Class X Session 2025-26
Subject - Mathematics (Standard)
Sample Question Paper - 07

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

Read the following instructions carefully and follow them:

1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study based questions carrying 4 marks each with sub parts of the values of 1, 1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Question of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E .
9. Draw neat and clean figures wherever required.
10. Take $\pi = \frac{22}{7}$ wherever required if not stated.
11. Use of calculators is not allowed.
12. **This question paper is based on CBSE Exam pattern 2025 but the chapter-wise weightage may differ.**

Section A

1. Prime factorisation of 882 is: **[1]**

a) $2^3 \times 3 \times 7^2$ b) $2^2 \times 3^2 \times 7$

c) $2^2 \times 3^3 \times 7$ d) $2 \times 3^2 \times 7^2$

2. The radius (in cm) of the largest right circular cone that can be cut out from a cube of edge 4.2 cm is **[1]**

a) 4.2cm b) 8.4cm

c) 2.1cm d) 1.05cm

3. If $\triangle ABC \sim \triangle DEF, \frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle DEF)} = \frac{9}{25}$, BC = 21 cm, then EF is equal to **[1]**

a) 25 cm b) 9 cm

c) 35 cm d) 6 cm

4. The median group in the following frequency distribution is: **[1]**

Class	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Frequency	5	8	20	15	7	5

a) 10 - 20

b) 20 - 30

c) 30 - 40

d) 40 - 50

5. In a cyclic quadrilateral ABCD, it is being given that ∠A = (x + y + 10)° ∠B = (y + 20)°, ∠C = (x + y - 30)° and ∠D = (x + y)°. Then, ∠B = ? **[1]**

a) 100°

b) 80°

c) 70°

d) 110°

6. $\sin^2 A + \sin^2 A \tan^2 A =$ **[1]**

a) $\tan^2 A$

b) $\cot^2 A$

c) $\sin^2 A$

d) $\cos^2 A$

7. If the two zeroes of a quadratic polynomial are $\pm\sqrt{5}$, then the quadratic polynomial is: **[1]**

a) $x^2 + 5$

b) $4\left(x^2 - 5\right)$

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

d) $(x + \sqrt{5})^2$

8. From the letters of the word **MOBILE**, a letter is selected at random. The probability that the selected letter is a vowel, is: **[1]**

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

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

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

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

9. Find the area of the segment if the area of the sector is 44 m and the part of a triangle in the sector is 12 m. **[1]**

a) 39 m^2

b) 32 m^2

c) 31 m^2

d) 22 m^2

10. The fourth vertex D of a parallelogram ABCD whose three vertices are A (-2, 3), B (6, 7) and C (8, 3) is **[1]**

a) (0, 1)

b) (1, 0)

c) (–1, 0)

d) (0, -1)

11. The 5th term of an AP is 20 and the sum of its 7th and 11th terms is 64. The common difference of the AP is **[1]**

a) 5

b) 3

c) 4

d) 2

12. The angle subtended by a tower of height 200 metres at a point 200 metres from the base is **[1]**

a) 30^o

b) 0^o

c) 45^o

d) 60^o

13. The roots of the quadratic equation $\frac{x^2-8}{x^2+20} = \frac{1}{2}$ are **[1]**

a) ± 4

b) ± 3

c) ± 2 | d) ± 6

14. If PA and PB are tangents to the circle with centre O such that $\angle$APB = 50°, then $\angle$OAB is equal to **[1]**

a) 50^o | b) 25^o
c) 40^o | d) 30^o

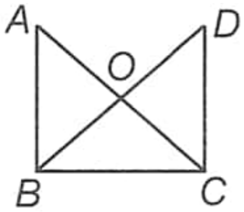
15. If a = $2^2 \times 3^x$, b = $2^2 \times 3 \times 5$, c = $2^2 \times 3 \times 7$ and LCM (a, b, c) = 3780, then x is equal to **[1]**

a) 1 | b) 2
c) 0 | d) 3

16. A solid consists of a circular cylinder with an exact fitting right circular cone placed at the top. The height of the cone is h. If the total volume of the solid is 3 times the volume of the cone, then the height of the circular cylinder is **[1]**

a) 2h | b) $\frac{2h}{3}$
c) h | d) 4h

17. In the given figure, $\triangle$ABC ~ $\triangle$DCB, then AB $\times$ DB = **[1]**



a) DC $\times$ AC | b) AB $\times$ DC
c) OB $\times$ OC | d) OA $\times$ OD

18. The median and mode respectively of a frequency distribution are 26 and 29. Then its mean is **[1]**

a) 28.4 | b) 27.5
c) 24.5 | d) 25.8

19. **Assertion (A):** Line represented by 2x + 2y = 0 and x + y = 0 do have non-zero solutions. **[1]**
Reason (R): Two lines represented by ax + by = 0 and px + qy = 0 always has non-zero solutions.

a) Both A and R are true and R is the correct explanation of A. | b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false. | d) A is false but R is true.

20. **Assertion (A):** sinθ $\times$ cosecθ = cotθ **[1]**
Reason (R): sinθ is reciprocal of cosecθ

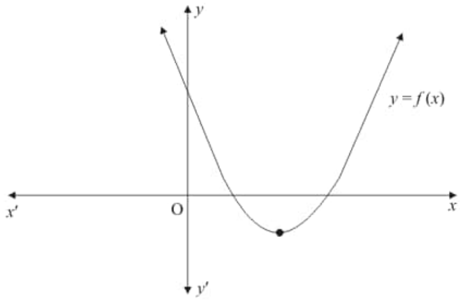
a) Both A and R are true and R is the correct explanation of A. | b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false. | d) A is false but R is true.

Section B

21. If α and β are the zeros of the quadratic polynomial f(x) = x^2 - x - 4, find the value of $\frac{1}{\alpha} + \frac{1}{\beta} - \alpha\beta$. **[2]**

OR

The graph of the polynomial f(x) = ax^2 + bx + c is as shown below (Fig.). Write the signs of 'a' and b^2 - 4ac

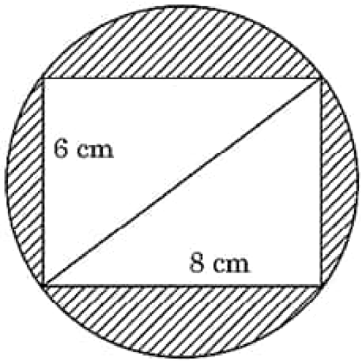


22. One card is drawn from a well-shuffled deck of 52 playing cards. Find the probability of getting the following: **[2]**
    i. a king of red colour
    ii. a red face card

OR

From a well-shuffled deck of 52 playing cards, all black queens and red kings are removed. One card is selected at random from the remaining cards. Find the probability that the selected card is:
   i. an ace.
   ii. a jack of red colour.
   iii. a king of spade.

23. Reeti prepares a Rakhi for her brother Ronit. The Rakhi consists of a rectangle of length 8 cm and breadth 6 cm inscribed in a circle as shown in the figure. Find the area of the shaded region. (Use $\pi = 3{\cdot}14$) **[2]**



24. Find a point on the y-axis which is equidistant from the points A(6, 5) and B (- 4, 3). **[2]**
25. The sum of the 2nd and the 7th terms of an AP is 30. If its 15th term is 1 less than twice its 8th term, find the AP. **[2]**

Section C

26. The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30^o, than when it is 60^o. Find the height of the tower. **[3]**

OR

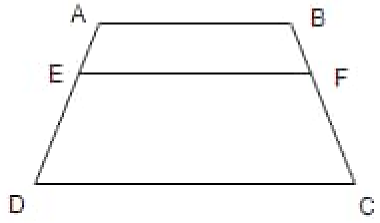
A kite is flying, attached to a thread which is 165 m long. The thread makes an angle of 30° with the ground. Find the height of the kite from the ground, assuming that there is no slack in the thread.

27. A plane left 30 minutes later than the schedule time and in order to reach its destination 1500 km away in time it has to increase its speed by 250 km/hr from its usual speed. Find its usual speed. **[3]**
28. If d_1, d_2 ($d_2 > d_1$) be the diameters of two concentric circles and c be the length of a chord of a circle which is tangent to the other circle, prove that $d_2^2 = c^2 + d_1^2$. **[3]**
29. Prove that $(3 - \sqrt{5})$ is irrational. **[3]**
30. A cube of side 5 cm contains a sphere touching its sides. Find the volume of the gap in between. **[3]**

OR

A golf ball has diameter equal to 4.1 cm. Its surface has 150 dimples each of radius 2 mm. Calculate total surface area which is exposed to the surroundings assuming that the dimples are hemispherical.

31. ABCD is a trapezium with AB || DC. E and F are two points on non-parallel sides AD and BC respectively, such that EF is parallel to AB. Show that $\frac{AE}{ED}=\frac{BF}{FC}$ **[3]**



Section D

32. The mode of the following frequency distribution is 55. Find the missing frequencies **a** and **b**. **[5]**

Class Interval	0 - 15	15 - 30	30 - 45	45 - 60	60 - 75	75 - 90	Total
Frequency	6	7	a	15	10	b	51

OR

Following is the distribution of I.Q. of 100 students. Find the median I.Q.

I.Q.	55-64	65-74	75-84	85-94	95104	105-114	115-124	125-134	135-144
No. of Students	1	2	9	22	33	22	8	2	1

33. Solve the pair of linear equations $\frac{3x}{2}-\frac{5y}{3}=-2$ and $\frac{x}{3}+\frac{y}{2}=\frac{13}{6}$ by substitution method. **[5]**

34. If cos A - sin A = m and cos A + sin A = n. Show that: $\frac{m^2-n^2}{m^2+n^2}$ = -2 sin A. cos A $=-\frac{2}{\tan A+\cot A}$ **[5]**

35. If α and β are the zeros of the quadratic polynomial f(x) = ax^2 + bx + c, then evaluate: **[5]**

$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)$

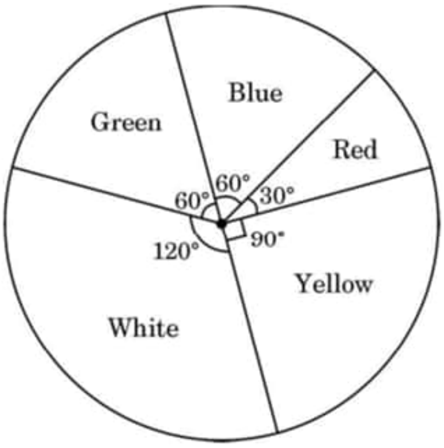
OR

Without actually calculating the zeroes, form a quadratic polynomial whose zeroes are reciprocals of the zeroes of the polynomial $5x^2$ + 2x - 3.

Section E

36. **Read the following text carefully and answer the questions that follow:** **[4]**

Some students were asked to list their favourite colour. The measure of each colour is shown by the central angle of a pie chart given below:



i. If a student is chosen at random, then find the probability of his/her favourite colour being white? (1)
ii. What is the probability of his/her favourite colour being blue or green? (1)
iii. If 15 students liked the colour yellow, how many students participated in the survey? (2)

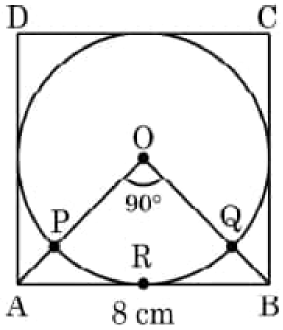
OR

What is the probability of the favourite colour being red or blue? (2)

37. **Read the following text carefully and answer the questions that follow:** **[4]**

For the inauguration of 'Earth day' week in a school, badges were given to volunteers. Organisers purchased these badges from an NGO, who made these badges in the form of a circle inscribed in a square of side 8 cm.

O is the centre of the circle and $\angle AOB = 90^o$:



i. What is the area of square ABCD? (1)

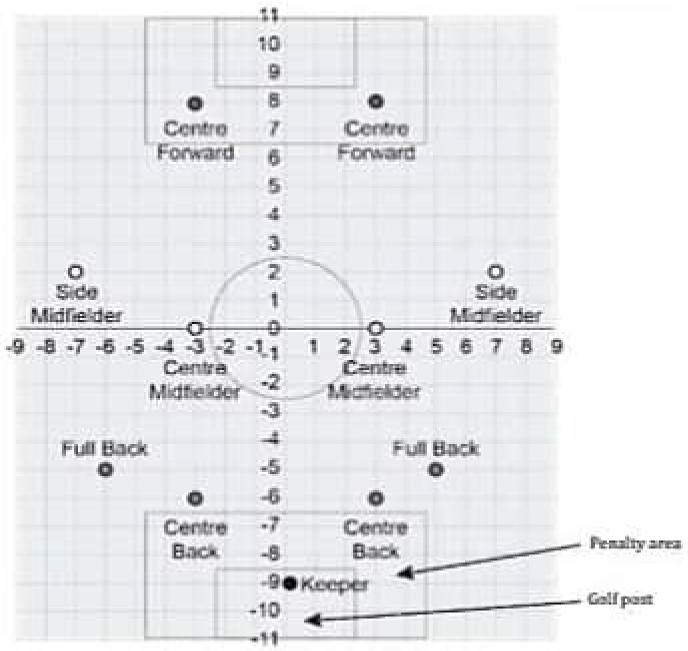
ii. What is the length of diagonal AC of square ABCD? (1)

iii. Find the area of sector OPRQO. (2)

OR

Find the area of remaining part of square ABCD when area of circle is excluded. (2)

38. Ronit is the captain of his school football team. He has decided to use a 4-4-2-1 formation in the next match. The figure below shows the positions of the players in a 4-4-2-1 formation on a coordinate grid. **[4]**



One square box represents 1 square unit.

i. What is the area of the middle circle?

ii. A ball hit from the left centre midfielder position touches the point (2, 11). Does the ball enter the goal post? Justify your answer.

iii. What are the coordinates of the point on the y-axis which is equidistant from the left centre forward and the right centre midfielder positions?

   a. (0, 0)
   b. (0, 2)
   c. (0, 4)
   d. (0, 8)

iv. What is the measure of the penalty area for one team?

   a. 10 m^2
   b. 17 m^2
   c. 25 m^2
   d. 29.25 m^2

Solution

Section A

1.

(d) $2 \times 3^2 \times 7^2$

Explanation:

2	882
3	441
3	147
7	49
7	7
	1

882 = $2 \times 3^2 \times 7^2$

2.

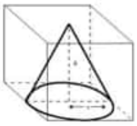
(c) 2.1cm

Explanation:

Given: edge of the cube = 4.2 cm

A right circular cone is a Cone whose height is perpendicular to the diameter (radius) of the base circle.

In a cube, a largest right circular Cone is formed when its base lies on one of the faces of the Cube and its tip lies on the opposite face.



$\therefore$ Diameter of largest right circular Cone in Cube = edge length of cube.

$\therefore$ Diameter = 4.2 cm

$\Rightarrow$ Radius = $\frac{\text{diameter}}{2} = \frac{4.2}{2}$ = 2.1 cm

$\therefore$ Radius of the largest right circular Cone in Cube is 2.1 cm

3.

(c) 35 cm

Explanation:

$\triangle$ABC $\sim$ $\triangle$DEF

$\frac{\text{ar}(\triangle \text{ ABC})}{\text{ar}(\triangle \text{ DEF})} = \left(\frac{AB}{DE}\right)^2 = \left(\frac{BC}{EF}\right)^2 = \left(\frac{AC}{DF}\right)^2$

$\frac{\text{ar}(\triangle \text{ ABC})}{\text{ar}(\triangle \text{ DEF})} = \left(\frac{BC}{EF}\right)^2$

$\frac{9}{25} = \left(\frac{21}{EF}\right)^2$

$\frac{9}{25} = \frac{441}{EF^2}$

EF^2 = $\frac{441 \times 25}{9}$

EF = $\sqrt{\frac{441 \times 25}{9}}$

EF = $\frac{21 \times 5}{9}$

EF = 35 cm.

4.

(b) 20 - 30

Explanation:

Class	**f**	**cf**
0-10	5	5
10-20	8	13
20-30	**20**	**33**
30-40	15	48
40-50	7	55
50-60	5	60

Median class $= \frac{n}{2} + 1 \cdot \frac{n}{2}$

= 31st and 32nd

Median class = 31.5

Which falls under 20-30

5.

(b) 80°

Explanation:

$\angle$A = (x + y +10), $\angle$B = (y + 20)^o, $\angle$C = (x + y - 30) and $\angle$D = (x + y)^o

And ABCD is a cylic quadrilateral

$\Rightarrow$ Sum of opposite angles = 180^o

$\angle A + \angle C = 180^o$
$\Rightarrow x + y + 10 + x + y - 30 = 180^o$
$\Rightarrow 2x + 2y - 20 = 180^o$
$\Rightarrow 2x + 2y = 200 \Rightarrow x + y = 100$ ... (1)
And
$\angle B + \angle D = 180^o$
$\Rightarrow y + 20 + x + y = 180^o$
$x + 2y = 160^o$ .... (2)
from eqn. (1) and (2)

$$\begin{array}{r} x + y = 100 \\ x + 2y = 160 \\ - \quad - \qquad - \\ \hline +y = +60 \\ \hline \end{array}$$

$\Rightarrow y = 60^o, x = 40^o$
Now $\angle B = y + 20$
$= 60 + 20 = 80^o$

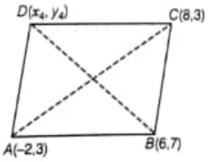
6. **(a)** $\tan^2 A$
Explanation:
Given: $\sin^2 A + \sin^2 A \tan^2 A$
$= \sin^2 A(1 + \tan^2 A)$
$= \sin^2 A(\sec^2 A)$
$= \sin^2 A \times \frac{1}{\cos^2 A}$
$= \frac{\sin^2 A}{\cos^2 A}$
$= \tan^2 A$

7. **(b)** $4\left(x^2-5\right)$
Explanation:
$\alpha=\sqrt{5}\ \beta=-\sqrt{5}$
$\alpha+\beta=\sqrt{5}-\sqrt{5}=0$
$\alpha\beta=(\sqrt{5})(-\sqrt{5})=-5$
req. poly is
$x^2-(\alpha+\beta)x+\alpha\beta=0$
$x^2-0x-5=0$
$x^2-5=0$

8. **(a)** $\frac{1}{2}$
Explanation:
No. of total letters in the word MOBILE = 6
No, of vowels = {O,I,E}, i, e = 3
Probability of being a vowel = $\frac{3}{6}=\frac{1}{2}$

9. **(b)** $32\ m^2$
Explanation:
The area of the segment $=\left(\frac{x^{\circ}}{360^{\circ}}\times\pi r^2\right)-\frac{bh}{2}$
= Area of the sector - Area of the triangle
= 44 - 12
$= 32\ m^2$

10. **(d)** (0, -1)
Explanation:
Given a parallelogram ABCD whose three vertices are;
A (- 2, 3), B (6, 7) and C (8, 3)



Let the fourth vertex of parallelogram, D = (x_4, y_4) and L, M be the middle points of AC and BD, respectively
L = $\left(\frac{-2+8}{2},\frac{3+3}{2}\right)=(3,3)$
Since, mid - point of a line segment having points (x_1, y_1) and (x_2, y_2)
$= \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}$
and
M = $\frac{6+x_4}{2}, \frac{7+y_4}{2}$
As we know ABCD is a parallelogram, therefore diagonals AC and BD will bisect each other.
So, L and M are the same points
$3 = \frac{6+x_4}{2}$ and $3 = \frac{7+y_4}{2}$

$\Rightarrow$ 6 = 6 + x_4 and 6 = 7 + y_4

$\Rightarrow$ x_4 = 0 and y_4 = 6 – 7

$\therefore$ x_4 = 0 and y_4 = - 1

Hence, the fourth vertex of parallelogram is D = (x_4, y_4) = (0, -1)

11.

(b) 3

Explanation:

T_5 = 20 $\Rightarrow$ a + 4d = 20 ...(i)

(T_7 + T_{11}) = 64

$\Rightarrow$ (a + 6d) + (a + 10d) = 64

$\Rightarrow$ a + 8d = 32 ... (ii)

Subtracting (i) from (ii), we get

4d = 12

$\Rightarrow$ d = 3

12.

(c) 45^o

Explanation:

tan(θ) = $\frac{height\ of\ the\ tower}{distance\ from\ the\ base}$

tan(θ) = $\frac{200}{200}$ = 1

θ = 45^o

13.

(d) ±6

Explanation:

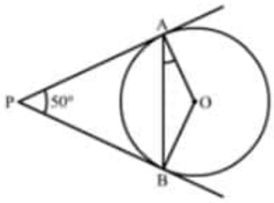
We have, $\frac{x^2-8}{x^2+20}$ = $\frac{1}{2}$

$\Rightarrow$ $2x^2$ - 16 = x^2 + 20 $\Rightarrow$ x^2 = 36 $\Rightarrow$ x = ±6

14.

(b) 25^o

Explanation:



Given, PA and PB are tangent lines.

PA = PB [Since, the length of tangents drawn from a point are equal]

$\angle\mathrm{PBA} = \angle\mathrm{PAB} = \theta$ (say)

In ΔPAB

$\angle P + \angle A + \angle B = 180^\circ$

[since, sum of angles of a triangle $= 180^\circ$

$50^\circ + \theta + \theta = 180^\circ$

$2\theta = 180^\circ - 50^\circ = 130^\circ$

$\theta = 65^\circ$

$\text{Also, OA} \perp \text{PA}$

[Since, tangent at any point of a circle is perpendicular to the radius through the point of contact]

$\angle\mathrm{PAO} = 90^\circ$

$\Rightarrow \angle PAB + \angle OAB = 90^\circ$

$\Rightarrow 65^\circ + \angle\mathrm{BAO} = 90^\circ$

$\Rightarrow \angle OAB = 90^\circ - 65^\circ = 25^\circ$

15.

(d) 3

Explanation:

$a = 2^2 \times 3^x$

$b = 2^2 \times 3 \times 5$

$c = 2^2 \times 3 \times 7$

LCM (a, b, c) = 3780

3780 = $2^2 \times 3^3 \times 5^1 \times 7^1$

In LCM, we consider highest power

So, x = 3

16.

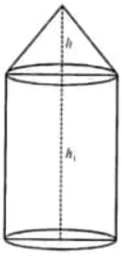
(b) $\frac{2h}{3}$

Explanation:

Height of cone = h

Volume of solid = 3 $\times$ volume of cone

Let h be the height of the cylinder and r be its radius, then
Volume of cylinder and r be its radius, then
Volume of cylinder = $\pi r^2 h_1$
and volume of cone = $\left(\frac{1}{3}\right) \pi r^2 h_1$



Then volume of solid = $\pi r^2 h_1 + \frac{1}{3}\pi r^2 h$
$= \pi r^2 \left(h_1 + \frac{1}{3}h\right)$
Now $\pi r^2 \left(h_1 + \frac{1}{3}h\right) = 3 \times \frac{1}{3}\pi r^2 h = \pi r^2 h$
$\Rightarrow h_1 + \frac{1}{3}h = h$ (comparing)
$h_1 = h - \frac{1}{3}h = \frac{2}{3}h$
Hence, height of cylinder = $\frac{2h}{3}$

17. **(a)** DC $\times$ AC
Explanation:
Since, triangles ABC and DCB are similar
$\therefore \frac{AB}{AC} = \frac{DC}{DB} \Rightarrow$ AB $\times$ DB = DC $\times$ AC

18.
(c) 24.5
Explanation:
Median = 26
Mode = 29
Mode = 3Median - 2Mean
Hence, $Mean = \frac{\text{3Median - Mode}}{2}$
$= \frac{3(26)-29}{2}$
$= \frac{78-29}{2}$
$= \frac{49}{2}$
= 24.5

19.
(c) A is true but R is false.
Explanation:
Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2}$ as $\frac{2}{1} = \frac{2}{1}$ is condition of non-zero solutions.
But all lines of type ax + by = 0 and cx + dy = 0 do not have non-zero solutions always.

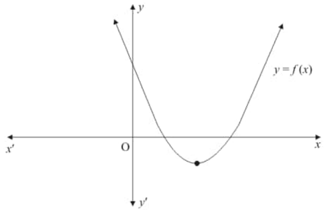
20.
(d) A is false but R is true.
Explanation:
sin θ and cosec θ are reciprocal of each other so sin $\theta \times$ cosec θ = 1
sin $\theta \times$ cosec $\theta \neq$ cot θ

Section B

21. F(x)=x^2-x-4
here a=1,b=-1,c=-4
Now α and β are zeros of f(x)
Sum of zeroes = α + β $= -\frac{b}{a}$=-$\frac{-1}{1}$=1
Product of the zeroes = αβ = $\frac{c}{a}$=$\frac{-4}{1} = -4$
$\frac{1}{\alpha} + \frac{1}{\beta} - \alpha\beta = \frac{\alpha+\beta-\alpha^2\beta^2}{\alpha\beta} = \frac{1-(-4)^2}{-4}$
$= \frac{1-16}{-4} = \frac{-15}{-4} = \frac{15}{4}$

OR

Clearly, $f(x) = ax^2 + bx + c$ represent a parabola opening upwards. Therefore, a>0



Since the parabola cuts the x-axis at two points, this means that the polynomial will have two real solutions.
Hence $b^2 - 4ac > 0$
Hence a>0 and $b^2 - 4ac > 0$
22. Total number of playing cards in a well-shuffled deck = 52

i. Total number of kings of red colour = 2 (hearts (♥), diamonds (♦))

Probability of getting a king of red colour = $\frac{\text{Favourabe outcomes}}{\text{Total outcomes}}$

$= \frac{2}{52}$

$= \frac{1}{26}$

ii. Total number of red face cards = 6 (Kings, queens and jacks are called face cards)

Probability of getting a red face card = $\frac{\text{Favourabe outcomes}}{\text{Total outcomes}}$

$= \frac{6}{52}$

$= \frac{3}{26}$

OR

i. P(an ace) = $\frac{4}{48}$ or $\frac{1}{12}$

ii. P(jack of red colour) = $\frac{2}{48}$ or $\frac{1}{24}$

iii. P(king of spade) = $\frac{1}{48}$

23. Diagonal of rectangle = $\sqrt{6^2 + 8^2}$ = 10

$\therefore$ Radius of circle r = $\frac{10}{2}$ = 5

Area of circle = 3.14 $\times$ 5 $\times$ 5

= 78.5

Area of rectangle = 6 $\times$ 8 = 48

Area of shaded region = 78.5 - 48

= 30.5 cm^2

$\therefore$ Area of shaded region is 30.5 cm^2

24. We have to find a point on the y-axis which is equidistant from the points A(6, 5) and B (- 4, 3).

We know that a point on y-axis is of the form (0, y). So, let the required point be P (0, y).

Then,

PA = PB

$\Rightarrow \sqrt{(0-6)^2 + (y-5)^2} = \sqrt{(0+4)^2 + (y-3)^2}$

$\Rightarrow$ 36 + $(y - 5)^2$ = 16 + $(y - 3)^2$

$\Rightarrow$ 36 + y^2 - 10y + 25 = 16 + y^2 - 6y + 9

$\Rightarrow$ 4y = 36

$\Rightarrow$ y = 9

So, the required point is (0, 9).

25. According to the given condition the sum of the 2nd and the 7th terms of an AP is 30. If its 15th term is 1 less than twice its 8th term.Now,

The general term of an AP is given by

a_n = a + (n - 1)d.

Given that $a_2 + a_7$ = 30

$\Rightarrow$ a + d + a + 6d = 30

$\Rightarrow$ 2a + 7d = 30 ......(i)

Next, $a_{15} = 2a_8 - 1$

$\Rightarrow$ a + 14d = 2(a + 7d) - 1

$\Rightarrow$ a + 14d = 2a + 14d - 1

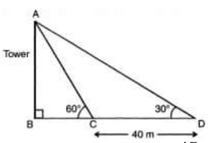
$\Rightarrow$ a = 1

Substituting in (i), we get d=4

So, the AP is a, a + d,a+2d, a + 3d.

that is 1, 5, 9, 13,......

Section C

26. 

In $\triangle ABC$, $\tan 60^\circ = \frac{AB}{BC}$

$\Rightarrow \quad AB = \sqrt{3}BC$ .....(i)

In $\triangle ABD$,

$\tan 30^\circ = \frac{AB}{BC+40}$

$\frac{1}{\sqrt{3}} = \frac{AB}{BC+40} = \frac{\sqrt{3}BC}{BC+40}$

3BC = BC + 40

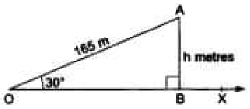
BC = 20, Hence from (i) we get

AB = 20√3 = 20 $\times$ 1.73 = 34.6 meter

OR

Let A be the position of the kite. Let O be the position of the observer and OA be the thread. Draw $AB \perp OX$

Then, $\angle BOA = 30^\circ$, OA = 165m and $\angle OBA = 90^\circ$.



Height of the kite from the ground $= AB$.

Let $AB = h\,m$.

From right ΔOBA, we have

$\frac{AB}{OA} = \sin 30^\circ = \frac{1}{2}$

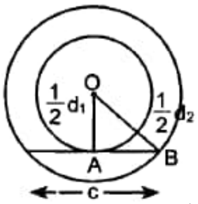
$\Rightarrow \frac{h}{165} = \frac{1}{2} \Rightarrow h = \frac{165}{2} = 82.5$

27. Let usual speed = x km/hr

New speed = (x + 250)km/hr

Total distance = 1500 km

Time taken by usual speed = $\frac{1500}{x}$hr
Time taken by new speed = $\frac{1500}{x+250}$hr
According to question,
$\frac{1500}{x} - \frac{1500}{x+250} = \frac{1}{2}$
$\Rightarrow \frac{1500x+1500\times250-1500x}{x^2+250x} = \frac{1}{2}$
$\Rightarrow$ x^2 + 250x = 750000
$\Rightarrow$ x^2 + 250x - 750000 = 0
$\Rightarrow$ x^2 + 1000x - 750x - 750000 = 0
$\Rightarrow$ x(x + 1000) - 750(x + 1000) = 0
$\Rightarrow$ x = 750 or x = -1000
Therefore, usual speed is 750 km/hr, -1000 is neglected.

28. 

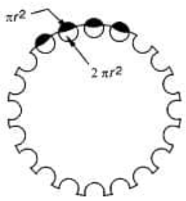
Radius of bigger circle = $\frac{1}{2}d_2$
Radius of smaller circle = $\frac{1}{2}d_1$
In right angled $\triangle$OAB,
By using **Pythagorean** theorem ,
$\text{OB}^2 = \text{AB}^2 + \text{OA}^2$
$\Rightarrow \left(\frac{1}{2}d_2\right)^2 = \left(\frac{1}{2}c\right)^2 + \left(\frac{1}{2}d_1\right)^2$
$\Rightarrow \frac{1}{4}d_2^2 = \frac{1}{4}c^2 + \frac{1}{4}d_1^2$
$\Rightarrow d_2^2 = c^2 + d_1^2$

29. Let $3 - \sqrt{5} = \frac{p}{q}$
$\therefore 3 - \sqrt{5} = \frac{p}{q}$ (where p and q are integers, co-prime and $q \neq 0$)
$\Rightarrow \quad 3 - \frac{p}{q} = \sqrt{5}$
$\Rightarrow \quad \frac{3q-p}{q} = \sqrt{5}$
$(3q - p)$ and q are integers, so $\left(\frac{3q-p}{q}\right)$ is a rational number, but $\sqrt{5}$ is an irrational number. This contradiction arises because of our wrong assumption.
So $(3 - \sqrt{5})$ is an irrational number

30. Each side of the cube (a) = 5 cm
Diameter of the sphere (2r) = 5 cm
$\therefore$Radius of the sphere (r) = $\frac{5}{2}$ cm
Volume of the cube = a^3 = 5^3 cm^3 = 125 cm^3
Volume of the sphere = $\frac{4}{3}\pi r^3$
$= \frac{4}{3} \times \frac{22}{7} \times (\frac{5}{2})^3$
$= \frac{4}{3} \times \frac{22}{7} \times \frac{5}{2} \times \frac{5}{2} \times \frac{5}{2}$
$= \frac{11\times125}{7\times3}$
= 65.476 cm^3
Volume of gap = 125.000 cm^3 - 65.476 cm^3 = 59.524 cm^3
Hence volume of gap between cube and sphere is 59.524 cm^3.

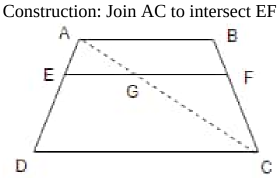
OR

We observe that:
Surface area of the ball = $4\pi \times \left(\frac{4.1}{2}\right)^2$ cm^2 = 16.81 π cm^2



In case of each dimple, surface area equal to πr^2 (r is the radius of each dimple) is removed from the surface of the ball where as the surface area of hemisphere i.e.$2\pi r^2$ is exposed to the surroundings. Let S be the total surface area exposed to the surroundings. Then,
S = Surface area of the ball - 150 $\times \pi r^2$ + 150 $\times$ 2πr^2
$\Rightarrow$ S = 16.81π + 150πr^2
$\Rightarrow$ S = {16.81π + 150 $\pi \times$ $(\frac{2}{10})^2$} cm^2
$\Rightarrow$ S = (16.81π + 6π) cm^2 = 22.81 π cm^2 = 22.81 $\times \frac{22}{7}$ cm^2 = 71.68 cm^2

31. Given, In trapezium ABCD,
$AB||DC$ and $EF||DC$
To prove $\frac{AE}{ED} = \frac{BF}{FC}$
Construction: Join AC to intersect EF at G.



Proof Since, $AB||DC$ and $EF||DC$

$EF||AB$ [since, lines parallel to the same line are also parallel to each other]...... (i)

In $\triangle ADC, EG||DC$ [$\because EF||DC$]

By using basic proportionality theorem,

$\frac{AE}{ED} = \frac{AG}{GC}$ ....(ii)

In $\triangle ABC, GF||AB$ [$\because EF||AB$ from (i)]

By using basic proportionality theorem ,

$\frac{CG}{AG} = \frac{CF}{BF}$ or $\frac{AG}{GC} = \frac{BF}{CF}$ [On taking reciprocal of the terms]............. (iii)

From Equations (ii) and (iii), we get

$\frac{AE}{ED} = \frac{BF}{FC}$

Hence Proved.

Section D

32. Modal Class: 45 - 60

Mode = 55

55 = 45 + $\frac{15-a}{30-(a+10)} \times 15$

$\Rightarrow$ a = 5

6 + 7 + a + 15 + 10 + b = 51

$\Rightarrow$ a + b = 13

$\Rightarrow$ b = 13 - 5 = 8

OR

Class interval (Inclusive)	Class interval (Exclusive)	Frequency	Cumulative frequency
55-64	54.5-64.5	1	1
65-74	64.5-74.5	2	3
75-84	74.5-84.5	9	12
85-94	84.5-94.5	22	34(F)
95-104	94.5-104.5 (median class)	33(f)	67
105-144	104.5-114.5	22	89
115-124	114.5-124.5	8	97
125-134	124.5-134.5	2	99
135-144	134.5-144.5	1	100
		N = 100	

N = 100

$\therefore \frac{N}{2} = \frac{100}{2}$ = 50

The cumulative frequency just greater than $\frac{N}{2}$ is 67.

the median class is 94.5 - 104.5

$\therefore$ Median = l + $\frac{\frac{N}{2}-F}{f} \times$ h

Here,

l = Lower limit of median class

F = Cumulative frequency of class prior to median class.

f = Frequency of median class.

h = Class size.

l = 94.5, f = 33, F = 34, h = 104.5 - 94.5 = 10

= 94.5 + $\frac{50-34}{33} \times$ 10

= 94.5 + 4.85

= 99.35

33. $\frac{3x}{2} - \frac{5y}{3} = -2; \frac{x}{3} + \frac{y}{2} = \frac{13}{6}$

The given system of linear equation is

$\frac{3x}{2} - \frac{5y}{3} = -2 \quad \ldots\ldots\ldots\ldots (1)$

$\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$ .... (2)

$\Rightarrow \quad 9x - 10y = -12$ .... (3)

2x + 3y = 13 ...... (4)

From equation (3)

9x - 10y = -12

9x = 10y - 12

$x = \frac{10y-12}{9}$

Substituting the value of y in equation (4), we get

$2\left(\frac{10y-12}{9}\right) + 3y = 13$

$20y - 24 + 27y = 117$

$47y = 117 + 24$

$y = \frac{141}{47}$

y = 3

Substituting the value of y in equation (4), we get

$2x + 3 \times 3 = 13$

$2x + 9 = 13$

$2x = 13 - 9$

$x = \frac{4}{2} = 2$

Therefore, the solution is

x = 2, y = 3

Verification, Substituting x = 2 and y = 3, we find that both the equations (1) and (2) are satisfied as shown below:

$\frac{3}{2}x - \frac{5y}{3} = \frac{3}{2}(2) - \frac{5}{3}(3) = 3 - 5 = -2$

$\frac{x}{3}+\frac{y}{2}=\frac{2}{3}+\frac{3}{2}=\frac{13}{6}$
This verifies the solution.

34. Given,
cos A - sin A = m
$\Rightarrow$ (cos A - sin A)^2 = m^2
$\Rightarrow$ cos^2 A + sin^2 A - 2 cos A sin A = m^2
$\Rightarrow$ 1 -2 cos A sin A = m^2 ...(i)

Also given,
cos A + sin A = n
$\Rightarrow$ (cos A + sin A)^2 = n^2
$\Rightarrow$ cos^2 A + sin^2 A + 2 cos A sin A= n^2
$\Rightarrow$ 1 + 2 cos A sin A = n^2 ...(ii)

Adding (i) & (ii), we get :-
(1 - 2cosAsinA) + (1 + 2cosAsinA) = m^2 + n^2
$\Rightarrow$ m^2 + n^2 = 2 .....(iii)

Similarly, on subtracting equation (ii) from (i) we get :-
- 4 cos A sin A = m^2 - n^2 ...(iv)

Now, L.H.S.
= $\frac{m^2-n^2}{m^2+n^2}$
$=\frac{-4\cos A\sin A}{2}$ [from (iii) & (iv)]
= - 2 sin A cos A
So, $\frac{m^2-n^2}{m^2+n^2}=-2SinACosA$ ......(v)
Now,
-2sinAcosA
$=\frac{-2\sin A\cos A}{1}$
$=\frac{-2\sin A\cdot\cos A}{\sin^2 A+\cos^2 A}$ ($\because$ sin^2 A + cos^2 A = 1)
$=\frac{\frac{-2\sin A\cos A}{\sin A\cos A}}{\frac{\sin^2 A+\cos^2 A}{\sin A\cdot\cos A}}$
$=\frac{-2}{\frac{\sin^2 A}{\sin A\cdot\cos A}+\frac{\cos^2 A}{\sin A\cdot\cos A}}$
$=\frac{-2}{\tan A+\cot A}$
So, -2sinAcosA $=\frac{-2}{\tan A+\cot A}$ ......(vi)
Now, from (v) & (vi) ,

$\frac{m^2-n^2}{m^2+n^2}$ = - 2 sin A . cos A $=\frac{-2}{\tan A+\cot A}$ Hence, Proved.

35. Since α and β are the zeros of the quadratic polynomial f(x) = ax^2 + bx + c
$\alpha+\beta=\frac{-\text{ Coefficient of }x}{\text{Coefficient of }x^2}=\frac{-b}{a}$
$\alpha\beta=\frac{\text{Constant term}}{\text{Coefficient of }x^2}=\frac{c}{a}$
We have,
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=a\left(\frac{\alpha^3+\beta^3}{\alpha\beta}\right)+b\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right)$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=a\left(\frac{(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)}{\alpha\beta}\right)+\left(\frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}\right)$
By substituting $\alpha+\beta=\frac{-b}{a}$ and $\alpha\beta=\frac{c}{a}$ we get,
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=a\left(\frac{\left(\frac{-b}{a}\right)^3-3\times\frac{c}{a}\left(\frac{-b}{a}\right)}{\frac{c}{a}}\right)+b\left(\frac{\left(\frac{-b}{a}\right)^2-2\times\frac{c}{a}}{\frac{c}{a}}\right)$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=a\left(\frac{\frac{-b^3}{a^3}+\frac{3bc}{a^2}}{\frac{c}{a}}\right)+b\left(\frac{\frac{b^2}{a^2}-\frac{2c}{a}}{\frac{c}{a}}\right)$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=a\left(\frac{-b^3+3bca}{a^3}\times\frac{a}{c}\right)+b\left(\frac{b^2-2ca}{a^2}\times\frac{a}{c}\right)$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=a\left(\frac{-b^3+3abc}{a^2c}\right)+b\left(\frac{b^2-2ca}{ac}\right)$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=\frac{-b^3+3abc}{ac}+\frac{b^3-2abc}{ac}$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=\frac{-b^3+3abc+b^3-2abc}{ac}$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=\frac{3abc-2abc}{ac}$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=\frac{abc}{ac}$
$a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)=b$
Hence, the value of $a\left(\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}\right)+b\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)$ is b.

OR

Sum of zeroes of a quadratic polynomial is $\frac{-b}{a}$ and the product is $\frac{c}{a}$
So a + b = $\frac{-2}{5}$ and ab = $\frac{-3}{5}$
According to question
Sum of zeroes of the polynomial is $\frac{1}{a}$ + $\frac{1}{b}$

$= \frac{a+b}{ab}$

$= \frac{\frac{-2}{5}}{\frac{-3}{5}}$

$= \frac{2}{3}$

Product of zeroes of the polynomial is $\frac{1}{ab}$

$= \frac{1}{\frac{-3}{5}}$

$= \frac{-5}{3}$

We know that a quadratic equation is of the form $ax^2 + bx + c$

$= x^2 - \frac{2}{3}x - \frac{5}{3}$

Section E

36. i. Since, Total angle in a pie chart is 360^o

So, Total no. of Sample Space = 360

Let 'E' be the event of having 'White' as favourite colour.

$P(E) = \frac{favourable\ outcome}{Total\ Outcome}$

$= \frac{120}{360}$

$= \frac{1}{3}$

ii. P(Blue or Green) = $\frac{60+60}{360}$

$= \frac{120}{360} = \frac{1}{3}$

iii. Since, Yellow represent 90^o in the Pie Chart

90^o = 15 Students

$360^o = \frac{15}{90} \times 360$ = 60 students

Hence, 60 Students participated in the survey.

OR

P(Red or Blue) = $\frac{30+60}{360}$

$= \frac{90}{360} = \frac{1}{4}$

37. i. Area of square ABCD = $(Side)^2$,

$= (8)^2$

$= 64\ cm^2$

ii. $\triangle ABC$, $\angle B = 90^o$

$\therefore AC^2 = AB^2 + BC^2 = 2AB^2$

$AC = \sqrt{2}\ AB$

Diagonal AC = $8\sqrt{2}$ cm

iii. Area of Sector OPRQO

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

$= \frac{90^\circ}{360^\circ} \times \frac{22}{7} \times 4 \times 4\ cm^2$

[Radius of inscribed circle = $\frac{1}{2}$ side of square]

Area of sector OPRQO = $\frac{88}{7}$

$= 12\frac{4}{7}\ cm^2$

OR

Area of circle = πr^2

$= \frac{22}{7} \times (4)^2$

$= \frac{352}{7}\ cm^2$

$\therefore$ Required Area = $64 - \frac{352}{7}$

$= \frac{448-352}{7}$

$= \frac{96}{7}\ cm^2$

$= 13\frac{5}{7}\ cm^2$

38. i. $(2.5)^2\pi$ or equivalent, with or without word square units

$(2.5)^2\pi = 19.63$ square units

ii. Yes. the point lies within the goal post.

iii. (c) (0, 4)

iv. (d) 40.5