Class: IX
SESSION : 2022-2023
SUBJECT: Mathematics
SAMPLE QUESTION PAPER - 7
with SOLUTION

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

General Instructions:

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

Section A

1. If (4, 19) is a solution of the equation y = ax + 3, then a = **[1]**

a) 4
b) 6
c) 3
d) 5

2. π is **[1]**

a) a rational number
b) an integer
c) an irrational number
d) a whole number

3. In a histogram the area of each rectangle is proportional to **[1]**

a) the class size of the corresponding class interval
b) cumulative frequency of the corresponding class interval
c) the class mark of the corresponding class interval
d) frequency of the corresponding class interval

4. The points (–5, 2) and (2, – 5) lie in the **[1]**

a) II and III quadrants, respectively
b) same quadrant
c) II and IV quadrants, respectively
d) IV and II quadrants, respectively

5. A point C is said to lie between the points A and B if **[1]**

a) AC + CB = AB

b) Points A, C and B are collinear

c) None of these

d) AC = CB

6. How many linear equations in 'x' and 'y' can be satisfied by x = 1, y = 2? **[1]**

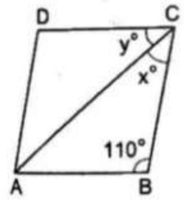
a) Infinitely many

b) Two

c) Only one

d) Three

7. In the given figure, ABCD is a Rhombus. Find the value of x and y? **[1]**



a) $x = 35°$ and $y = 35°$

b) $x = 45°$ and $y = 45°$

c) $x = 37°$ and $y = 37°$

d) $x = 40°$ and $y = 40°$

8. Two complementary angles are such that two times the measure of one is equal to three times the measure of the other. The measure of the smaller angle is **[1]**

a) 30°

b) None of these

c) 36°

d) 45°

9. If $x^4 + \frac{1}{x^4} = 623$, then $x + \frac{1}{x}$ = **[1]**

a) 27

b) $-3\sqrt{3}$

c) $3\sqrt{3}$

d) 25

10. The equation x - 2 = 0 on number line is represented by **[1]**

a) infinitely many lines

b) two lines

c) a point

d) a line

11. If the bisector of the angle A of a $\triangle ABC$ is perpendicular to the base BC of the triangle then the triangle ABC is: **[1]**

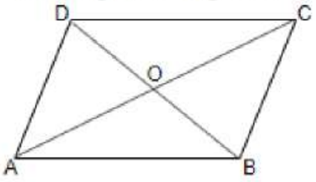
a) Isosceles

b) Obtuse Angled

c) Equilateral

d) Scalene

12. In the given figure, ABCD is a Rhombus. Then, **[1]**



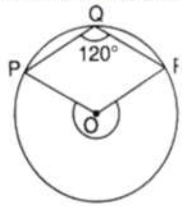
a) $(AC^2 + BD^2) = 3AB^2$

b) $AC^2 + BD^2 = 4AB^2$

c) $AC^2 + BD^2 = AB^2$

d) $AC^2 + BD^2 = 2AB^2$

13. What fraction of the whole circle is minor arc RP in the given figure? **[1]**



a) $\frac{1}{4}$ of the circle

b) $\frac{1}{5}$ of the circle

c) $\frac{1}{3}$ of the circle

d) $\frac{1}{2}$ of the circle

14. If $4^x - 4^{x-1} = 24$, then $(2x)^x$ equals **[1]**

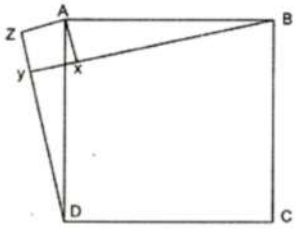
a) $\sqrt{5}$

b) $25\sqrt{5}$

c) 125

d) $5\sqrt{5}$

15. In figure, X is a point in the interior of square ABCD. AXYZ is also a square. If DY = 3 cm and AZ = 2 cm, then BY = **[1]**



a) 6 cm

b) 5 cm

c) 8 cm

d) 7 cm

16. When $p(x) = x^4 + 2x^3 - 3x^2 + x - 1$ is divided by (x - 2), the remainder is **[1]**

a) -15

b) 21

c) -1

d) 0

17. If x + 2 is a factor of $x^2 + mx + 14$, then m = **[1]**

a) 2

b) 9

c) 7

d) 14

18. If a solid sphere of radius 10 cm is moulded into 8 spherical solid balls of equal radius, then the surface area of each ball (in sq. cm) is **[1]**

a) 100π

b) 60π

c) 75π d) 50π

19. **Assertion (A):** The point (0, 3) lies on the graph of the linear equation 3x + 4y = 12. **[1]**
Reason (R): (0, 3) satisfies the equation 3x + 4y = 12.

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):** The side of an equilateral triangle is 6 cm then the area of the triangle is 9 cm^2. **[1]**
Reason (R): All the sides of an equilateral triangle are equal.

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. Using factor theorem, show that g(x) is a factor of p(x), when $p(x) = 2x^4 + 9x^3 + 6x^2 - 11x - 6$, $g(x) = x - 1$. **[2]**

22. The base of a right-angled triangle measures 4 cm and its hypotenuse measures 5 cm. Find the area of the triangle. **[2]**

23. Factorise: $a^3 - 2\sqrt{2}b^3$ **[2]**

OR

Factorise: $x^4 + x^2y^2 + y^4$

24. Find the volume and surface area of a sphere whose radius is 3.5 cm. **[2]**

25. Find whether the given equation have x = 2, y = 1 as a solution: **[2]**
$2x + 3y = 7$

OR

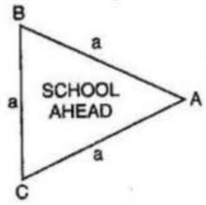
Write four solutions of the equation: $2x + y = 7$

Section C

26. Factorize the polynomial: **[3]**
$64a^3 - 27b^3 - 144a^2b + 108ab^2$

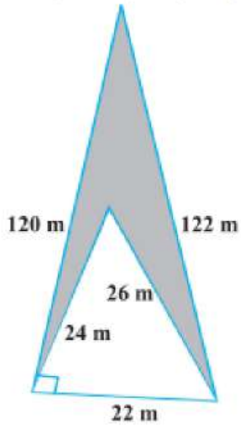
27. A traffic signal board, indicating SCHOOLAHEAD is an equilateral triangle with side a Find the area of the signal board, using Heron's formula. If its perimeter is **[3]**

180 cm, what will be the area of the signal board?



OR

Calculate the area of the shaded region in Fig.

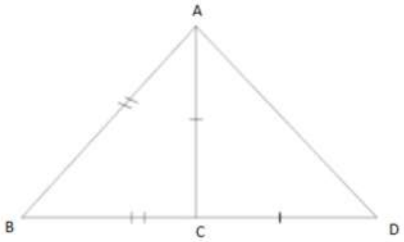


28. Locate $\sqrt{8}$ on the number line. **[3]**

29. Find at least 3 solutions for the following linear equation in two variables: $2x - 3y + 7 = 0$ **[3]**

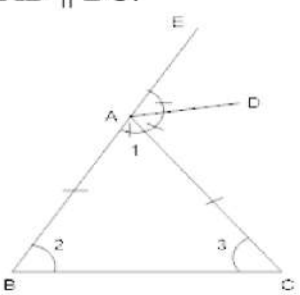
30. Draw the graphs of $y = x$ and $y = -x$ in the same graph. Also find the co-ordinates of the point where the two lines intersect. **[3]**

31. From the following figure, prove that $\angle BAD = 3\angle ADB$. **[3]**



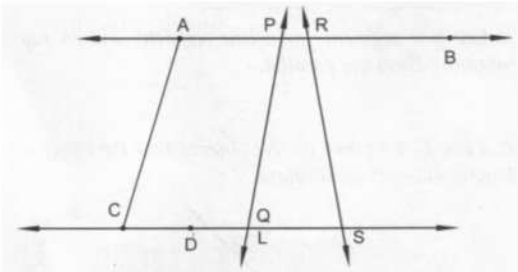
OR

$\triangle ABC$ is an isosceles triangle with AB = AC. AD bisects the exterior $\angle A$. prove that AD || BC.



Section D

32. In Fig, name the following: **[5]**



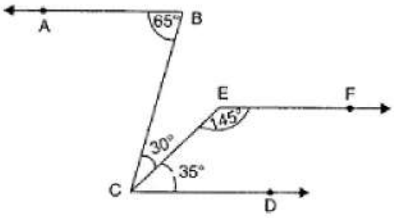
i. Five line segments
ii. Five rays
iii. Four collinear points
iv. Two pairs of non-intersecting line segments

33. If $a = \frac{\sqrt{2}+1}{\sqrt{2}-1}$ and $b = \frac{\sqrt{2}-1}{\sqrt{2}+1}$, then find the value of $a^2 + b^2 - 4ab$. **[5]**

OR

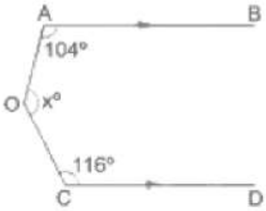
Simplify: $\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$.

34. In figure, $\angle ABC = 65^{o}$, $\angle BCE = 30^{o}$, $\angle DCE = 35^{o}$ and $\angle CFE = 145^{o}$. Prove that AB || EF. **[5]**



OR

In the given figure, AB || CD and $\angle AOC = x^\circ$. If $\angle OAB = 104^\circ$ and $\angle OCD = 116^\circ$, find the value of x.



35. The runs scored by two teams A and B on the first 60 balls in a cricket match are given below : **[5]**

Number of balls	Team A	Team B
1-6	2	5
7-12	1	6
13-18	8	2
19-24	9	10
25-30	4	5

Number of balls	Team A	Team B
31-36	5	6
37-42	6	3
43-48	10	4
49-54	6	8
55-60	2	10

Represent the data of both the teams on the same graph by frequency polygons.
[Hint: First make the class intervals continuous.]

Section E

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

In the Meharali, New DTC bus stop was constructed. The bus stop is barricaded from the remaining part of the road, by using 50 hollow cones. Each hollow cone is made of recycled cardboard.
Each cone has a base diameter of 40 cm and a height of 1 m.

(i) Find the curved surface area of the cone.

(ii) What is the volume of a cone?

OR

If the cost of cardboard is ₹100 per m^2 then what will be cost of cardboard for 50 cones?

(iii) If the outer side of each of the cones is to be painted and the cost of painting is ₹12 per m^2, what will be the cost of painting all these cones?

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

While dusting a maid found a button whose upper face is of red color, as shown in the figure. The diameter of each of the smaller identical circles is $\frac{1}{4}$ of the diameter of the larger circle whose radius is 16 cm.

(i) Find the area of each of the smaller circle.

(ii) Find the area of the larger circle.

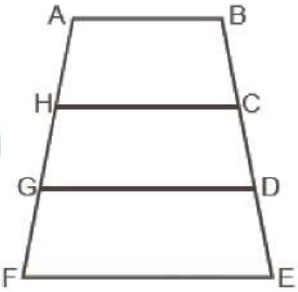
(iii) Find the area of the black colour region.

OR

Find the area of quadrant of a smaller circle.

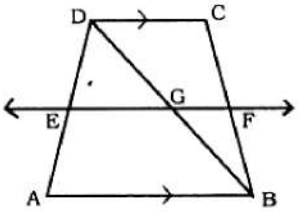
38. **Read the text carefully and answer the questions:** **[4]**

Sohan wants to show gratitude towards his teacher by giving her a card made by him. He has three pieces of trapezium pasted one above the other as shown in fig. These pieces are arranged in a way that AB || HC || GD || FE. Also AH = HG = GF and DE = 4 cm. He wants to decorate the card by putting up colored tape on the nonparallel sides of the trapezium.



(i) What is the difference between trapezium and parallelogram?

(ii) ABCD is a trapezium where AB || DC, BD is the diagonal and E is the midpoint of AD. A line is drawn through E parallel to AB intersecting BC at F. Show that BF = FC



OR

ABHC is a trapezium in which AB || HC and ∠A = ∠B = 45°. Find angles C and H of the trapezium.

(iii) Find the total length of colored tape required if GF = 6 cm.

SOLUTION

Section A

1. **(a)** 4

   Explanation: Given, (4, 19) is a solution of the equation $y=ax+3$

   $=19 = 4a + 3$

   $= a = 4$

2. **(c)** an irrational number

   Explanation: $\pi = 3.14159265359$…….., which is non-terminating non-recurring. Hence, it is an irrational number.

3. **(d)** frequency of the corresponding class interval

   Explanation: A histogram is a display of statistical information that uses rectangles to show the frequency of data items in successive numerical intervals of equal size. In the most common form of histogram, the independent variable is plotted along the horizontal axis and the dependent variable is plotted along the vertical axis.

4. **(c)** II and IV quadrants, respectively

   Explanation: In point (-5,2), x-coordinate is negative and y-coordinate is positive, so it lies in II quadrant and in point (2, – 5), x- coordinate is positive and y-coordinate is negative, so it lies in IV quadrant.

5. **(b)** Points A, C and B are collinear

   Explanation: A point C is said to lie between A and B if the points A, C and B are collinear

6. **(a)** Infinitely many

   Explanation: There are many linear equations in 'x' and 'y' can be satisfied by x = 1, y = 2

   for example

   $x + y = 3$ $\qquad$ $x - y =-1$

   $2x + y =4$

   and so on there are infinte number of examples

7. **(a)** $x = 35°$and $y = 35°$

   Explanation: ABCD is a rhombus and a rhombus is also a parallelogram. A rhombus has four equal sides.

   In $\triangle ABC$, $\angle BAC = \angle BCA = x$

   In $\triangle ABC$

   $x + x + 110^0 = 180^0$ ..(angle sum property of triangle)

   $\Rightarrow 2x = 180^0 - 110^0 = 70^0$

   $\Rightarrow x = 35^0$

   Now, $\angle B + \angle C = 180°$(Adjacent angles are supplementary)

   But, $\angle C = x + y = 70°$

   $\Rightarrow y = 70° - x$

   $\Rightarrow y = 70° - 35° = 35°$

   Hence, $x = 35°$and $y = 35°$

8. **(c)** 36°

   Explanation: Let x and $(90^O - x)$ be two complimentary angles

   According to question,

   $2x = 3\ (90^O - x)$

$2x = 270^o - 3x$

$x = 54^o$

The angles are:

54^o and $90^o - 54^o = 36^o$

Thus, smallest angle is 36^o

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

Explanation: $\left(x^4 + \frac{1}{x^4}\right) = 623$

$\Rightarrow \left(x^2\right)^2 + \left(\frac{1}{x^2}\right) + 2 \times x^2 \times \frac{1}{x^2} = 623 + 2 \times x^2 \times \frac{1}{x^2}$

$\Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 = 625$

$\Rightarrow x^2 + \frac{1}{x^2} = \sqrt{625} = 25$

Now ,

$\Rightarrow \left(x^2\right) + \left(\frac{1}{x^2}\right) + 2 \times x \times \frac{1}{x} = 25 + 2 \times x \times \frac{1}{x}$

$\Rightarrow \left(x + \frac{1}{x}\right)^2 = 27$

$\Rightarrow x + \frac{1}{x} = \sqrt{27} = 3\sqrt{3}$

10. **(c)** a point

Explanation: $x - 2 = 0$

$x = 2$ is a point on the number line

11. **(c)** Equilateral

Explanation: Angle bisector is perpendicular to the opposite side only in equilateral triangle.

12. **(b)** $AC^2 + BD^2 = 4AB^2$

Explanation: ABCD is a rhombus.

AB = BC = CD = DA

In Rhombus, diagonals bisect each other at right angles.

So, AO = CO and BO = DO

In triangle AOB , $AO^2 + BO^2 = AB^2$ (Pythagoras theorem)

$(1/2\ AC)^2 + (1/2\ BD)^2 = AB^2$

$AC^2/4 + BD^2/4 = AB^2$

$AC^2 + BD^2 = 4\ AB^2$

13. **(c)** $\frac{1}{3}$ of the circle

Explanation: Complete the cyclic quadrilateral PQRS, with S being a point on a point on the major arc. Then $\angle S = 60^0$ (Opposite angles of a cyclic quadrilateral)

Then $Major \angle POR = 120^0$

Thus fraction the minor arc $= \frac{120^0}{360^0} = \frac{1}{3}$

14. **(b)** $25\sqrt{5}$

Explanation: $4^x - 4^{x-1} = 24$

$\Rightarrow 4^x - \frac{4^x}{4^1} = 24$

$\Rightarrow 4^x\left(1 - \frac{1}{4}\right) = 24$

$\Rightarrow 4^x\left(\frac{3}{4}\right) = 24$

$\Rightarrow 4^x = \frac{24\times4}{3}$

$\Rightarrow 4^x = 32$

$\Rightarrow (2^2)^x = (2)^5$

$\Rightarrow 2^{2x} = 2^5$

Comparing, we get

$2x = 5 \Rightarrow x = \frac{5}{2}$

$\therefore (2x)^x \left(2 \times \frac{5}{2}\right)^{\frac{5}{2}} = (5)^{\frac{5}{2}}$

$= \sqrt{5^5} = \sqrt{5\times5\times5\times5\times5}$

$= 5\times5\sqrt{5} = 25\sqrt{5}$

15. **(d)** 7 cm

Explanation: $\angle Z = 90°$ (Angle of square)

Therefore, AZD is a right angle triangle,

By Pythagoras theorem,

$AD^2 = AZ^2 + ZD^2$

$AD^2 = 2^2 + (2+3)^2$

$AD^2 = 4 + 25$

$AD = \sqrt{29}$

In $\triangle AXB$, with X as right angle,

By Pythagoras theorem,

$AB^2 = AX^2 + XB^2$

$XB^2 = 29 - 4$

$XB = 5$

$BY = XB + XY$

$= 5 + 2$

$= 7cm$

16. **(b)** 21

Explanation: $x^4 + 2x^3 - 3x^2 + x - 1$

Using remainder theorem,

$= (2)^4 + 2(2)^3 - 3(2)^2 + 2 - 1$

$= 16 + 16 - 12 + 2 - 1$

$= 34 - 13$

$= 21$

17. **(b)** 9

Explanation: firstly, we will divide $x^2 + mx + 14$ by x+2

when we divide them remainder comes to be 18-2m........1

since x+2 is a factor of $x^2 + mx + 14$

therefore remainder should be zero......2

from 1 and 2

18 - 2m = o

2m = 18

m = 9

18. **(a)** 100π

Explanation: Volume of sphere = $(4/3)\pi r^3$

Given, solid sphere of radius 10 cm is moulded into 8 spherical solid balls of equal radius

$\Rightarrow (4/3)\pi \times 10^3 = 8 \times (4/3)\pi \times r^3$

$\Rightarrow r = 10/2 = 5$cm

Surface area of a sphere = $4\pi r^2$

Thus, the surface area of each sphere = $4 \times \pi \times 5^2 = 100\pi$

19. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: Both A and R are true and R is the correct explanation of A.

20. **(d)** A is false but R is true.

Explanation: $s = \frac{6+6+6}{2} = \frac{18}{2} = 9$ cm

Area = $\sqrt{9(9-6)(9-6)(9-6)}$

$= \sqrt{9 \times 3 \times 3 \times 3} = 9\sqrt{3}$ cm^2

Section B

21. Let: $p(x) = 2x^4 + 9x^3 + 6x^2 - 11x - 6$

Here, $x - 1 = 0 \Rightarrow x = 1$

By the factor theorem, (x - 1) is a factor of the given polynomial if g(1) = 0

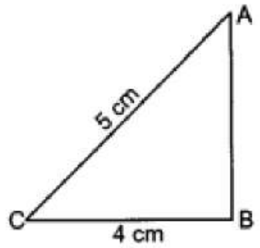
Therefore, we have: $g(1) = (2 \times 1^4 + 9 \times 1^3 + 6 \times 1^2 - 11 \times 1 - 6)$

$= (2 + 9 + 6 - 11 - 6) = 0$

Therefore, (x - 1) is a factor of the given polynomial.

22. Given: base of a right-angled triangle = 4 cm and hypotenuse = 5 cm.

In right-angled triangle ABC



$AB^2 + BC^2 = AC^2$ (By Pythagoras Theorem)

$\Rightarrow AB^2 + 4^2 = 5^2$

$\Rightarrow AB^2 = 25 - 16 = 9$

$\Rightarrow AB = 3$ cm

$\therefore$ Area of $\Delta ABC = \frac{1}{2} BC \times AB = \frac{1}{2} \times 4 \times 3 = 6\text{cm}^2$

Hence area of given right-angled triangle is 6 cm^2.

23. We have,

$a^3 - 2\sqrt{2}b^3 = (a)^3 - (\sqrt{2}b)^3$

$= (a - \sqrt{2}b)\{(a)^2 + (a)(\sqrt{2}b) + (\sqrt{2}b)^2\}$ $[\because a^3 - b^3 = (a - b)(a^2 + ab + b^2)]$

$= (a - \sqrt{2}b)(a^2 + \sqrt{2}ab + 2b^2)$

OR

Adding x^2y^2 and subtracting x^2y^2 to the given equation

$= x^4 + x^2y^2 + y^4 + x^2y^2 - x^2y^2$

$= x^4 + 2x^2y^2 + y^4 - x^2y^2$

$= (x^2)^2 + 2x^2y^2 + (y^2)^2 - (xy)^2$

Using the identity $(p + q)^2 = p^2 + q^2 + 2pq$

$= (x^2 + y^2)^2 - (xy)^2$

Using the identity $p^2 - q^2 = (p + q)(p - q)$

$= (x^2 + y^2 + xy)(x^2 + y^2 - xy)$

$\therefore x^4 + x^2y^2 + y^4 = (x^2 + y^2 + xy)(x^2 + y^2 - xy)$

This is the required factorisation.

24. We have Radius of sphere = 3.5 cm

Therefore Volume of the sphere = $\left(\frac{4}{3}\pi r^3\right)$

$= \left(\frac{4}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 3.5\right)\ cm^3$

$= 179.67\ cm^3$

Also Surface area of the sphere = $\left(4\pi r^2\right)$

$= \left(4 \times \frac{22}{7} \times 3.5 \times 3.5\right)\ cm^2$

$= 154\ cm^2$

25. 2x+3y=7

For x = 2, y = 1

L.H.S. = 2x + 3y

= 2(2) + 3(1)

= 4 + 3 = 7

= R.H.S.

$\therefore$ x = 2, y = 1 is a solution of 2x + 3y = 7

OR

2x + y = 7

$\Rightarrow$ y = 7 – 2x

Put x = 0, we get y = 7 – 2(0) = 7 – 0 = 7

Put x = 1, we get y = 7 – 2(1) = 7 – 2 = 5

Put x = 2, we get y = 7 – 2(2) = 7 – 4 = 3

Put x = 3, we get y = 7 – 2(3) = 7 – 6 = 1

$\therefore$ Four solutions are (0, 7), (1, 5), (2, 3) and (3, 1).

Section C

26. $64a^3 - 27b^3 - 144a^2b + 108ab^2$

The expression $64a^3 - 27b^3 - 144a^2b + 108ab^2$ can also be written as

$(4a)^3 - (3b)^3 - 3 \times 4a \times 4a \times 3b + 3 \times 4a \times 3b \times 3b$

$= (4a)^3 - (3b)^3 - 3 \times 4a \times 3b(4a - 3b)$.

Using identity $(x - y)^3 = x^3 - y^3 - 3xy(x - y)$ with respect to the expression

$(4a)^3 - (3b)^3 - 3 \times 4a \times 3b(4a - 3b)$, we get

$(4a - 3b)^3$

Therefore, after factorizing the expression

$64a^3 - 27b^3 - 144a^2b + 108ab^2 weget\ (4a - 3b)^3$

27. Let the Traffic signal board is ΔABC.

According to question, Semi-perimeter of ΔABC (s) $= \frac{a+a+a}{2} = \frac{3a}{2}$

Using Heron's Formula, Area of triangle ABC = $\sqrt{s(s-a)(s-b)(s-c)}$

$=\sqrt{\frac{3a}{2}\left(\frac{3a}{2}-a\right)\left(\frac{3a}{2}-a\right)\left(\frac{3a}{2}-a\right)}$

$=\sqrt{\frac{3a}{2}\times\frac{a}{2}\times\frac{a}{2}\times\frac{a}{2}}$

$=\sqrt{3\left(\frac{a}{2}\right)^4}$

$=\frac{\sqrt{3}a^2}{4}$

Now,If Perimeter of this triangle = 180 cm

$\Rightarrow$ Side of triangle (a) $=\frac{180}{3}=60$ cm

Using the above derived formula,

Area of triangle ABC

$=\frac{\sqrt{3}(60^2)}{4}$

$=15\times 60\sqrt{3}$

$=900\sqrt{3}\text{cm}^2$

OR

For the triangle having the sides 122 m, 120 m and 22 m:

$s=\frac{122+120+22}{2}=132$

Area of the triangle $=\sqrt{s(s-a)(s-b)(s-c)}$

$=\sqrt{132(132-122)(132-120)(132-22)}$

$=\sqrt{132\times 10\times 12\times 110}$

$= 1320\ \text{m}^2$

For the triangle having the side 22m, 24m and 26m:

$s=\frac{22+24+26}{2}=36$

Area of the triangle $=\sqrt{36(36-22)(36-24)(36-26)}$

$=\sqrt{36\times 14\times 12\times 10}$

$=24\sqrt{105}$

$= 24\times 10.25\ \text{m}^2$ (approx.)

$= 246\ \text{cm}^2$

Therefore, the area of the shaded portion.

= Area of larger triangle - Area of smaller (shaded) triangle.

$= (1320 - 246)\ \text{m}^2$

$= 1074\ \text{m}^2$

28. Draw a number line.

Take a point O which represents zero. Consider a point A so that OA = 2 units.

Construct a perpendicular at A and name it as AZ Draw a cut off are AB = 2 units

On the basis of Pythagoras Theorem,

$OB^2 = OA^2 + AB^2$

$= 2^2 + 2^2$

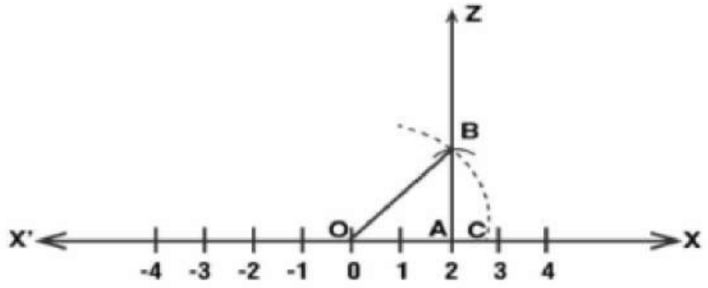
$= 4 + 4$

$= 8$

$OB = \sqrt{8}$

Consider O as the center and OB = $\sqrt{8}$ as the radius construct an arc which cuts the line at the point C. Thus, OB = OC = $\sqrt{8}$

$\sqrt{8}$ is represented by point C on the number line.



29. $2x - 3y + 7 = 0$

$\Rightarrow 3y = 2x + 7$

$\Rightarrow y = \frac{2x+7}{3}$

Put x = 0, then $y = \frac{2(0)+7}{3} = \frac{7}{3}$

Put x = 1, then $y = \frac{2(1)+7}{3} = 3$

Put x = 2, then $y = \frac{2(2)+7}{3} = \frac{11}{3}$

Put x = 3, then $y = \frac{2(3)+7}{3} = \frac{13}{3}$

$\therefore (0, \frac{7}{3}), (1, 3), (2, \frac{11}{3}), (3, \frac{13}{3})$ are the solutions of the equation $2x - 3y + 7 = 0$.

30. y = x

We have, y = x

Let x = 1 : y = 1

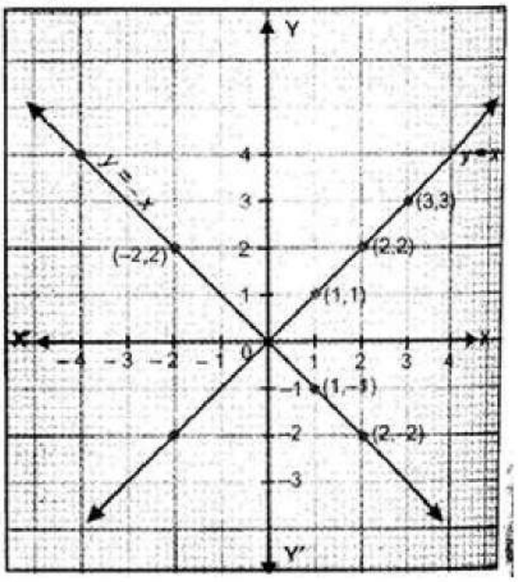
Let x = 2 : y = 2

Let x = 3 : y = 3

Thus, we have the following table :

x	1	2	3
y	1	2	3

By plotting the points (1, 1), (2, 2) and (3, 3) on the graph paper and joining them by a line, we obtain the graph of y = x.



y = -x

We have, y = -x

Let x = 1 : y = -1

Let x = 2 : y = -2

Let x = -2 : y = -(-2) = 2

Thus, we have the following table exhibiting the abscissa and ordinates of the points of the line represented by the equation y = -x.

x	1	2	-2
y	-1	-2	2

Now, plot the points (1, -1), (2, -2) and (-2, 2) and join them by a line to obtain the line represented by the equation y = -x.

The graphs of the lines y = x and y = -x are shown in figure.

Two lines intersect at O (0, 0).

31. Let $\angle ADC = Q$

$\Rightarrow \angle CAD = Q$ [$\because$ CA = CD]

Exterior$\Rightarrow \angle CAD = Q$ [$\because$CA = CD]

= 2Q

$\Rightarrow \angle BAC = 2Q$ [$\because$ BA = BC]

$\angle BAD = \angle BAC + \angle CAD$

Hence = 2Q + Q

$= 3Q = 3\angle ADC = 3\angle ADB$

OR

SOLUTION: Since AD bisects the exterior A,

$\angle EAD = \angle DAC$ ...(1)

$\angle 2 = \angle 3$ [OPPOSITE ANGLE OF EQUAL SIDE] ...(2)

$\angle EAC = \angle EAD + \angle DAC$ ...(3)

$\angle EAC = \angle 2 + \angle 3$ [EXTERIOR ANGLE THEOREM FOR A TRIANGLE] ...(4)

From equation (3) & (4)

$\angle EAD + \angle DAC = \angle 2 + \angle 3$

From equation (1) & (2)

$\angle DAC + \angle DAC = \angle 3 + \angle 3$

$2\angle DAC = 2\angle 3$

$\angle DAC = \angle 3$

alternate angle are equal so - AD || BC

Section D

32. i. Five line segments are: $\overline{PQ}, \overline{PN}, \overline{RS}, \overline{ND}, \overline{TL}$

ii. Five rays are: $\underset{QC}{\longrightarrow}, \underset{PM}{\longrightarrow}, \underset{RB}{\longrightarrow}, \underset{DF}{\longrightarrow}, \underset{LH}{\longrightarrow}$

iii. Four Collinear points are: A, P, R, B

iv. Two pairs of non-intersecting line segments are: PN, RS and PQ, TL

33. Given, $a = \frac{\sqrt{2}+1}{\sqrt{2}-1}$ and $b = \frac{\sqrt{2}-1}{\sqrt{2}+1}$

Here, $a = \frac{\sqrt{2}+1}{\sqrt{2}-1} = \frac{\sqrt{2}+1}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} = \frac{(\sqrt{2}+1)^2}{(\sqrt{2})^2-1^2}$

$= \frac{(\sqrt{2})^2+1+2\sqrt{2}}{2-1} = \frac{2+1+2\sqrt{2}}{1} = 3 + 2\sqrt{2}$

$\therefore \quad a = 3 + 2\sqrt{2}$ ...(i)

$b = \frac{\sqrt{2}-1}{\sqrt{2}+1} = \frac{\sqrt{2}-1}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1} = \frac{(\sqrt{2}-1)^2}{(\sqrt{2})^2-1}$

$= \frac{(\sqrt{2})^2+1^2-2\sqrt{2}}{2-1} = \frac{2+1-2\sqrt{2}}{1} = 3 - 2\sqrt{2}$

$\therefore \quad b = 3 - 2\sqrt{2}$ ...(ii)

From equation (i) and (ii)

$a + b = 3 + 2\sqrt{2} + 3 - 2\sqrt{2} = 6$

$ab = (3 + 2\sqrt{2})(3 - 2\sqrt{2}) = 3^2 - (2\sqrt{2})^2$

$= 9 - 4 \times 2 = 9 - 8 = 1$

$\therefore a^2 + b^2 - 4ab = a^2 + b^2 + 2ab - 6ab$

$= (a + b)^2 - 6ab$

$= 6^2 - 6$

$= 36 - 6 = 30$

OR

$\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$

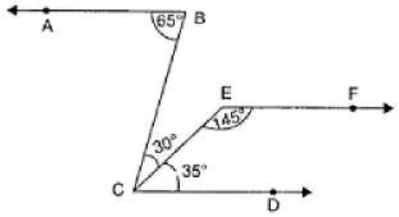
$= \frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} \times \frac{\sqrt{10}-\sqrt{3}}{\sqrt{10}-\sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} \times \frac{\sqrt{6}-\sqrt{5}}{\sqrt{6}-\sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}} \times \frac{\sqrt{15}-3\sqrt{2}}{\sqrt{15}-3\sqrt{2}}$

$= \frac{7\sqrt{3}(\sqrt{10}-\sqrt{3})}{10-3} - \frac{2\sqrt{5}(\sqrt{6}-\sqrt{5})}{6-5} - \frac{3\sqrt{2}(\sqrt{15}-3\sqrt{2})}{15-18}$

$= \sqrt{3}(\sqrt{10} - \sqrt{3}) - 2\sqrt{5}(\sqrt{6} - \sqrt{5}) + \sqrt{2}(\sqrt{15} - 3\sqrt{2})$

$= \sqrt{30} - 3 - 2\sqrt{30} + 10 + \sqrt{30} - 6$

$= 2\sqrt{30} - 9 - 2\sqrt{30} + 10 = 1$

34. 

$\angle ABC = 65^o$

$\angle BCD = \angle BCE + \angle ECD = 30^o + 35^o = 65^o$

$\therefore \angle ABC = \angle BCD$

These angles form a pair of equal alternate angles

$\therefore$ AB || CD . . . (1)

$\angle FEC + \angle ECD = 145^o + 35^o = 180^o$

These angles are consecutive interior angles formed on the same side of the transversal.

$\therefore$ CD || EF . . . . (2)

AB || EF . . . [From (1) and (2)]

OR

Through O draw OE || AB || CD

Then, $\angle AOE + \angle COE = x^\circ$

Now, AB || OE and AO is the transversal

$\therefore \angle OAB + \angle AOE = 180^\circ$

$\Rightarrow 104^\circ + \angle AOE = 180^\circ$

$\Rightarrow \angle AOE = (180 - 104)^\circ = 76^\circ$ .....(1)

Again, CD || OE and OC is the transversal

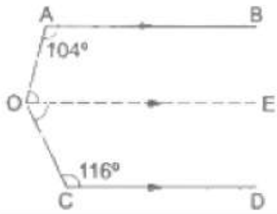
$\therefore \angle COE + \angle OCD = 180^\circ$

$\Rightarrow \angle COE + 116^\circ = 180^\circ$

$\Rightarrow \angle COE = (180^\circ - 116^\circ) = 64^\circ$ ....(2)

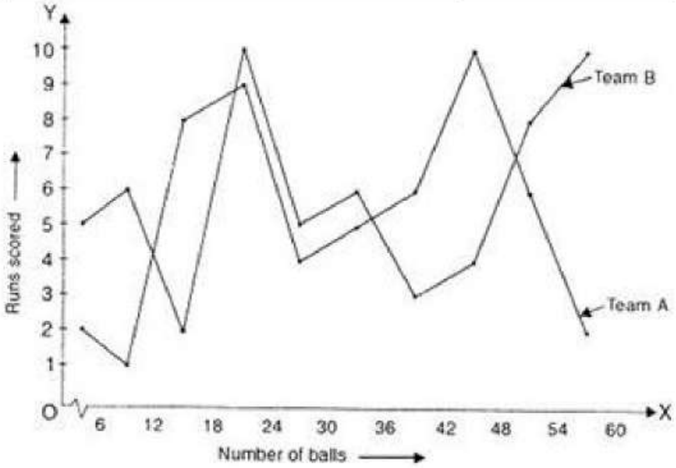
$\therefore \angle AOC = \angle AOE + \angle COE = (76^o + 64^o) = 140^o$ [from (1) and (2)]

Hence, $x^\circ = 140^\circ$



35.

Number of balls	Class-Marks	Team A	Team B
0.5-6.5	3.5	2	5
6.5-12.5	9.5	1	6
12.5-18.5	15.5	8	2
18.5-24.5	21.5	9	10
24.5-30.5	27.5	4	5
30.5-36.5	33.5	5	6
36.5-42.5	39.5	6	3
42.5-48.5	45.5	10	4
48.5-54.5	51.5	6	8
54.5-60.5	57.5	2	10



Section E

36. **Read the text carefully and answer the questions:**

In the Meharali, New DTC bus stop was constructed. The bus stop is barricaded from the remaining part of the road, by using 50 hollow cones. Each hollow cone is made of recycled cardboard.

Each cone has a base diameter of 40 cm and a height of 1 m.

(i) Diameter of cone = 40 cm

$\Rightarrow$ Radius of cone (r) = $\frac{40}{2}$

= 20 cm

$= \frac{20}{100}$ m

= 0.2 m

Height of cone (h) = 1 m

Slant height of cone (l) = $\sqrt{r^2 + h^2}$

$= \sqrt{(0.2)^2 + (1)^2}$

$= \sqrt{1.04}$ m

Curved surface area of cone = $\pi r l$

$= 3.14 \times 0.2 \times \sqrt{1.04}$

= 0.64056 m^2

(ii) Radius of base of cone = 20 cm = 0.2 m

Height of cone = 1 m

Volume of each cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 0.2 \times 0.2 \times 1$

= 0.042 m^3

OR

Cost of 1 m^2 cardboard = ₹100

Curved surface area of 50 cones = 0.640 × 50 = 32 m^2

Cost of card board of these 50 cones = 50 × 32 = ₹1600

(iii) ∴ Cost of painting 1m^2 of a cone = ₹12

∴ Cost of painting 0.64056 m^2 of a cone = 12 × 0.64056 = ₹7.68672

∴ Cost of painting of 50 such cones = 50 × 7.68672 = ₹384.336

37. **Read the text carefully and answer the questions:**

While dusting a maid found a button whose upper face is of red color, as shown in the figure. The diameter of each of the smaller identical circles is $\frac{1}{4}$ of the diameter of the larger circle whose radius is 16 cm.

(i) Let r and R be the radii of each smaller circle and larger circle respectively.

d and D are diameter of each smaller circle and larger circle respectively.

We have, d = $\frac{1}{4}$D

$\Rightarrow r = \frac{1}{4}R \Rightarrow r = \frac{1}{4} \times 16 \Rightarrow r = 4$ cm

Area of smaller circle = πr^2

$= \frac{22}{7} \times 4 \times 4 = 50.28$ cm^2

(ii) Let r and R be the radii of each smaller circle and larger circle respectively.

We have, d = $\frac{1}{4}$D

$\Rightarrow r = \frac{1}{4}R \Rightarrow r = \frac{1}{4} \times 16 \Rightarrow r = 4$ cm

Area of larger circle = πR^2

$= \frac{22}{7} \times 16 \times 16 = \frac{5632}{7} = 804.57 \text{ cm}^2$

(iii) Let r and R be the radii of each smaller circle and larger circle respectively.

We have, $d = \frac{1}{4}D$

$\Rightarrow r = \frac{1}{4}R \Rightarrow r = \frac{1}{4} \times 16 \Rightarrow r = 4$ cm

Area of the black colour region = Area of larger circle - Area of 4 smaller circles

$= 804.57 - 4 \times 50.28 = 603.45 \text{ cm}^2$

OR

Let r and R be the radii of each smaller circle and larger circle respectively.

We have, $d = \frac{1}{4}D$

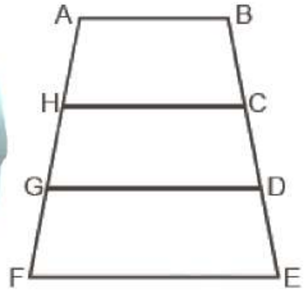
$\Rightarrow r = \frac{1}{4}R \Rightarrow r = \frac{1}{4} \times 16 \Rightarrow r = 4$ cm

Area of quadrant of a smaller circle

$= \frac{1}{4} \times 50.28 = 12.57 \text{ cm}^2$

38. **Read the text carefully and answer the questions:**

Sohan wants to show gratitude towards his teacher by giving her a card made by him. He has three pieces of trapezium pasted one above the other as shown in fig. These pieces are arranged in a way that AB || HC || GD || FE. Also AH = HG = GF and DE = 4 cm. He wants to decorate the card by putting up colored tape on the nonparallel sides of the trapezium.



(i) Trapezium has 1 pair of parallel sides, and parallelogram has 2 pairs of parallel sides.

(ii) In Δ ADC, EG || AB and E is mid-point of AD.

Property: The line drawn through the mid-point of one side of a triangle, parallel to another side bisects the third side ...(1)

G is mid-point of BD.

Now EG || AB ||CD

$\Rightarrow$ CD || EG

$\Rightarrow$ CD || GF

In Δ BDC,CD || GF

Again, by property (1)

F is the mid-point of BC

Hence BF = FC

OR

AB || HC

In trapezium ABHC

$\angle A = \angle B = 45^o$

$\angle A + \angle = 180^o$ (Sum of interior angles)

$\angle H = 180^o - 45^o = 135^o$

Similary, $\angle B + \angle C = 180^o$ (Sum of interior angles)

$\angle C = 180^o - 45^o = 135^o$

(iii)We know the property: If given three parallel lines making equal intercepts on any transversal, then they will make equal intercept on the other transversal also.

$AB \parallel HC \parallel GD \parallel FE$

$\Rightarrow BC = CD = DE$

$\Rightarrow AF + BE = AH + HG + GF + BC + CD + DE = 6 + 6 + 6 + 4 + 4 + 4 = 30$ cm

Hence tape required to decorate nonparallel sides = 30 cm