Class: IX
SESSION : 2022-2023
SUBJECT: Mathematics
SAMPLE QUESTION PAPER - 3
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. x = 2, y = 5 is a solution of the linear equation **[1]**

a) 5 x + y = 7 b) x + y = 7

c) 5x +2y = 7 d) x + 2y = 7

2. The simplest rationalising factor of $2\sqrt{5}-\sqrt{3}$,is **[1]**

a) $\sqrt{5}+\sqrt{3}$ b) $2\sqrt{5}+3$

c) $\sqrt{5}-\sqrt{3}$ d) $2\sqrt{5}+\sqrt{3}$

3. The name of the horizontal line drawn to determine the position of any point in the Cartesian plane is **[1]**

a) None of these b) Cartesian line

c) x-axis d) y-axis

4. The line represented by the equation x + y = 16 passes through (2, 14). How many more lines pass through the point (2, 14) **[1]**

a) 10 b) 2

c) many d) 100

5. In a bar graph if 1 cm represents 30 km, then the length of bar needed to represent 75 km is **[1]**

a) 3.5 cm b) 2.5 cm

c) 2 cm

d) 3 cm

6. John is of the same age as Mohan. Ram is also of the same age as Mohan. State the Euclid's axiom that illustrates the relative ages of John and Ram. **[1]**

a) Second Axiom

b) Fourth Axiom

c) First Axiom

d) Third Axiom

7. If one angle of a triangle is equal to the sum of the other two angles, then the triangle is **[1]**

a) an isosceles triangle

b) an equilateral triangle

c) a right triangle

d) an obtuse angled triangle

8. In a Quadrilateral ABCD, $\angle A = \angle C$, $\angle B = 2\angle A$, $\angle D = \frac{1}{2}\angle A$, Then $\angle A$, $\angle B$, $\angle C$ and $\angle D$ respectively are: **[1]**

a) 20^o, 30^o, 160^o and 160^o

b) 100^o, 100^o, 80^o and 80^o

c) 90^o, 90^o, 90^o and 90^o

d) 80^o, 160^o, 80^o and 40^o

9. The graph of the linear equation 2x + 3y = 6 is a line which meets the x-axis at the point **[1]**

a) (0,3)

b) (3,0)

c) (2, 0)

d) (0 ,2)

10. If $x^3 - \frac{1}{x^3} = 14$, then $x - \frac{1}{x} =$ **[1]**

a) 2

b) 3

c) 4

d) 5

11. $\triangle ABC \cong \triangle PQR$, then which of the following is true? **[1]**

a) CA = RP

b) CB = QP

c) AB = RP

d) AC = RQ

12. E Divides AB in the ratio 1 : 3 and also, F divides AC in the ratio 1 : 3. EF = 2.8 cm, Find BC **[1]**

a) 11.2 cm

b) 11 cm

c) 11.5 cm

d) 12 cm

13. Decimal representation of a rational number cannot be **[1]**

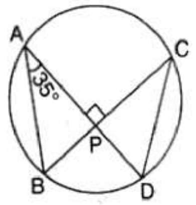
a) non-terminating non-repeating

b) non-terminating

c) non-terminating repeating

d) terminating

14. In a given figure, chords AD and BC intersect each other at right angles at point P. If $\angle DAB = 35^o,$ then $\angle ADC =$ **[1]**



a) 35^o

b) 45^o

c) 65^o

d) 55^o

15. 8 is a polynomial of degree **[1]**

a) 1

b) none of these

c) 0

d) 8

16. In △ABC, BC = AB and ∠B = 80°. Then ∠A is equal to **[1]**

a) 50°

b) 40°

c) 80°

d) 100°

17. The zeros of the polynomial p(x) = x^2 + x - 6 are **[1]**

a) -2, 3

b) -2, -3

c) 2, -3

d) 2, 3

18. **Assertion (A):** The sides of a triangle are in the ratio of 25 : 14 : 12 and its perimeter is 510 cm. Then the area of the triangle is 4449.08 cm^2. **[1]**
Reason (R): Perimeter of a triangle = a + b + c, where a, b, c are sides of a triangle.

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) R is not the correct explanation of A.

d) A is false but R is true.

19. A cube of side 4 cm contains a sphere touching its sides. Find the approximate volume of the gap in between. **[1]**

a) 33.52 cm^3

b) 30.48 cm^3

c) 34 cm^3

d) 33 cm^3

20. **Assertion (A):** The equation of 2x + 5 = 0 and 3x + y = 5 both have degree 1. **[1]**
Reason (R): The degree of a linear equation in two variables is 2.

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 the area of an equilateral triangle is $81\sqrt{3}\text{cm}^2$, find its height. **[2]**

22. How many lead balls, each of radius 1 cm, can be made from a sphere of radius 8 cm? **[2]**

23. Find the remainder when f(x) is divided by g(x) : $f(x) = 3x^4 + 2x^3 - \frac{x^3}{3} - \frac{x}{9} + \frac{2}{27}$, $g(x) = x + \frac{2}{3}$ **[2]**

24. Find whether the given equation have x = 2, y = 1 as a solution: **[2]**

$2x - 3y + 7 = 8$

OR

Find whether the given equation have x = 2, y = 1 as a solution:

$2x - 3y = 1$

25. Examine whether x + 2 is a factor of $x^3 + 3x^2 + 5x + 6$ and of 2x + 4. **[2]**

OR

In the class test of mathematics, a teacher asked his students to write different kinds of polynomials. 6 students wrote the following polynomials. Identify the type of polynomials written by these students:

i. $f(p) = 3 - p^2 + \sqrt{7}p$

ii. $p(v) = \sqrt{3}v^4 - \frac{2}{3}v + 7$

iii. $q(x) = \frac{\sqrt{2}}{5}x^3 + 1$

iv. $p(z) = \sqrt{5}z + 2\sqrt{2}$

v. $r(t) = \frac{-t+3t^2-4t^3}{t}$

Section C

26. Factorize: $8x^3 - 125y^3 + 180xy + 216$ **[3]**

27. Simplify the following by rationalizing the denominator: $\frac{4+\sqrt{5}}{4-\sqrt{5}} + \frac{4-\sqrt{5}}{4+\sqrt{5}}$ **[3]**

28. A traffic signal board indicating 'school ahead' is an equilateral triangle with side 'a' find the area of the signal board using heron's formula. Its perimeter is 180 cm, what will be Its area? **[3]**

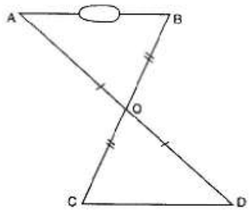
OR

From a point in the interior of an equilateral triangle, perpendiculars are drawn on the three sides. The lengths of the perpendiculars are 14 cm, 10 cm and 6 cm. Find the area of the triangle.

29. In $\triangle ABC$, it is given that $\angle A = 70^{o}$, $\angle B = 52^{o}$, BO and CO are the bisectors of $\angle B$ and $\angle C$ respectively. Find $\angle OCB$ and $\angle BOC$. **[3]**

OR

Swati wishes to determine the distance between two objects A and B but there is an obstacle between these two objects which prevents her from making a direct measurement. She devises an ingenious way to overcome this difficulty. First she fixes a pole at a convenient point O so that both A and B are visible. Then she fixes another pole at a point D on the line AO (produced) such that AO = DO. In a similar way, she fixes a third pole at a point C on the line BO (produced) such that BO = CO. Then she measures CD and finds that CD = 540 cm. Prove that the distance between objects A and B is also 540 cm.



30. Find at least 3 solutions for the following linear equation in two variables: $x + y - 4 = 0$ **[3]**

31. Write the answer of each of the following questions: **[3]**

i. What is the name of horizontal and the vertical lines drawn to determine the position of any point in the Cartesian plane?

ii. What is the name of each part of the plane formed by these two lines?

iii. Write the name of the point where these two lines intersect.

Section D

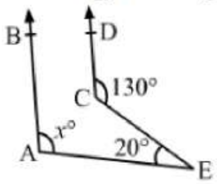
32. Read the following statements which are taken as axioms: **[5]**

i. If a transversal intersects two parallel lines, then corresponding angles are not necessarily equal.

ii. If a transversal intersect two parallel lines, then alternate interior angles are equal.

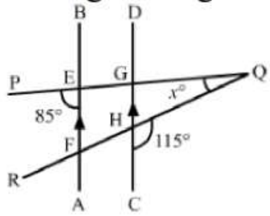
Is this system of axioms consistent? Justify your answer.

33. In the given figure, AB || CD. Find the value of x° **[5]**



OR

In the given figure below, AB || CD. Find the value of x°



34. Given below is a table which shows the yearwise strength of a school. Represent this data by a bar graph. **[5]**

Year	2012-13	2013-14	2014-15	2015-16	2016-17
No. of students	800	975	1100	1400	1625

35. Visualise 2.665 on the number line, using successive magnification. **[5]**

OR

If $p = \frac{3-\sqrt{5}}{3+\sqrt{5}}$ and $q = \frac{3+\sqrt{5}}{3-\sqrt{5}}$, find the value of $p^2 + q^2$.

Section E

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

Once four friends Rahul, Arun, Ajay and Vijay went for a picnic at a hill station. Due to peak season, they did not get a proper hotel in the city. The weather was fine so they decided to make a conical tent at a park. They were carrying 300 m² cloth with them. As shown in the figure they made the tent with height 10 m and diameter 14 m. The remaining cloth was used for the floor.

(i) How much Cloth was used for the floor?

(ii) What was the volume of the tent?

OR

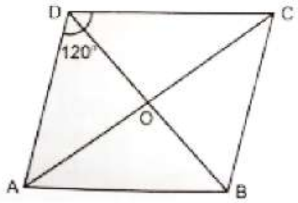
What was the total surface area of the tent?

(iii) What was the area of the floor?

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

Tarun and Samay are two friends live in small town. The area near their houses and school is in the shape of Rhombus. Usually, they go to school by Bicycle.

ABCD is an area in the shape of rhombus in which $\angle ADC = 120^{o}$. Samay and Tarun lived at D and C and their school located at O.



(i) Find the measure of $\angle DCB$.

(ii) Calculate measure of $\angle CDO$ and $\angle DCO$.

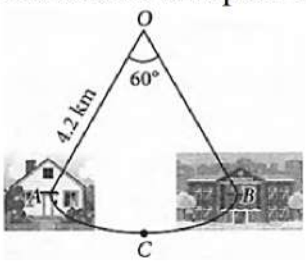
OR

Find the measure of $\angle BAC$.

(iii) Who can reach school early?

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

Govind has his home located at A and his college located at B. Govind drives his motorbike three days in a week and rides his bicycle in the remaining 3 days, to go to his college and back to home. AOB is a sector of a circle with centre O, central angle 60° and radius 4.2 km. Path AOB is the route for driving by motorbike and path ACB is for bicycle only.



(i) Find the total distance travelled by Govind through the motorbike in a week to go to college.

(ii) Find the total distance travelled by Govind through the bicycle in a week to go to college.

(iii) Find the area of sector AOB.

OR

If the cost of fuel for the motorbike is ₹20 per km, then find the total cost of fuel used in a week in going to college.

SOLUTION

Section A

1. **(b)** x + y = 7
   Explanation: x = 2 and y = 5 satisfy the given equation.
2. **(d)** $2\sqrt{5}+\sqrt{3}$
   Explanation: $2\sqrt{5}-\sqrt{3}$
   $= (2\sqrt{5}-\sqrt{3})(2\sqrt{5}+\sqrt{3})$
   $= (2\sqrt{5})^2-(\sqrt{3})^2$
   = 20 - 3
   = 17
   17 is rational number
   $\because$ rationalizing factor of $2\sqrt{5}-\sqrt{3}$ is $2\sqrt{5}+\sqrt{3}$
3. **(c)** x-axis
   Explanation: In co-ordinate, we have two axis, one is a horizontal line called x-axis and the other is vertical line called y-axis.
   Used to determine the position of any point in Cartesian plane.
4. **(c)** many
   Explanation: There are many lines pass through the point (2, 14).
   For example
   x - y = -12
   2x + y = 18
   and many more.
5. **(b)** 2.5 cm
   Explanation: 1 cm = 30 km
   So for 75 km
   $\frac{75}{30}$ = 2.5 cm
6. **(c)** First Axiom
   Explanation: Given that
   John's age = Mohan's age &
   Ram's age = Mohan's age.
   So, by the first axiom of Euclid,
   John's age = Ram's age.
   Euclid's first axiom states that things, which are equal to the same thing, are equal to one another.
7. **(c)** a right triangle
   Explanation: The sum of the angles of triangle is 180^o.
   let the angles of triangle be a, b, c
   We have given that one angle of a triangle is equal to the sum of the other two angles so we have
   c = a + b
   a + b + c = 180^o
   Substitute c for a + b
   c + c = 180^o
   2c = 180^o

$c = 90^o$

Therefore the triangle is a right triangle.

8. **(d)** 80^O, 160^O, 80^O and 40^O

   Explanation: $\angle A + \angle B + \angle C + \angle D = 360^O$ (angle sum property)

   $\angle A + 2\angle A + \angle A + \frac{1}{2}$ of $\angle A = 360^O$

   $\frac{9}{2}$ of $\angle A = 360^O$

   $\angle A = 80^O$

   So, $\angle B = 2(80^O) = 160^O$, $\angle C = 80^\circ$ and $\angle D = \frac{1}{2}$ of $80^O = 40^O$

9. **(b)** (3,0)

   Explanation: $2x + 3y = 6$ meets the X-axis.

   Put $y = 0$,

   $2x + 3(0) = 6$

   $x = 3$

   Therefore, graph of the given line meets X-axis at (3, 0).

10. **(a)** 2

    Explanation: Given : $x^3 - \left(\frac{1}{x^3}\right) = 14$

    Let x = a and $\frac{1}{x} = b$

    Say, $x - \frac{1}{x} = A$

    Then, $a^3 - b^3 = 14$

    $\Rightarrow (a - b)(a^2 + ab + b^2) = 14$

    $\Rightarrow (a - b)(\{(a - b)^2 + 2ab\} + 2ab) = 14$

    $\Rightarrow (a - b)\{(a-b)^2 + 3ab\} = 14$

    $\Rightarrow (a - b)\{(a - b)^2 + 3\} = 14$

    $\Rightarrow A(A^2 + 3) = 14$

    $\Rightarrow A(A^2 + 3) = 14$

    $\Rightarrow A^3 + 3A - 14 = 0$

    $\Rightarrow A^3 - 2A^2 + 2A^2 - 4A + 7A - 14 = 0$

    $\Rightarrow A^2(A - 2) + 2Y(Y - 2) + 7(Y - 2) = 0$

    $\Rightarrow (A-2)(A^2 + 2A + 7) = 0$

    $\Rightarrow A - 2 = 0, \quad \Rightarrow A = 2$

    $\Rightarrow x - \frac{1}{x} = 2$

11. **(a)** CA = RP

    Explanation: Corresponding sides are equal for two congruent triangles.

12. **(a)** 11.2 cm

    Explanation: Let AE = x and EB = 3x, AF = y and FC = 3y.

    EF = 2.8 cm

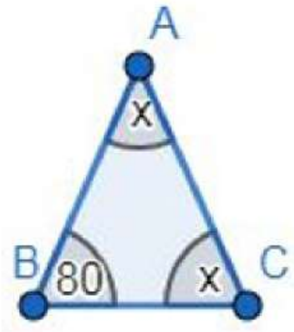
    AE + AF = 2.8 implies x + y = 2.8

    BC = CF + FA + AE + EB

    = 3y + y + x + 3x

    = 4 (x + y) = 4 (2.8) = 11.2 cm

13. **(a)** non-terminating non-repeating
Explanation: Decimal representation of a rational number cannot be non-terminating non-repeating. It is always be terminating or non terminating repeating.
14. **(d)** 55^{0}
Explanation: From triangle APB, $\angle ABP = 180^0 - 90^0 - 35^0 = 55^0$
Thus, $\angle ADC = 55^0$ $(\angle ABC = \angle ADC)$
15. **(c)** 0
Explanation: Since 8 is a constant term.
Therefore its degree is 0.
16. **(a)** 50°
Explanation:
Given: $\triangle$ABC, BC = AB and $\angle$B = 80^{0}



As BC = AB
So it is an isosceles triangle.
let $\angle C = \angle A = x$
$\angle B = 80°$ (given)
As we know $\angle A + \angle B + \angle C = 180°$
$\Rightarrow x + 80° + x = 180°$
$\Rightarrow 2x = 180° - 80°$
$\Rightarrow 2x = 100°$
$\Rightarrow x = 50°$
So, $\angle C = \angle A = 50°$
17. **(c)** 2, -3
Explanation: The given polynomial is $p(x) = x^2 + x - 6$
Putting x = 2 in p(x), we get
$p(2) = 2^2 + 2 - 6 = 4 + 2 - 6 = 0$
Therefore, x = 2 is a zero of the polynomial p(x).
Putting x = -3 in p(x), we get
$p(-3) = (-3)^2 - 3 - 6 = 9 - 9 = 0$
Therefore, x = -3 is a zero of the polynomial p(x)
Thus, 2 and -3 are the zeroes of the given polynomial p(x).
18. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: 510 = a + b + c
510 = 25x + 14x + 12x
510 = 51x
x = 10
Three side of the triangle are
$25x = 25 \times 10 = 250$ cm

$14x = 14 \times 10 = 140$ cm and
$12x = 12 \times 10 = 120$ cm
$s = \frac{250+140+120}{2} = 255$ cm
Area = $\sqrt{255 \times 5 \times 115 \times 135}$
= 4449.08 cm^2

19. **(b)** 30.48 cm^3
Explanation: Gap between the two = volume of cube - volume of sphere
= $edge^3 - \frac{4}{3}\pi r^3$
= $4^3 - \frac{4}{3} \times \frac{22}{7} \times 2^3$ (sphere touches cube, so diameter of sphere would be 4)
= 64 - 33.52
= 30.48 cm^3

20. **(c)** A is true but R is false.
Explanation: Every linear equation has degree 1.
2x + 5 = 0 and 3x + y = 5 are linear equations. So, both have degree 1.

Section B

21. Area of an equilateral triangle $= \frac{\sqrt{3}}{4} \times (\text{ Side })^2$
$\Rightarrow \frac{\sqrt{3}}{4} \times (\text{ Side })^2 = 81\sqrt{3}$
$\Rightarrow (\text{Side})^2 = 324$
$\Rightarrow$ Side = 18 cm
Now, we have
For an equilateral triangle, hight $= \frac{\sqrt{3}}{2} \times$ Side
$= \frac{\sqrt{3}}{2} \times 18$
$= 9\sqrt{3}$cm

22. Given that,
Radius of the sphere = 8 cm
Volume of the sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 8^3 = 2145.52$ cm^3
Radius of one lead ball = 1 cm
Volume of one lead ball = $\frac{4}{3} \times \frac{22}{7} \times 1^3 = 4.19$ cm^3
Therefore, Number of lead balls = $\frac{\textit{volume of the sphere}}{\textit{volume of one lead ball}} = \frac{2145.52}{4.19} = 512.05 \approx 512$

23. The given polynomials are,
$f(x) = 3x^4 + 2x^3 - \frac{x^3}{3} - \frac{x}{9} + \frac{2}{27}$
$g(x) = x + \frac{2}{3}$
from remainder theorem when f(x) is divided by $g(x) = x - (-\frac{2}{3})$, the remainder is equal to $f(-\frac{2}{3})$
substitute the value of x in f(x),we have,
$f\left(-\frac{2}{3}\right) = 3\left(-\frac{2}{3}\right)^4 + 2\left(-\frac{2}{3}\right)^3 - \frac{\left(-\frac{2}{3}\right)^3}{3} - \frac{\left(-\frac{2}{3}\right)}{9}$
$= 3\left(\frac{16}{81}\right) + 2\left(\frac{-8}{27}\right) - \frac{4}{(9\times3)} - \left(\frac{-2}{(9\times3)}\right) + \frac{2}{27}$
$= \left(\frac{16}{27}\right) - \left(\frac{16}{27}\right) - \frac{4}{27} + \left(\frac{2}{27}\right) + \frac{2}{27}$
$= \left(\frac{4}{27}\right) - \left(\frac{4}{27}\right)$

$= 0$

Therefore, the remainder is 0.

24. $2x - 3y + 7 = 8$

For $x = 2$, $y = 1$

L.H.S. $= 2x - 3y + 7$

$= 2(2) - 3(1) + 7$

$= 4 - 3 + 7 = 8$

= R.H.S.

$\therefore$ $x = 2$, $y = 1$ is a solution of $2x - 3y + 7 = 8$

OR

For $x = 2$, $y = 1$

L.H.S. $= 2x - 3y$

$= 2(2) - 3(1)$

$= 4 - 3 = 1$

= R.H.S.

$\therefore$ $x = 2$, $y = 1$ is a solution of $2x - 3y = 1$.

25. The zero of $x + 2$ is -2.

Let $p(x) = x^3 + 3x^2 + 5x + 6$ and $s(x) = 2x + 4$

Then, $p(-2) = (-2)^3 + 3(-2)^2 + 5(-2) + 6$

$= -8 + 12 - 10 + 6$

$= 0$

So, by the Factor Theorem, $x + 2$ is a factor of $x^3 + 3x^2 + 5x + 6$.

Again, $s(-2) = 2(-2) + 4 = 0$

So, $x + 2$ is a factor of $2x + 4$.

OR

i. Quadratic polynomial
ii. Biquadratic polynomial
iii. Cubic polynomial
iv. Linear polynomial
v. Quadratic polynomial

Section C

26. $8x^3 - 125y^3 + 180xy + 216$

or $8x^3 - 125y^3 + 216 + 180xy$

$= (2x)^3 + (-5y)^3 + 6^3 - 3 \times (2x)(-5y)(6)$

$= (2x + (-5y) + 6)\ ((2x)^2 + (-5y)^2 + 6^2 - 2x(-5y) - (-5y)6 - 6(2x))$

$= (2x - 5y + 6)\ (4x^2 + 25y^2 + 36 + 10xy + 30y - 12)$

$\therefore 8x^3 - 125y^3 + 180xy = 216$

$= (2x - 5y + 6)\ (4x^2 + 25y^2 + 36 + 10xy + 30y - 12)$

27. $\frac{4+\sqrt{5}}{4-\sqrt{5}} + \frac{4-\sqrt{5}}{4+\sqrt{5}}$

$= \frac{(4+\sqrt{5})(4+\sqrt{5})+(4-\sqrt{5})(4-\sqrt{5})}{(4-\sqrt{5})(4+\sqrt{5})}$

$= \frac{(4+\sqrt{5})^2+(4-\sqrt{5})^2}{(4-\sqrt{5})(4+\sqrt{5})}$

$= \frac{\left\{(4)^2+2(4)(\sqrt{5})+(\sqrt{5})^2\right\}+\left\{(4)^2-2(4)(\sqrt{5})+(\sqrt{5})^2\right\}}{(4)^2-(\sqrt{5})^2}$

$= \frac{(16+8\sqrt{5}+5)+(16-8\sqrt{5}+5)}{16-5} = \frac{42}{11}$

28. $S = \frac{a+a+a}{2}$ units $= \frac{3a}{2} units$

$\therefore$Area of triangle = $\sqrt{\frac{3a}{2} \times (\frac{3a}{2} - a)(\frac{3a}{2} - a)(\frac{3a}{2} - a)}$

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

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

Now, perimeter = 180 cm

$\therefore$ each side $= \frac{180}{3} = 60cm$

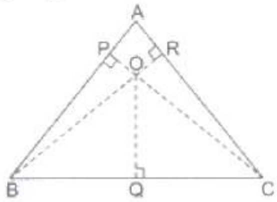
Using above derived formula

$\therefore$ Area of signal board = $\frac{\sqrt{3}}{4}\ (60)^2$ sq cm

$= 900\ \sqrt{3}$ sq cm

OR

Let ABC be an equilateral triangle, O be the interior point and OQ, OR and OC are the perpendicular drawn from points O. Let the sides of an equilateral triangle be a m.



Area of $\Delta AOB = \frac{1}{2} \times AB \times OP$

[$\because$ Area of a triangle $= \frac{1}{2} \times (base \times height)$]

$= \frac{1}{2} \times a \times 14 = 7a\,cm^2$ ...(1)

Area of $\Delta OBC = \frac{1}{2} \times BC \times OQ = \frac{1}{2} \times a \times 10$

= 5a cm^2 ...(2)

Area of $\Delta OAC = \frac{1}{2} \times AC \times OR = \frac{1}{2} \times a \times 6$

= 3a cm^2...(3)

$\therefore$ Area of an equilateral ΔABC

= Area of $(\Delta OAB + \Delta OBC + \Delta OAC)$

= (7a + 5a + 3a) cm^2

= 15a cm^2...(4)

We have, semi-perimeter $s = \frac{a+a+a}{2}$

$\Rightarrow\ s = \frac{3a}{2}cm$

$\therefore$ Area of an equilateral $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ [By Heron's formula]

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

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

$= \frac{\sqrt{3}}{4}a^2$ ...(5)

From equations (4) and (5), we get

$\frac{\sqrt{3}}{4}a^2 = 15a$

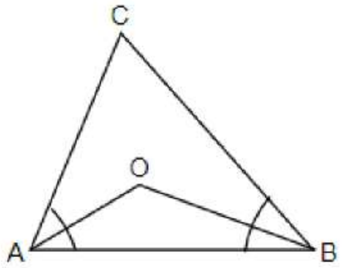
$\Rightarrow a = \frac{15 \times 4}{\sqrt{3}} = \frac{60}{\sqrt{3}}$

$\Rightarrow a = \frac{60}{\sqrt{3}} = \frac{\sqrt{3}}{\sqrt{3}} = 20\sqrt{3} cm$

On putting $a = 20\sqrt{3}$ in equation (5), we get

Area of $\Delta ABC = \frac{\sqrt{3}}{4}(20\sqrt{3})^2 = \frac{\sqrt{3}}{4} \times 400 \times 3 = 300\sqrt{3} cm^2$

Hence, the area of an equilateral triangle is $300\sqrt{3} cm^2$.

29. 

We know that the sum of the angles of a triangle is 180^{o}.

$\therefore \angle A + \angle B + \angle C = 180^\circ$

$\Rightarrow 70^\circ + 52^\circ + \angle C = 180^\circ$

$\Rightarrow \angle C = (180^\circ - 122^\circ) = 58^\circ$

$\therefore \angle OCB = \frac{1}{2}\angle C = \left(\frac{1}{2} \times 58^\circ\right) = 29^\circ$

and $\angle OBC = \frac{1}{2}\angle B = \left(\frac{1}{2} \times 52^\circ\right) = 26^\circ$

In $\triangle BOC$, we have

$\angle OBC + \angle OCB + \angle BOC = 180^\circ$

$\Rightarrow 26^{o} + 29^{o} + \angle BOC = 180^{o}$

$\Rightarrow \angle BOC = (180^\circ - 55^\circ) = 125^\circ$

Hence, $\angle OCB = 29^\circ$ and $\angle BOC = 125^\circ$

OR

In DOAB and DODC

OA = OD ...[Given]

OB = OC ...[Given]

$\angle$AOB = $\angle$DOC ...[Vertically opposite angles]

$\therefore$ DOAB $\cong$ DODC ...[By SAS property]

$\therefore$ AB = DC ...[c.p.c.t.]

But DC = 540 cm ...[Given]

$\therefore$ AB = 540 cm.

30. x + y – 4 = 0

$\Rightarrow$ y = 4 – x

Put x = 0, then y = 4 – 0 = 4

Put x = 1, then y = 4 – 1 = 3

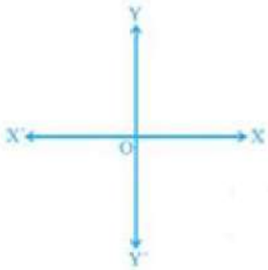
Put x = 2, then y = 4 – 2 = 2

Put x = 3, then y = 4 – 3 = 1

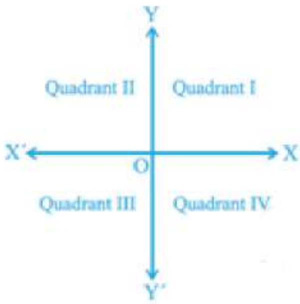
$\therefore$ (0, 4), (1, 3), (2, 2) and (3, 1) are the solutions of the equation x + y – 4 = 0

31. i. The horizontal line that is drawn to determine the position of any point in the Cartesian plane is called as x-axis. The vertical line that is drawn to determine the

position of any point in the Cartesian plane is called as y-axis



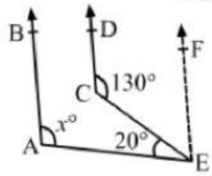
ii. The name of each part of the plane that is formed by x-axis and y-axis is called as quadrant.



iii. The point, where the x-axis and the y-axis intersect is called as origin.

Section D

32. i. A system of axiom is called consistent if there is no statement which can be deduced from these axioms such that it contradicts any axiom. It is known that, if a transversal intersects two parallel lines, then each pair of corresponding angles are equal, which is a theorem. Therefore, Statement I is false and it is not an axiom.
ii. It is known that, if a transversal intersects two parallel lines, then each pair of alternate interior angles are equal. It is also a theorem. So, Statement parallel is true and an axiom. Therefore, in the given statement, first is false and second is an axiom. Therefore, given system of axioms is not consistent.

33. 

Draw EF || AB || CD

EF || CD and CE is the transversal

Then,

$\angle ECD + \angle CEF = 180^\circ$

[Angles on the same side of a transversal line are supplementary]

$\Rightarrow 130^\circ + \angle CEF = 180^\circ$

$\Rightarrow \angle CEF = 50^\circ$

Again EF || AB and AE is the transversal

Then,

$\angle BAE + \angle AEF = 180^\circ$ [Angles on the same side of a transversal line are supplementary]

$\Rightarrow \angle BAE + \angle AEC + \angle CEF = 180^\circ$ $[\angle AEF = \angle AEC + \angle CEF]$

$\Rightarrow x^\circ + 20^\circ + 50^\circ = 180^\circ$

$\Rightarrow x^\circ + 170^\circ = 180^\circ$

$\Rightarrow x^\circ = 110^\circ$

OR

AB || CD and PQ is the transversal

Then,

$\angle PEF = \angle EGH$ [Corresponding Angles]

$\Rightarrow \angle EGH = 85^\circ$

And

$\angle EGH + \angle QGH = 180^\circ$ [Since PQ is a straight line]

$\Rightarrow 85^\circ + \angle QGH = 180^\circ$

$\Rightarrow \angle QGH = 95^\circ$

Also,

$\angle CHQ + \angle GHQ = 180^\circ$ [Since CD is a straight line

$\Rightarrow 115^\circ + \angle GHQ = 180^\circ$

$\Rightarrow \angle GHQ = 65^\circ$

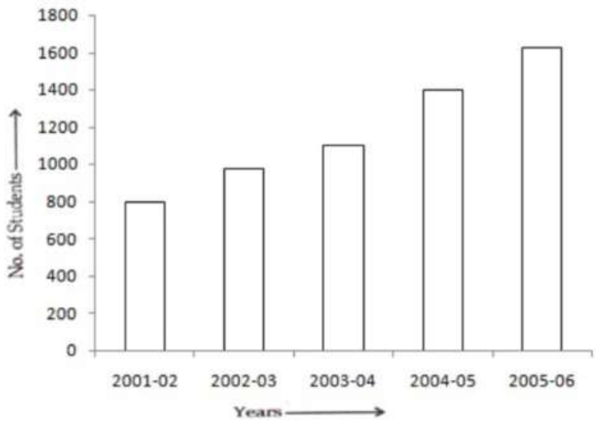
We know that the sum of angles of a triangle is 180°

$\Rightarrow \angle QGH + \angle GHQ + \angle GQH = 180^\circ$

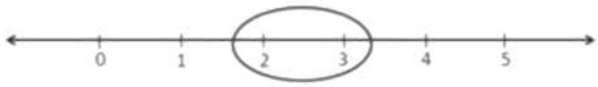
$\Rightarrow 95^\circ + 65^\circ + x^\circ = 180^\circ$

$\Rightarrow x^\circ = 20^\circ$

34. Take the academic year along the x-axis and the number of students along the y-axis.
    Along the y-axis, take 1 big division = 200 units.
    Now we shall draw the bar chart, as shown below:



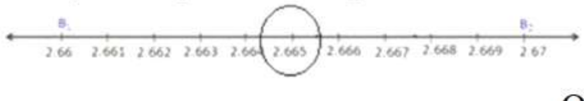
35. The following steps for successive magnification to visualise 2.665 are:
    i. We observe that 2.665 lies between 2 and 3 on the number line.



    ii. Divide this portion into 10 equal parts and mark each point of division. The first mark to the right of 2 will represent 2.1, the next 2.2 and soon. Again we observe that 2.665 lies between 2.6 and 2.7.

    iii. Again divide this portion into 10 equal parts and represent 2.61, the number 2.62, and soon. We observe 2.665 lies between 2.66 and 2.67.

    iv. Again divide this portion into 10 equal parts and represent 2.661, then next 2.662, and so on.
    Clearly, fifth point will represent 2.665



OR

$p = \frac{3-\sqrt{5}}{3+\sqrt{5}}$

$= \frac{3-\sqrt{5}}{3+\sqrt{5}} \times \frac{3-\sqrt{5}}{3-\sqrt{5}}$

$= \frac{(3-\sqrt{5})^2}{3^2-\sqrt{5}^2}$

$= \frac{9+5-6\sqrt{5}}{9-5}$

$= \frac{14-6\sqrt{5}}{4}$

$= \frac{7-3\sqrt{5}}{2}$

$q = \frac{3+\sqrt{5}}{3-\sqrt{5}}$

$= \frac{3+\sqrt{5}}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3+\sqrt{5}}$

$= \frac{(3+\sqrt{5})^2}{3^2-\sqrt{5}^2}$

$= \frac{9+5+6\sqrt{5}}{9-5}$

$= \frac{14+6\sqrt{5}}{4}$

$= \frac{7+3\sqrt{5}}{2}$

$p^2 + q^2$

$= \left(\frac{7-3\sqrt{5}}{2}\right)^2 + \left(\frac{7+3\sqrt{5}}{2}\right)^2$

$= \frac{49+45-42\sqrt{5}}{4} + \frac{49+45+42\sqrt{5}}{4}$

$= \frac{94-42\sqrt{5}}{4} + \frac{94+42\sqrt{5}}{4}$

$= \frac{47-21\sqrt{5}}{2} + \frac{47+21\sqrt{5}}{2}$

$= \frac{47-21\sqrt{5}+47+21\sqrt{5}}{2}$

$= \frac{94}{2}$

$= 47$

Section E

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

Once four friends Rahul, Arun, Ajay and Vijay went for a picnic at a hill station. Due to peak season, they did not get a proper hotel in the city. The weather was fine so they decided to make a conical tent at a park. They were carrying 300 m^2 cloth with them. As shown in the figure they made the tent with height 10 m and diameter 14 m. The remaining cloth was used for the floor.

(i) Height of the tent h = 10 m

Radius r = 7 cm

Thus Latent height l = $\sqrt{r^2+h^2} = \sqrt{7^2+10^2} = \sqrt{149}$ = 12.20 m

Curved surface of tent = $\pi r l = \frac{22}{7} \times 7 \times 12.2$ = 268.4 m^2

Thus the length of the cloth used in the tent = 268.4 m^2

The remaining cloth = 300 - 268.4 = 31.6 m^2

Hence the cloth used for the floor = 31.6 m^2

(ii) Height of the tent h = 10 m

Radius r = 7 cm

Thus the volume of the tent = $\frac{1}{3}\pi r^2 h$

= $\frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 10$

= 513.3 m^3

OR

Radius of the floor r = 7 m

Latent height of the tent l = 12.2 m

Thus total surface area of the tent = $\pi r(r+l)$

= $\frac{22}{7} \times 7(7+12.2)$

= 22 × 19.2

= 422.4 m^2

(iii)Radius of the floor = 7 m

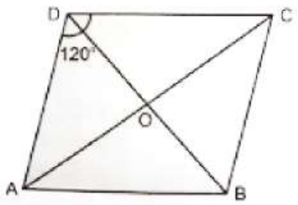
Area of the floor = $\pi r^2 = \frac{22}{7} \times 7 \times 7$

= 154 m^2

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

Tarun and Samay are two friends live in small town. The area near their houses and school is in the shape of Rhombus. Usually, they go to school by Bicycle.

ABCD is an area in the shape of rhombus in which ∠ADC = 120°. Samay and Tarun lived at D and C and their school located at O.



(i) ABCD is a rhombus and adjacent angles of a rhombus are supplementary.

Thus, ∠CDA + ∠DCB = 180°

⇒ 120° + ∠DCB = 180°

⇒ ∠DCB = 180° - 120° = 60°

(ii) Diagonal of a rhombus bisects the angles is passing from.

So, ∠CDO = $\frac{1}{2}$ ∠CDA

= $\frac{1}{2}$ (120)° = 60°

∠ADC + ∠DCB = 180°

$120^{\circ} + \angle DCB = 180^{\circ}$

$\Rightarrow \angle DCB = 180^{\circ} - 120^{\circ} = 60^{\circ}$

$\angle DCO = \frac{1}{2} \angle DCB$

$= \frac{1}{2} (60^{\circ}) = 30^{\circ}$

Measure of $\angle CDO = 60^{\circ}$ and $\angle DCO = 30^{\circ}$

OR

Since, ABCD is a rhombus. So, AB||CD and AC is a transversal.

Thus, $\angle BAC = \angle DCA = 30^{\circ}$ (alternate interior angles)

(iii) $\angle CDO = 60^{\circ}$ and $\angle DCO = 30^{\circ}$

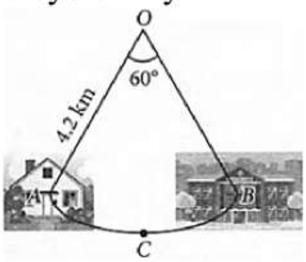
Since, $\angle CDO > \angle DCO$

$\Rightarrow$ CO > DO (side opposite to greater angle is greater.)

$\Rightarrow$ Samay will reach school early.

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

Govind has his home located at A and his college located at B. Govind drives his motorbike three days in a week and rides his bicycle in the remaining 3 days, to go to his college and back to home. AOB is a sector of a circle with centre O, central angle 60° and radius 4.2 km. Path AOB is the route for driving by motorbike and path ACB is for bicycle only.



(i) In a week, Govind drives his motorbike 3 days to go to college.

$\therefore$ Total distance travelled by Govind through motorbike = $2 \times 4.2 \times 6 = 50.4$ km

(ii) In a week Govind rides his bicycle 3 days to go to college.

$\therefore$ Total distance travelled by Govind through bicycle

= Length of arc $\widehat{ACB} \times 6$

$= \frac{\theta}{360^{\circ}} \times 2\pi r \times 6 = \frac{60^{\circ}}{360^{\circ}} \times 2 \times \frac{22}{7} \times 4.2 \times 6 = 26.4$ km

(iii) Area of sector AOB = $\frac{\theta}{360^{\circ}} \times \pi r^2$

$= \frac{60^{\circ}}{360^{\circ}} \times \frac{22}{7} \times (4.2)^2 = 9.24 \text{ km}^2$

OR

Total cost of fuel used for a week = ₹(20 × 50.4) = ₹1008