph is **[1]**

a) -5

b) 2

c) -4

d) -3

43. Find the value of the polynomial represented by the graph when x = 0. **[1]**

a) -8

b) -6

c) 6

d) 8

44. The polynomial representing the graph drawn in the **[1]**

a) quadratic polynomial

b) bi-quadratic polynomial

c) linear polynomial

d) cubic polynomial

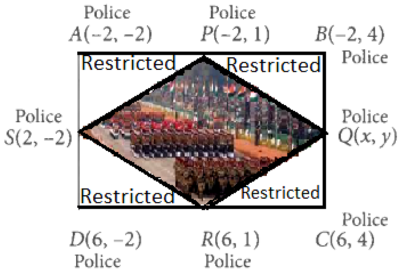
45. The sum of the product of zeroes, taken two at a time, of the polynomial represented by the graph is **[1]**

a) 2 b) 3

c) -3 d) -2

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

In order to facilitate smooth passage of the parade, movement of traffic on certain roads leading to the route of the Parade and Tableaux ah rays restricted. To avoid traffic on the road Delhi Police decided to construct a rectangular route plan, as shown in the figure.



46. If Q is the mid point of BC, then coordinates of Q are **[1]**

a) (-1, 1) b) (2, -4)

c) (2, 4) d) (1, -1)

47. Quadrilateral PQRS is a **[1]**

a) Trapezium b) Rectangle

c) Rhombus d) Square

48. What is the length of sides of quadrilateral PQRS? **[1]**

a) 5 units each b) 4, 5, 6, 7 units

c) 8 units each d) 3, 4, 5, 6 units

49. What is the length of route PQRS? **[1]**

a) 20 units b) 45 units

c) 25 units d) 35 units

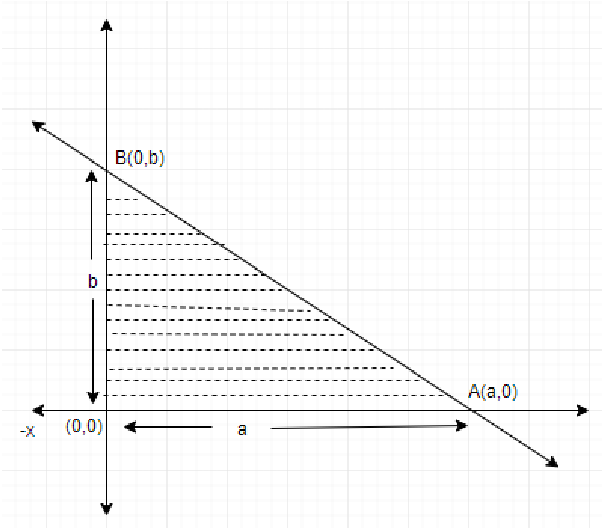
50. What is the length of route ABCD? **[1]**

a) 26 units b) 29 units

c) 28 units d) 27 units

Solution

Section A

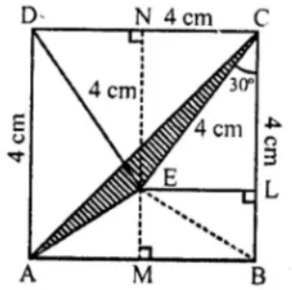
1. **(c)** 2
   Explanation: Divisor = 9 and remainder = 7
   Let b be the quotient, then
   n = 9 b + 7
   Multiplying both sides by 3 and subtracting 1.
   3n - 1 = 3(9b + 7) - 1
   3n - 1 = 27b + 21 - 1
   3n - 1 = 9(3b) + 9 $\times$ 2 + 2
   3n - 1 = 9(3b + 2) + 2
   Remainder = 2
2. **(d)** $\frac{1}{2}ab$ sq. units
   Explanation: Area of triangle OAB = $\frac{1}{2}$ $\times$ OA $\times$ OB = $\frac{1}{2}ab$
   

3. **(c)** similar to the original triangle
   Explanation: The line segments joining the midpoints of a triangle form 4 triangles which are similar to the given (original) triangle.
4. **(a)** 39 and 13
   Explanation: Let the two numbers be x and y
   According to question, x - y = 26 and x = 3y
   Putting the value of x in x - y = 26, we get,
   3y - y = 26
   $\Rightarrow$ y = 13 And x = 3 $\times$ 13 = 39
   Therefore, the two numbers are 13 and 39.
5. **(d)** $\frac{1}{3}$
   Explanation: cosec^2 θ- cot$^{2\theta}$ =1
   $\implies (3x)^2 - \left(\frac{3}{x}\right)^2 = 1 \Rightarrow 9x^2 - \frac{9}{x^2} = 1 \Rightarrow 9\left(x^2 - \frac{1}{x^2}\right) = 1$
   $\Rightarrow \left(x^2 - \frac{1}{x^2}\right) = \frac{1}{9}$
   $\Rightarrow 3\left(x^2 - \frac{1}{x^2}\right) = 3 \times \frac{1}{9} = \frac{1}{3}$
6. **(b)** 3
   Explanation: Since, it is given that
   $n = 2^3 \times 3^4 \times 5^4 \times 7$

$= 2^3 \times 5^4 \times 3^4 \times 7$
$= 2^3 \times 5^3 \times 5 \times 3^4 \times 7$
$= (2 \times 5)^3 \times 5 \times 3^4 \times 7$
$= 5 \times 3^4 \times 7 \times (10)^3$
So, this means the given number n will end with 3 consecutive zeroes.

7. **(d)** $\frac{2}{3}, \frac{-1}{7}$
Explanation: $7x^2 - \frac{11x}{3} - \frac{2}{3} = \frac{21x^2-11x-2}{3}$
Now, $21x^2 - 11x - 2 = 21x^2 - 14x + 3x - 2$
= 7x(3x - 2) + (3x - 2) = (3x - 2)(7x + 1)
$\therefore$ the zeros are $\frac{2}{3}, \frac{-1}{7}$

8. **(d)** $4(\sqrt{3} - 1)\text{cm}^2$
Explanation:
Side of square ABCD = 4 cm and side of equilateral $\triangle CED$ = 4 cm



Area of square = $(\text{side})^2$ = 4 $\times$ 4 = 16 cm^2
and area of $\triangle CED = \frac{\sqrt{3}}{4}$ $(\text{side})^2$
$= \frac{\sqrt{3}}{4} \times 4 \times 4 = 4\sqrt{3}\text{cm}^2$
Join AE, AB and AC and draw EL $\perp$ CB and EN $\perp$ CD
Now area of $\triangle\text{ABC}$
$= \frac{1}{2}\text{AB} \times \text{BC} = \frac{1}{2} \times 4 \times 4 = 8\text{cm}^2$
In $\triangle BEC$, EL = $\frac{4}{2}$ = 2 $\left(\because \sin 30^\circ = \frac{1}{2}\right)$
$\therefore$ area $\triangle\text{BEC} = \frac{1}{2} \times \text{BC} \times \text{EL}$
$= \frac{1}{2} \times 4 \times 2 = 4\text{cm}^2$
and in $\triangle\text{AEB}$, EM = MN - EN = $(4 - 2\sqrt{3})\text{cm}$
$\therefore$ area $\triangle\text{AEB} = \frac{1}{2}\text{AB} \times \text{EM} = \frac{1}{2} \times 4(4 - 2\sqrt{3})$
$= 4(2 - \sqrt{3}) = 8 - 4\sqrt{3}\text{cm}^2$
$\therefore$ area $\triangle\text{AEC}$ = area $\triangle\text{ABC}$ - (area $\triangle\text{AEB}$ + area $\triangle\text{BEC}$)
= 8 - (8 - $4\sqrt{3}$ + 4) = 8 - 8 - 4 + $4\sqrt{3}$
= $4\sqrt{3}$ - 4 = 4 $(\sqrt{3} - 1)\text{cm}^2$

9. **(d)** degree
Explanation: A degree in a polynomial function is the greatest exponent of that equation. The degree of the constant polynomial is zero.

10. **(a)** $3CD^2$
Explanation: In ΔADC
$\text{AC}^2 = \text{AD}^2 + \text{CD}^2 \Rightarrow \text{AD}^2 = \text{AC}^2 - \text{CD}^2$
$\Rightarrow \text{AD}^2 = \text{BC}^2 - \text{CD}^2 \Rightarrow \text{AD}^2 = (2\text{CD})^2 - \text{CD}^2$
$\Rightarrow \text{AD}^2 = 4\text{CD}^2 - \text{CD}^2 \Rightarrow \text{AD}^2 = 3\text{CD}^2$

11. **(d)** $\frac{7}{36}$
Explanation: A pair of dice is thrown simultaneously
$\therefore$ No. of total events (n) = 6 $\times$ 6 = 36
Total outcomes ,
{(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)}

$\therefore$ Event whose sum is a perfect square are (1, 3), (2, 2), (3, 1), (3, 6), (4, 5), (6, 4), (6, 3)

$\therefore$ m = 7

$\therefore$ Probability = $\frac{m}{n} = \frac{7}{36}$

12. **(a)** an even number

Explanation: Let p_1 and p_2 be 5 two odd primes.

Then,

$p_1^2 - p_2^2 = (p_1 - p_2)(p_1 + p_2)$

We know that sum and difference of two odd numbers is even

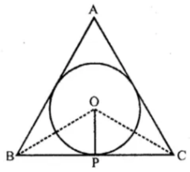
$\therefore$ $(p_1 - p_2)$ *and* $(p_1 + p_2)$ are even numbers.

Also, we know that product of even numbers is an even number, therefore

$p_1^2 - p_2^2 = (p_1 - p_2)(p_1 + p_2)$, is an even number.

13. **(d)** 72 units

Explanation: Area of a circle inscribed in an equilateral triangle = 48π sq. units



$\therefore$ Radius of the circle = $\sqrt{\frac{\text{Area}}{\pi}} = \sqrt{\frac{48\pi}{\pi}}$

$= \sqrt{48}$ units $= 4\sqrt{3}$ units

$\because \mathrm{OP} \perp \mathrm{BC}$ and $\angle \mathrm{B} = 60^\circ$

$\therefore \angle \mathrm{OBP} = 30^\circ$

Now $\tan\theta = \frac{\mathrm{OP}}{\mathrm{BP}} \Rightarrow \tan 30^\circ = \frac{4\sqrt{3}}{\mathrm{BP}}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{4\sqrt{3}}{\mathrm{BP}} \Rightarrow \mathrm{BP} = 4\sqrt{3} \times \sqrt{3}$ = 12 units

$\therefore$ BC = 2 $\times$ BP = 2 $\times$ 12 = 24 units

$\therefore$ Perimeter of $\triangle\mathrm{ABC}$ = 3 $\times$ side

= 3 $\times$ 24 = 72 units

14. **(c)** $\left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right) r^2$

Explanation: We have to find area of segment ACB.

Area of the ACB segment $= \left(\frac{\pi\theta}{360} - \sin\frac{\theta}{2}\cos\frac{\theta}{2}\right) r^2$

We know that$\theta = 120^\circ$.

Substituting the values we get,

$\therefore$ Area of the PAQ segment $= \left(\frac{\pi \times 120}{360} - \sin 60 \cos 60\right) r^2$

$= \left(\frac{\pi}{3} - \sin 60 \cos 60\right) r^2$

Substituting $\sin 60 = \frac{\sqrt{3}}{2}$ and $\cos 60 = \frac{1}{2}$we get,

Area of the ACB segment $= \left(\frac{\pi}{3} - \frac{\sqrt{3}}{2} \times \frac{1}{2}\right) r^2$

$= \left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right) r^2$

Therefore, area of the segment ACB is $\left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right) r^2$.

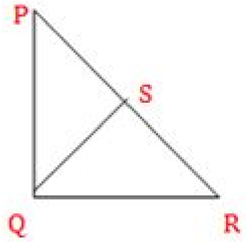
15. **(a)** $\frac{60}{13} cm.$

Explanation: Here $\mathrm{PR} = \sqrt{5^2 + 12^2} = \sqrt{25 + 144} = \sqrt{169}$ = 13 cm

In $\Delta\mathrm{PQR}$ and $\Delta\mathrm{SQR}$

$\angle$PQR = $\angle$QSR = 90° and $\angle$R = $\angle$R [Common] $\therefore \Delta\mathrm{PQR} \sim \Delta\mathrm{QSR}$ [AA similarity]

$\therefore \frac{PQ}{QS} = \frac{PR}{QR}$
$\Rightarrow \frac{5}{QS} = \frac{13}{12}$
$\Rightarrow QS = \frac{5 \times 12}{13} = \frac{60}{13}$ cm



16. **(b)** 1
Explanation: Given: $\cos A + \cos^2 A = 1$
$\Rightarrow \cos A = 1 - \cos^2 A$
$\Rightarrow \cos A = \sin^2 A$
Squaring both sides, we get
$\Rightarrow \cos^2 A = \sin^4 A$
$\Rightarrow 1 - \sin^2 A = \sin^4 A$
$\Rightarrow \sin^2 A + \sin^4 A = 1$

17. **(d)** $k \neq 8$
Explanation: Given: $a_1 = 3$, $a_2 = 6$, $b_1 = -4$, $b_2 = -k$, $c_1 = -7$ and $c_2 = -5$
If there is a unique solution, then $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
$\Rightarrow \frac{3}{6} \neq \frac{-4}{-k}$
$\Rightarrow -3k \neq -4 \times 6$
$\Rightarrow k \neq 8$

18. **(c)** $\frac{1}{4}$
Explanation: Total numbers of outcomes = 100
So, the prime numbers between 1 to 100 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97.
$\therefore$ Total number of possible outcomes = 25
$\therefore$ Required probability = 25/100 = $\frac{1}{4}$

19. **(c)** 194400
Explanation: Let the HCF of the numbers be x and their LCM be y.
It is given that the sum of the HCF and LCM is 1260, therefore
x + y = 1260 ....(i)
And, LCM is 900 more than HCF.
y = x + 900 ..... (ii)
Substituting (ii) in (i), we get:
x + x + 900 =1260
$\Rightarrow$ 2x + 900 = 1260
$\Rightarrow$ 2x = 1260 - 900
$\Rightarrow$2x = 360
$\Rightarrow$ x = 180
Substituting x = 180 in (i), we get:
y = 180 + 900
$\Rightarrow$ y = 1080
We also know that the product the two numbers is equal to the product of their LCM and HCF
Thus, product of the numbers = 1080(180) = 194400

20. **(c)** 3.5 cm
Explanation: $\pi R^2 = 1386 \Rightarrow R^2 = \left(1386 \times \frac{7}{22}\right) = 441 = (21)^2 \Rightarrow R = 21\text{cm}$

$\pi r^2 = 962.5 \Rightarrow r^2 = \left(\frac{9625}{10} \times \frac{7}{22}\right) = \frac{(49 \times 25)}{4} \Rightarrow r = \left(\frac{7 \times 5}{2}\right) \text{cm} = \frac{35}{2} \text{cm}$

Width of the ring = $(R - r) = \left(21 - \frac{35}{2}\right) \text{cm} = \frac{7}{2} \text{cm} = 3.5 \text{cm}$

Section B

21. **(a)** a - 5b = 0

Explanation: Given Equations are 2x - 3y = 7

and (a + b) x - (a + b - 3) y = 4 a + b represent coincident lines.

When lines are coincident then the condition of equations

$a_1x + b_1y = c_1$,

$a_2x + b_2y = c_2$

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

On comparing, we get

$\frac{2}{a+b} = \frac{3}{a+b-3} = \frac{7}{4a+b}$

Now, we can equate any two equation. So, taking

$\frac{2}{a+b} = \frac{7}{4a+b}$

$\Rightarrow$ 2(4a + b) = 7(a + b)

$\Rightarrow$ 8a + 2b = 7a + 7b

$\Rightarrow$ 8a − 7a = 7b − 2b

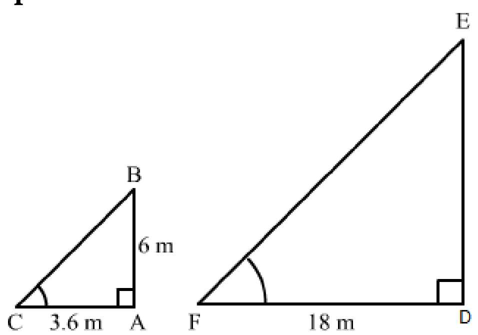
$\Rightarrow$ a = 5b

$\Rightarrow$ a − 5b = 0

Therefore, The required equation satisfied by a and b is a - 5b = 0.

22. **(a)** 30 m

Explanation:



Let AB and AC be the vertical pole and its shadow, respectively.

According to the question:

AB = 6 m

AC = 3.6 m

Again, let DE and DF be the tower and its shadow.

According to the question:

DF = 18 m

DE = ?

Now, in right-angled triangles ABC and DEF, we have:

$\angle$BAC = $\angle$EDF = 90°

$\angle$ACB = $\angle$DFE (Angular elevation of the Sun at the same time)

Therefore, by AA similarity theorem,

we get: $\triangle$ABC$\sim$ $\triangle$DEF

$\Rightarrow \frac{AB}{AC} = \frac{DE}{DF}$

$\Rightarrow \frac{6}{3.6} = \frac{DE}{18}$

$\Rightarrow DE = \frac{6 \times 18}{3.6} = 30 \text{m}$

23. **(a)** 500

Explanation: It is given that the LCM of two numbers is 1200 .

We know that the HCF of two numbers is always the factor of LCM.

500 is not the factor of 1200.
So this cannot be the HCF.

24. **(a)** $\frac{m^2-n^2}{m^2+n^2}$

Explanation: Given: tanθ = $\frac{m}{n}$

Dividing all the terms of $\frac{m\sin\theta-n\cos\theta}{m\sin\theta+n\cos\theta}$ by $\cos\theta$,

= $\frac{m\tan\theta-n}{m\tan\theta+n}$

= $\frac{m\times\frac{m}{n}-n}{m\times\frac{m}{n}+n}$

= $\frac{m^2-n^2}{m^2+n^2}$

25. **(c)** $\frac{1}{x}-\frac{1}{y}=0$

Explanation: Given that x = - y and y > 0

$\frac{1}{x}-\frac{1}{y}=0$

$\Rightarrow\frac{1}{-y}-\frac{1}{y}=0$

$\Rightarrow\frac{-2}{y}\neq 0$

Since y > 0, also $\frac{1}{y}$ > 0 but $\frac{-2}{y}$ <0

Hence, it is not satisfied.

26. **(b)** $\frac{25}{3}cm$

Explanation: Using Pythagoras Theorem,

$\mathrm{AB}=\sqrt{\mathrm{AD}^2+\mathrm{BD}^2}$ = $\sqrt{(3)^2+(4)^2}$ = $\sqrt{9+16}=\sqrt{25}$ = 5 cm

Now, in $\triangle\mathrm{ADB}$ and $\triangle\mathrm{ABC}$,

$\angle$ADB = $\angle$ABC = 90°

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

$\therefore\triangle$ADB$\sim\triangle$ABC [AA similarity]

$\therefore\frac{\mathrm{AD}}{\mathrm{AB}}=\frac{\mathrm{AB}}{\mathrm{AC}}\Rightarrow\frac{3}{5}=\frac{5}{\mathrm{AC}}$

$\Rightarrow$ AC = $\frac{5\times5}{3}=\frac{25}{3}$ cm

27. **(d)** $DC^2=CF\times AC$

Explanation: In $\triangle\mathrm{ABC}$, using Thales theorem,

$\frac{\mathrm{DC}}{\mathrm{AC}}=\frac{\mathrm{CE}}{\mathrm{BC}}$ $[AB||DE]$ ....(i)

And in triangle BCD, using Thales theorem,

$\frac{\mathrm{CF}}{\mathrm{DC}}=\frac{\mathrm{CE}}{\mathrm{BC}}$ $[BD||EF]$ ....(ii)

From eq. (i) and (ii), we have

$\frac{\mathrm{DC}}{\mathrm{AC}}=\frac{\mathrm{CF}}{\mathrm{DC}}$

$\Rightarrow DC^2=CF\times AC$

28. **(c)** $a\left(t+\frac{1}{t}\right)^2$

Explanation: The distance between $(at^2, 2at)$ and $\left(\frac{a}{t^2},\frac{-2a}{t}\right)$

= $\sqrt{\left(\frac{a}{t^2}-at^2\right)^2+\left(\frac{-2a}{t}-2at\right)^2}$

= $a\sqrt{\frac{1}{t^4}+t^4-2+\frac{4}{t^2}+4t^2+8}$

= $a\sqrt{\frac{1}{t^4}+t^4+\frac{4}{t^2}+4t^2+6}$

= $a\sqrt{\frac{1}{t^4}+t^4+4+2+\frac{4}{t^2}+4t^2}$

= $a\sqrt{\left(t^2+\frac{1}{t^2}+2\right)^2}$

= $a\left(t^2+\frac{1}{t^2}+2\right)$
= $a\left(t+\frac{1}{t}\right)^2$ units

29. **(c)** $\frac{4}{5}$
Explanation: We know that the sum of all the angles on one side of a straight line is 180°.
These angles are said to be in linear pairs.
Therefore, using the figure, we get
$\theta+\phi+90^\circ=180^\circ$
Therefore, $\theta=90^\circ-\phi$ ...(a)
Using trigonometric ratio in $\triangle ABC$, we get
$\sin\theta=\frac{4}{5}$ ...(b)
Using equation (a) in equation (b), we get
$\sin(90^\circ-\phi)=\frac{4}{5}$
We know that for any angle theta,
$\sin(90^\circ-\theta)=\cos\theta$.
Therefore, we get
$\cos\phi=\frac{4}{5}$
Therefore, the correct option is option is $\frac{4}{5}$

30. **(b)** $x=\frac{5}{2}, y=\frac{1}{2}$
Explanation: Put $\frac{1}{x+y}=u$ and $\frac{1}{x-y}=v$ to get 3u + 2v = 2 and 9u - 4v = 1.
Solve for u and v to get u = $\frac{1}{3}$ and v = $\frac{1}{2}$
$\therefore$ x + y = 3 and x - y = 2.
x + y = 3 .... (1)
x - y = 2 .... (2)
Add 1 and 2, we get
2x = 5
$x=\frac{5}{2}$
then $y=\frac{1}{2}$

31. **(d)** $\frac{77}{210}$
Explanation: $\frac{77}{210}$ = $\frac{11}{30}=\frac{11}{2\times3\times5}$
Because non-terminating repeating decimal expansion should have the denominator other than 2 or 5.

32. **(a)** x^2y^2
Explanation: $x^2y^5 = y^3(x^2y^2)$
$x^3y^3 = x(x^2y^2)$
Therefore HCF (m, n) is x^2y^2

33. **(d)** 1
Explanation: We have, $\frac{x\csc^2 30^\circ \sec^2 45^\circ}{8\cos^2 45^\circ \sin^2 60^\circ}=\tan^2 60^\circ-\tan^2 30^\circ$
$\Rightarrow \frac{x(2)^2(\sqrt{2})^2}{8\left(\frac{1}{\sqrt{2}}\right)^2\left(\frac{\sqrt{3}}{2}\right)^2}=(\sqrt{3})^2-\left(\frac{1}{\sqrt{3}}\right)^2$
$\Rightarrow \frac{x\times4\times2}{8\times\frac{1}{2}\times\frac{3}{4}}=3-\frac{1}{3}\Rightarrow\frac{8x}{3}=\frac{8}{3}$
$\Rightarrow x=\frac{8}{3}\times\frac{3}{8}=1$

34. **(d)** 8 cm
Explanation: We have given length of the arc and area of the sector bounded by that arc and we are asked to find the radius of the circle.
We know that area of the sector $=\frac{\theta}{360}\times\pi r^2$.
Length of the arc $=\frac{\theta}{360}\times 2\pi r$

Now we will substitute the values.
Area of the sector $= \frac{\theta}{360} \times \pi r^2$
$20\pi = \frac{\theta}{360} \times \pi r^2$ ....(1)
Length of the arc $= \frac{\theta}{360} \times 2\pi r$
$5\pi = \frac{\theta}{360} \times 2\pi r$ ....(2)
$\frac{20\pi}{5\pi} = \frac{\frac{\theta}{360} \times \pi r^2}{\frac{\theta}{360} \times 2\pi r}$
$\frac{20}{5} = \frac{r^2}{2r}$
$\therefore 4 = \frac{r}{2}$
$\therefore$ r = 8
Therefore, radius of the circle is 8 cm.

35. **(d)** $\frac{1}{2}$
Explanation: Total outcomes = = {HHH, TTT, HHT, HTH, HTT, THH, THT, TTH} = 8
Number of possible outcomes (at least two tails) = 4
$\therefore$ Required Probability = $\frac{4}{8} = \frac{1}{2}$

36. **(d)** 40 years
Explanation: Let us assume the present age of men be x years
Also, the present age of his son be y years
According to question, after 5 years:
(x + 5) = 3 (y + 5)
x + 5 = 3y + 15
x - 3y = 10 ...(i)
Also, five years ago:
(x - 5) = 7 (y - 5)
x - 5 = 7y - 35
x - 7y = - 30 ...(ii)
Now, on subtracting (i) from (ii) we get:
- 4y = - 40
y = 10
Putting the value of y in (i), we get
x - 3 $\times$ 10 = 10
x - 30 = 10
x = 10 + 30
x = 40
$\therefore$ The present age of men is 40 years

37. **(b)** other than 2 or 5 only
Explanation: A rational number can be expressed as a **non-terminating** repeating decimal if the denominator has the factors other than 2 or 5 only.

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

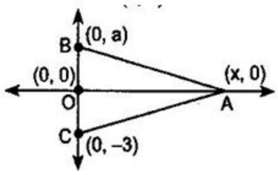
39. **(c)** $\frac{1}{200}$
Explanation: Number of possible outcomes = 5
Number of total outcomes = 1000
$\therefore$ Required Probability = $\frac{5}{1000} = \frac{1}{200}$

40. **(d)** (0, 3)
Explanation: Let the coordinate of B be $(0, a)$.(0, a).

It is given that (0, 0) is the mid-point of BC.

Therefore 0 = (0 + 0) /2 , 0 =(a - 3) /2   a - 3 = 0 , a = 3 0 = $\frac{0+0}{2}$, 0 = $\frac{a-3}{2}$, a - 3 = 0, a = 3

Therefore, the coordinates of B are (0, 3).



Section C

41. **(b)** 3

    Explanation: Since the graph intersect the x-axis at 3 points, therefore the polynomial has 3 zeroes.

42. **(a)** -5

    Explanation: Clearly the graph intersect the x-axis at x = -4, x = -2 and x = 1, therefore the zeroes are -4, -2 and 1. Now, the sum of zeroes = -4 - 2 + 1 = -5.

43. **(a)** -8

    Explanation: From the graph, it can be seen that

    When x = 0, then y = -8.

44. **(d)** cubic polynomial

    Explanation: Since there are 3 zeroes, therefore the graph represents a cubic polynomial.

45. **(a)** 2

    Explanation: The sum of product of zeroes taken two at a time = (-4)(-2) + (-2) (1) + (1)(-4) = 8 - 2 - 4 = 2

46. **(c)** (2, 4)

    Explanation: Q(x, y) is mid-point of B(-2, 4) and C(6, 4)

    ∴ (x, y) = $\left(\frac{-2+6}{2}, \frac{4+4}{2}\right) = \left(\frac{4}{2}, \frac{8}{2}\right)$ = (2, 4)

47. **(c)** Rhombus

    Explanation: Since P, Q, R and S are mid-points of sides AB, BC, CD and AD respectively.

    ∴ PQRS is a rhombus.

    [∵ The quadrilateral formed by joining the midpoints of a rectangle is a rhombus]

48. **(a)** 5 units each

    Explanation: Since PQRS is a rhombus, therefore, PQ = QR = RS = PS.

    ∴ PQ = $\sqrt{(-2-2)^2+(1-4)^2}$ = $\sqrt{16+9} = \sqrt{25}$ = 5 units

    Thus, length of each side of PQRS is 5 units.

49. **(a)** 20 units

    Explanation: Length of route PQRS = 4 PQ

    = 4 $\times$ 5 = 20 units

50. **(c)** 28 units

    Explanation: Length of CD = 4 + 2 = 6 units and length of AD = 6 + 2 = 8 units

    ∴ Length of route ABCD - 2(6 + 8) = 28 units