Class IX Session 2025-26
Subject - Mathematics
Sample Question Paper - 1

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 Questions 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 $\pi = 22/7$ wherever required if not stated.
11. Use of calculators is not allowed.

Section A

1. An irrational number between $\frac{3}{8}$ and $\frac{5}{8}$ is ________. **[1]**

   a) $\left(\frac{3}{8} \times \frac{5}{8}\right)$
   b) $\sqrt{\frac{3}{8} \times \frac{5}{8}}$
   c) $\frac{1}{2}\left(\frac{3}{8} + \frac{5}{8}\right)$
   d) $\sqrt{\frac{3}{8} + \frac{5}{8}}$

2. **The cost of a notebook is twice the cost of a pen.** The equation to represent this statement is **[1]**

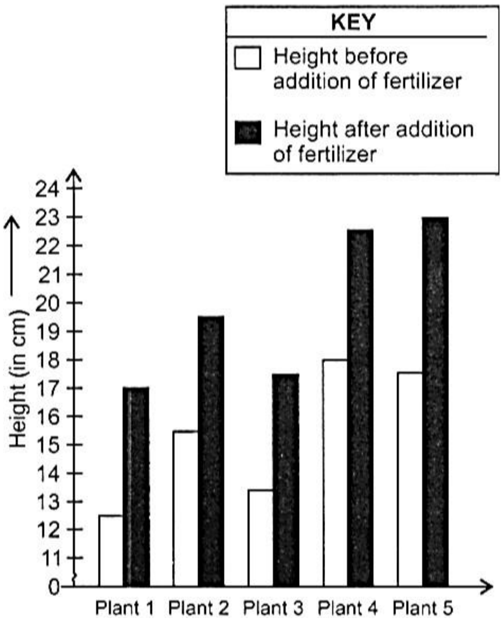
   a) x + 2y = 0
   b) x = 3y
   c) x - 2y = 0
   d) 2x = 3y

3. The co-ordinates of a point above the x-axis lying on y-axis at a distance of 4 units are **[1]**

   a) (0, -4)
   b) (0, 4)
   c) (4, 0)
   d) (-4, 0)

4. The owner of a plant nursery wanted to test the effectiveness of a new type of fertilizer. He measured the heights **[1]**

of 5 plants, and then gave each an equal amount of fertilizer. Two weeks later, he measured the heights of the plants again. The graph below shows the height of the plants before and after the addition of fertilizer.



What was the mean growth of the plants?

a) 5.5 cm

b) 6 cm

c) 4.5 cm

d) 5 cm

5. The linear equation 3x – y = x – 1 has : **[1]**

a) Infinitely many solutions

b) No solution

c) Two solutions

d) A unique solution

6. Greek's emphasised on: **[1]**

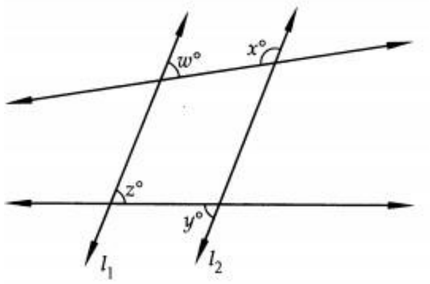
a) Practical use of geometry

b) Inductive reasoning

c) Both Deductive reasoning and Inductive reasoning

d) Deductive reasoning

7. In Fig. if $l_1 \parallel l_2$, what is $x + y$ in terms of w and z? **[1]**



a) 180 – w + z

b) 180 – w – z

c) 180 + w – z

d) 180 + w + z

8. A diagonal of a rectangle is inclined to one side of the rectangle at 35^o. The acute angle between the diagonals is **[1]**

a) 70^o

b) 50^o

c) 55^o

d) 45^o

9. (x + 1) is a factor of $x^n + 1$ only if **[1]**

a) n is an odd integer

b) n is a positive integer

c) n is a negative integer

d) n is an even integer

10. The point which lies on y-axis at a distance of 6 units in the positive direction of y-axis is **[1]**

a) (0, 6)

b) (0, -6)

c) (6, 0)

d) (-6, 0)

11. In a parallelogram ABCD, if $\angle$DAB = 75^o and $\angle$DBC = 60^o, then $\angle$BDC = **[1]**

a) 75 °

b) 50 °

c) 65 °

d) 45^o

12. Diagonals of a Parallelogram ABCD intersect at O. If $\angle BOC = 90^\circ$, $\angle BDC = 50^\circ$ then $\angle OAB$ is **[1]**

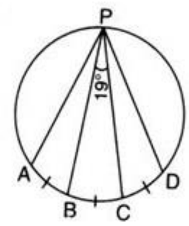
a) 90°

b) 40°

c) 50°

d) 10°

13. In the given figure, $\angle BPC = 19^o$, arc AB = arc BC = arc CD. Then, the measure of $\angle APD$ is **[1]**



a) 38^o

b) 59^o

c) 76^o

d) 57^o

14. If $(3^3)^2 = 9^x$ then 5^x = ? **[1]**

a) 25

b) 125

c) 5

d) 1

15. Which of the following points lie on the line y = 3x – 4? **[1]**

a) (3, 9)

b) (5, 15)

c) (2, 2)

d) (4, 12)

16. If the altitudes from two vertices of a triangle to the opposite sides are equal then the triangle is **[1]**

a) isosceles

b) scalene

c) right angled

d) equilatera

17. In a bar graph, 0.25 cm length of a bar represents 100 people. Then, the length of bar which represents 2000 people is **[1]**

a) 4 cm

b) 4.5 cm

c) 3.5 cm

d) 5 cm

18. The surface area of a cube whose volume is 64 cm^3 is **[1]**

a) 96 cm^2

b) 64 cm^2

c) 72 cm^2

d) 108 cm^2

19. **Assertion (A):** The perimeter of a right angled triangle is 60 cm and its hypotenuse is 26 cm. The other sides of the triangle are 10 cm and 24 cm. Also, area of the triangle is 120 cm^2. **[1]**

Reason (R): $(Base)^2 + (Perpendicular)^2 = (Hypotenuse)^2$

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.

20. **Assertion (A):** The point (1, 1) is the solution of x + y = 2. **[1]**

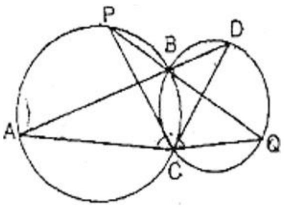
Reason (R): Every point which satisfy the linear equation is a solution of the equation.

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

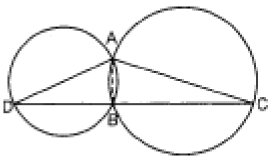
21. Find the area of an isosceles triangle, the measure of one of its equal sides being b and the third side is a. **[2]**

22. Two circles intersect at two points B and C. Through B, two line segments ABD and PBQ are drawn to intersect the circles at A, D, P, Q respectively (see figure). Prove that ACP = QCD. **[2]**



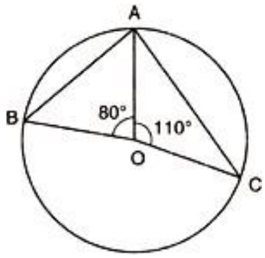
23. The volume of two spheres are in the ratio 64: 27. Find the ratio of their surface areas. **[2]**

24. In the given figure, two circles intersect at two points A and B. AD and AC are diameters to the two circles. Prove that B lies on the line segment DC. **[2]**



OR

In given Fig. *O* is the centre of the circle. Find $\angle BAC$.



25. Draw the graph of the equation: y + 5 = 0 **[2]**

OR

Express the linear equation $x - \frac{y}{5} - 10 = 0$ in the form ax + by + c = 0 and indicate the value of a, b and c in case.

Section C

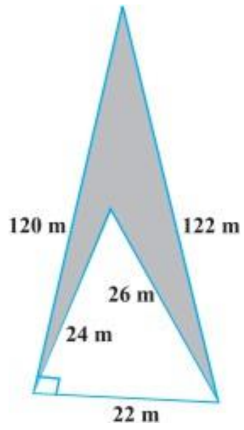
26. Find the values of a and b in each of $\frac{5+2\sqrt{3}}{7+4\sqrt{3}} = a - b\sqrt{3}$ **[3]**

27. Find the remainder when $x^3 - ax^2 + 6x - a$ is divided by $x - a$. **[3]**

28. The sides of a triangular plot are in the ratio of 3 : 5 : 7 and its perimeter is 300 m. Find its area. **[3]**

OR

Calculate the area of the shaded region in Fig.



29. Draw the graph of the following equation and check whether : **[3]**

i. x = 2, y = 5

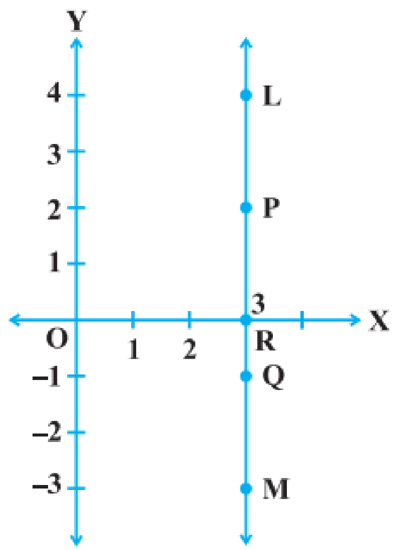
ii. x = –1, y = 3 are the solutions for 2x + 3y = 4

30. E and F are points on diagonal AC of a parallelogram ABCD such that AE = CF. Show that BFDE is a parallelogram. **[3]**

OR

ABC is a triangle. D is a point on AB such that AD = $\frac{1}{4}$ AB and E is a point of AC such that AE = $\frac{1}{4}$ AC. Prove that DE = $\frac{1}{4}$ BC.

31. In Figure, LM is a line parallel to the y-axis at a distance of 3 units. **[3]**



i. What are the coordinates of the points P, R and Q?

ii. What is the difference between the abscissa of the points L and M?

Section D

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

OR

If $\frac{9^n \times 3^2 \times \left(3^{-n/2}\right)^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$, prove that m - n = 1.

33. In the adjoining figure, name: **[5]**

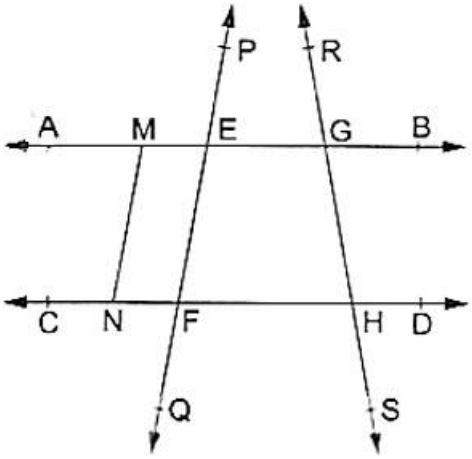
i. Six points

ii. Five line segments

iii. Four rays

iv. Four lines

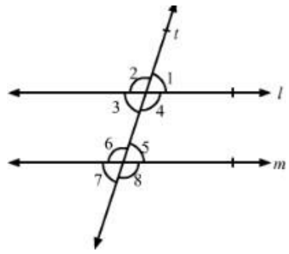
v. Four collinear points



34. If is given that $\angle XYZ = 64^{\circ}$ and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects ∠ZYP, find ∠XYQ and reflex ∠QYP. **[5]**

OR

In the given figure, l || m and a transversal t cuts them. If $\angle 1 : \angle 2 = 2 : 3$, find the measure of each of the marked angles.



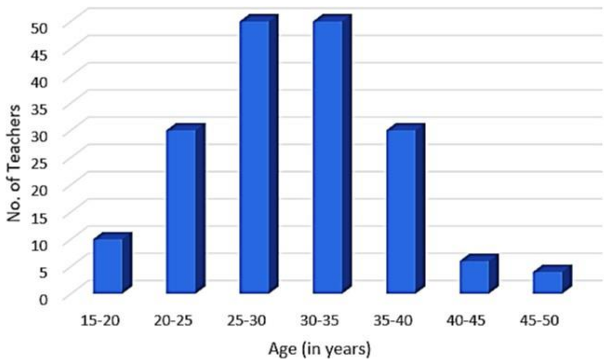
35. If x = 0 and x = -1 are the zeros of the polynomial $f(x) = 2x^3 - 3x^2 + ax + b$, find the value of a and b. **[5]**

Section E

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

A teacher is a person whose professional activity involves planning, organizing, and conducting group activities to develop student's knowledge, skills, and attitudes as stipulated by educational programs. Teachers may work with students as a whole class, in small groups or one-to-one, inside or outside regular classrooms. In this indicator, teachers are compared by their average age and work experience measured in years.

For the same in 2015, the following distribution of ages (in years) of primary school teachers in a district was collected to evaluate the teacher on the above-mentioned criterion.



i. What is the total no of teachers? (1)

ii. Find the class mark of class 15 - 20, 25 - 30 and 45 - 50? (1)

iii. What is the no of teachers of age range 25 - 40 years? (2)

OR

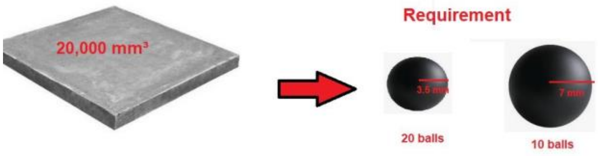
Which classes are having same no. of teachers? (2)

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

In Agra in a grinding mill, there were installed 5 types of mills. These mills used steel balls of radius 5 mm, 7 mm, 10 mm, 14 mm and 16 mm respectively. All the balls were in the spherical shape.

For repairing purpose mills need 10 balls of 7 mm radius and 20 balls of 3.5 mm radius. The workshop was having 20000 mm^3 steel.

This 20000 mm^3 steel was melted and 10 balls of 7 mm radius and 20 balls of 3.5 mm radius were made and the remaining steel was stored for future use.



i. What was the volume of one ball of 3.5 mm radius? (1)

ii. What was the surface area of one ball of 3.5 mm radius? (1)

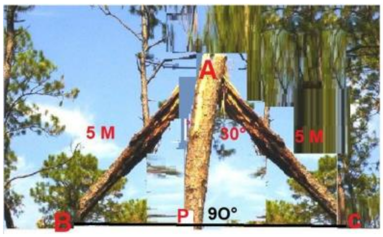
iii. What was the volume of 10 balls of radius 7 mm? (2)

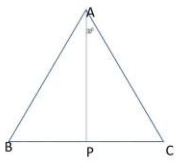
OR

How much steel was kept for future use? (2)

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

In a forest, a big tree got broken due to heavy rain and wind. Due to this rain the big branches AB and AC with lengths 5m fell down on the ground. Branch AC makes an angle of 30° with the main tree AP. The distance of Point B from P is 4 m. You can observe that ΔABP is congruent to ΔACP.





i. Show that $\triangle ACP$ and $\triangle ABP$ are congruent. (1)

ii. Find the value of $\angle ACP$? (1)

iii. Find the value of $\angle BAP$? (2)

OR

What is the total height of the tree? (2)

Solution

Section A

1.

(b) $\sqrt{\frac{3}{8} \times \frac{5}{8}}$

Explanation:

An irrational number between $\frac{3}{8}$ and $\frac{5}{8}$ is $\sqrt{\frac{3}{8} \times \frac{5}{8}}$

2.

(c) x - 2y = 0

Explanation:

Let the cost of the notebook is ₹ x and pen is ₹ y and we have given that the cost of a notebook is twice the cost of a pen. So we have

x = 2y

or x - 2y = 0

3.

(b) (0, 4)

Explanation:

It lies on y-axis so it's abscissa = 0 and it lies on y-axis at a distance of 4unit.

Thus point will be (0, 4).

4.

(c) 4.5 cm

Explanation:

Mean growth of plants = $\frac{4.5+4+4+4.5+5.5}{5}$

= 4.5 cm

5. **(a)** Infinitely many solutions

Explanation:

3x - y = x-1

y = 3 x - x +1

y = 2 x + 1

This is linear equation of two variable. If we take any random value of x and solve y corresponding value of x . We will get infinite many solutions.

6.

(d) Deductive reasoning

Explanation:

Greek's emphasised on deductive reasoning.

7. **(a)** 180 – w + z

Explanation:

Given that,

$l_1 \parallel l_2$

Let m and n be two transversal cutting them

$\angle w + \angle x = 180^o$ (Consecutive interior angle)

$x = 180^o - w$ (i)

z = y (Alternate angles) (ii)

From (i) and (ii), we get

x + y = 180^o – w + z

8. **(a)** 70^o

Explanation:

$\angle$OAD = 90^o - ($\angle$OAB)

= 90^o - 35^o = 55^o.

Now, $\angle$ODA = $\angle$OAD = 55^o [$\because$ OA = OD since diagonals of a rectangles are equal and bisect each other].

$\angle$AOD = 180^o - ($\angle$OAD + $\angle$ODA)

= 180^o - (55^o + 55^o) = 70^o.

9. **(a)** n is an odd integer

Explanation:

The linear polynomial (x - 1) is a factor of $x^n + 1$, only if

f(-1) = $(-1)^n + 1 = 0$

If n is odd integer, then f(-1) = -1 + 1 = 0

10. **(a)** (0, 6)

Explanation:

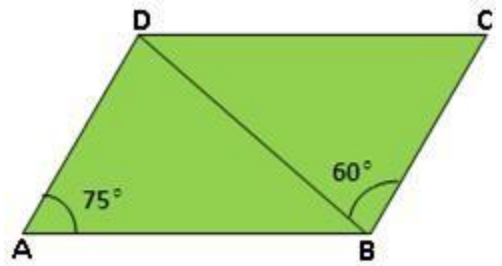
At y-axis the value of x co-ordinate is 0 and y-axis at a distance of 6 units in the positive direction so the co-ordinate of the y-axis is 6.

So the co-ordinate of point is (0, 6).

11.

(d) 45^o

Explanation:



We know that the opposite angles of a parallelogram are equal.

Therefore, $\angle$BCD = $\angle$BAD = 75°. .. (i)

(i) Now, in Δ BCD, we have

$\angle$CDB + $\angle$DBC + $\angle$BCD = 180° [Since, sum of the angles of a triangle is 180°]

$\Rightarrow$ $\angle$CDB + 60° + 75° = 180°

$\Rightarrow$ $\angle$CDB + 135° = 180°

$\Rightarrow$ $\angle$CDB = (180° - 135°) = 45°.

12.

(b) 40°

Explanation:

$\angle$BOC + $\angle$COD = 180^o (linear pair)

$\angle$COD = 180^o - 90^o = 90^o

In triangle DOC, $\angle$DOC + $\angle$DCO + $\angle$ODC = 180^o (angle sum property)

90^o + $\angle$DCO + 50 = 90^o

$\angle$DCO = 180^o - 140^o = 40

$\angle$DCO = $\angle$OAB = 40 (alternate angles)

13.

(d) 57^o

Explanation:

Equal arcs subtend equal angles at the centre and the angle subtended by them at the circumference would be double the angle subtended by them at the centre. As the angle subtended at centre were same so the angle subtended at the circumference would also become same. Thus each arc would make an angle of 19^o. Thus the total length of all the three angles would be thrice 19^o that is 57^o.

14.

(b) 125

Explanation:

$(3^3)^2 = 9^x$

$(3^2)^3 = 9^x$

$9^3 = 9^x$

$\Rightarrow$ x=3

$\therefore 5^3 = 125$

15.

(c) (2, 2)

Explanation:

When we put x=2 in the given equation,

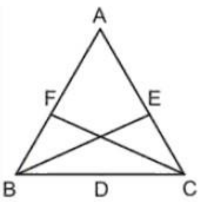
Then, y = (3×2) – 4

y =6–4 = 2, so point is (2, 2)satisfied the given equation,

Hence point (2, 2) will lie on the line y = 3x - 4

16. **(a)** isosceles

Explanation:



In triangles ABE and ACF

$\angle AEB = \angle AFC$ (90^o each)

$\angle BAE = \angle CAF$ (common angle)

$\Rightarrow \angle ABE = \angle ACF$ ... using angle sum property

BE = CF (given)

$\Rightarrow \Delta ABE \cong \Delta ACF$ (ASA)

$\Rightarrow$ AB = AC (c.p.c.t)

Hence, $\triangle$ABC is an isosceles triangle..... as two sides are equal to each other.

17.

(d) 5 cm

Explanation:

Use unitary method

0.25 cm - 100 people

So 1 cm - 400 people

So for 2000 people:

$\frac{2000}{400}$ = 5 cm

18. **(a)** 96 cm^2

Explanation:

Given: Volume of cube = 64 cm^3

$\Rightarrow a^3 = 64$

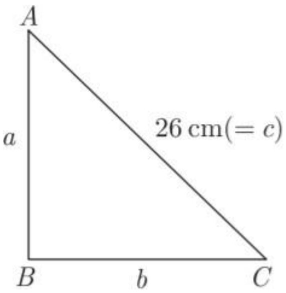
$\Rightarrow a^3 = (4)^3$

$\Rightarrow a = 4$ cm

$\therefore$ Surface Area of cube = $6a^2 = 6(4)^2 = 96$ sq. cm

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

Explanation:



a + b + c = 60

a + b + 26 = 60

a + b = 34 ...(i)

Now, $26^2 = a^2 + b^2$ ...(ii)

Squaring (1) both sides, we get

$(a + b)^2 = (34)^2$

$a^2 + b^2 + 2ab = 34 \times 34$

$(26)^2 + 2ab = 1156$ [From (ii)]

2ab = 1156 - 676

2ab = 480

ab = 240 ...(iii)

Now, $a + \frac{240}{a} = 34$ [From (i) and (iii)]

$a^2 - 24a - 10a + 240 = 0$

a(a - 24) - 10(a - 24) = 0

a = 10, 24

Now, other sides are 10 cm and 24 cm

$s = \frac{26+10+24}{2} = 30$ cm

Area of triangle = $\sqrt{30(30-26)(30-10)(30-24)}$

$= \sqrt{30 \times 4 \times 20 \times 6} = 120\ cm^2$

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

Explanation:

Putting (1, 1) in the given equation, we have

L.H.S = 1 + 1 = 2 = R.H.S

L.H.S = R.H.S

Hence (1, 1) satisfy the x + y = 2. So it is the solution of x + y = 2.

Section B

21. 'a' = b, 'b' = b, 'c' = a

$\therefore s = \frac{'a'+'b'+'c'}{2}$

$s = \frac{b+b+a}{2} = \frac{2b+a}{2}$ units.

$\therefore$ Area of the isosceles triangle

$= \sqrt{s(5-'a')(s-'b')(s-'c')}$

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

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

$= \frac{a}{4}\sqrt{(2b+a)(2b-a)}$

$= \frac{a}{4}\sqrt{4b^2 - a^2}$ square units.

22. In triangles ACD and QCP,

$\angle$A = $\angle$P and $\angle$Q = $\angle$D [Angles in same segment]

$\therefore$ $\angle$ACD = $\angle$QCP [Third angles] ...(i)

Subtracting $\angle$PCD from both the sides of eq. (i), we get,

$\angle$ACD - $\angle$PCD = $\angle$QCP - $\angle$PCD

$\angle$ACP = $\angle$QCD

Hence proved.

23. Suppose r_1 and r_2 be the radii of two spheres.

$\therefore$ the ratio of their volumes = $\frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{64}{27}$

$\left(\frac{r_1}{r_2}\right)^3 = \left(\frac{4}{3}\right)^3 \Rightarrow \frac{r_1}{r_2} = \frac{4}{3}$

Ratios of surface areas of two spheres = $\frac{4\pi r_1^2}{4\pi r_2^2}$

$= \left(\frac{r_1}{r_2}\right)^2 = (\frac{4}{3})^2 = \frac{16}{9}$

$\therefore$Required ratio = 16: 9.

24. In the given diagram join AB. Also $\angle$ABD = 90° (because angle in a semicircle is always 90°)

Similarly, we have $\angle$ABC = 90°

So, $\angle$ABD + $\angle$ABC = 90° + 90° = 180°

Therefore, DBC is a line i.e., B lies on the line segment DC.

OR

We have, $\angle$AOB = 80°

$\angle$AOC = 110°

$\angle$AOB + $\angle$AOC + $\angle$BOC = 360° (Complete angle)

$80^\circ + 110^\circ$ + $\angle$BOC = 360°

$\angle$BOC = 170°

By degree measure theorem,

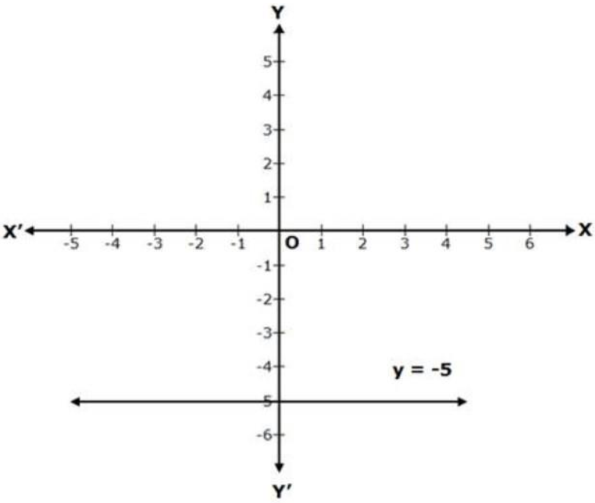
$\angle$BOC = 2 $\angle$BAC

170° = 2 $\angle$BAC

$\angle$BAC = 85°.

25. y + 5 = 0

$\Rightarrow$ y = -5, which is a line parallel to the X-axis, at a distance of 5 units from it, below the X-axis.



OR

We need to express the linear equation $x - \frac{y}{5} - 10 = 0$ in the form ax + by + c = 0 and indicate the values of a, b and c.

$x - \frac{y}{5} - 10 = 0$ can also be written as $1 \cdot x - \frac{y}{5} - 10 = 0.$

We need to compare the equation $1 \cdot x - \frac{y}{5} - 10 = 0$ with the general equation ax + by + c = 0, to get the values of a, b and c.

Therefore, we can conclude that $a = 1, b = -\frac{1}{5}$ and $c = -10$

Section C

26. LHS = $\frac{5+2\sqrt{3}}{7+4\sqrt{3}} = \frac{5+2\sqrt{3}}{7+4\sqrt{3}} \times \frac{7-4\sqrt{3}}{7-4\sqrt{3}}$

$= \frac{(5+2\sqrt{3})(7-4\sqrt{3})}{(7)^2-(4\sqrt{3})^2}$

$= \frac{35-20\sqrt{3}+14\sqrt{3}-24}{49-48}$

$= \frac{11-6\sqrt{3}}{1} = 11 - 6\sqrt{3}$

Now, $11 - 6\sqrt{3} = a - b\sqrt{3}$

$\Rightarrow$ a = 11 & b = 6

27. We need to find the zero of the polynomial $x - a$.

$x - a = 0 \Rightarrow x = a$

While applying the remainder theorem, we need to put the zero of the polynomial $x - a$ in the polynomial , $x^3 - ax^2 + 6x - a$ to get

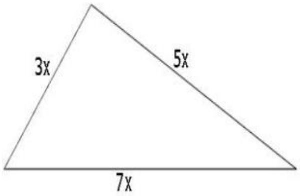
$p(x) = x^3 - ax^2 + 6x - a$

$p(a) = (a)^3 - a(a)^2 + 6(a) - a$

$= a^3 - a^3 + 6a - a$

$= 5a$

Therefore, we conclude that on dividing the polynomial $x^3 - ax^2 + 6x - a$ by $x - a$, we will get the remainder as $5a$.

28. 

Suppose that the sides in metres are 3x, 5x and 7x.

Then, we know that 3x + 5x + 7x = 300 (Perimeter of the triangle)

Therefore, 15x = 300, which gives x = 20.

So the sides of the triangles are 3×20 m, 5×20 m and 7×20 m
i.e., 60m, 100m and 140m.

We have s = $\frac{60+100+140}{2}$ = 150 m

and area will be = $\sqrt{150(150-60)(150-100)(150-140)}$

$= \sqrt{150 \times 90 \times 50 \times 10}$

$= 1500\sqrt{3}$ m^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 m^2

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

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

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

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

$= 24\sqrt{105}$

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

= 246 cm^2

Therefore, the area of the shaded portion.

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

= (1320 - 246) m^2

= 1074 m^2

29. 2x + 3y = 4

$\Rightarrow$ 3y = 4– 2x

$\Rightarrow y = \frac{4-2x}{3}$

x	2	–1
y	0	2

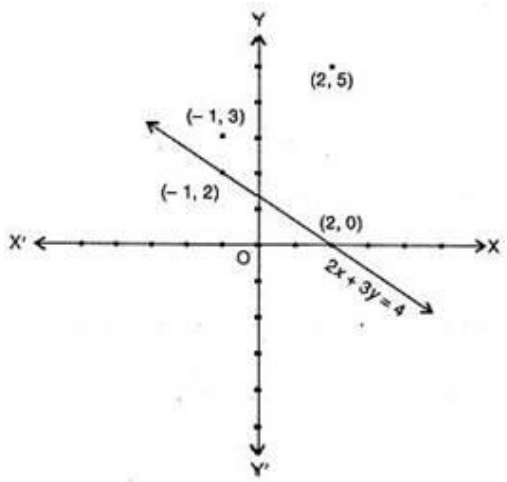
We plot the points (2, 0) and (–1, 2) on the graph paper and join the same by a ruler to get the line which is the graph of the equation $2x + 3y = 4$.

i. The point (2, 5) does not lie on the graph

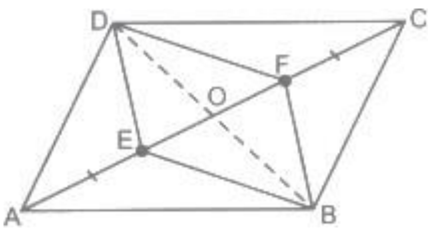
$\therefore$ x = 2, y = 5 is not a solution.

ii. $\because$The point (–1, 3) does not lie on the graph

$\therefore$ x = –1, y = 3 is not a solution.

iii. 

30. Given: A parallelogram ABCD: E and F are points of diagonal AC of parallelogram ABCD such that AE = CF.



To prove: BFDE is parallelogram.

Proof: ABCD is a parallelogram.

$\therefore$ OD = OB ...(1) [$\because$ Diagonals of parallelogram bisect each other]

OA = OC ...(2) [$\because$ Diagonals of parallelogram bisect each other]

AE = CF …(3) [Given]

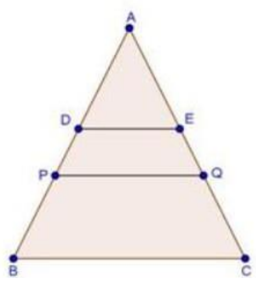
By subtracting (3) from (2), we obtain

OA – AE = OC – CF

$\therefore$ OE = OF …(4)

Therefore, BFDE is a parallelogram. [Because OD = OB and OE = OF]

OR



Let P and Q be the mid-points of AB and AC respectively.

Then PQ || BC such that

PQ = $\frac{1}{2}$ BC ...(i)

In $\triangle$APQ, D and E are mid-points of AP and AQ are respectively.

$\therefore$ DE || PQ and DE = $\frac{1}{2}$ PQ ...(ii)

From equation (i) and equation (ii), we get

DE = $\frac{1}{2}$ PQ = $\frac{1}{2}$ [$\frac{1}{2}$ BC]

$\Rightarrow$ DE = $\frac{1}{4}$ BC

Hence the required result is proved.

31. Given LM is a line parallel to the Y-axis and its perpendicular distance from Y-axis is 3 units.

    i. Coordinate of point P = (3,2)
    Coordinate of point Q = (3,-1)
    Coordinate of point R = (3, 0) [since its lies on X-axis, so its y coordinate is zero].

    ii. Abscissa of point L = 3, abscissa of point M=3
    $\therefore$ Difference between the abscissa of the points L and M = 3 – 3 = 0

Section D

32. Given, $\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$

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

$= \frac{7\sqrt{3}(\sqrt{10}-\sqrt{3})}{(\sqrt{10})^2-(\sqrt{3})^2} - \frac{2\sqrt{30}-2\times 5}{(\sqrt{6})^2-(\sqrt{5})^2} - \frac{3\sqrt{30}-18}{(\sqrt{15})^2-(3\sqrt{2})^2}$

$= \frac{7(\sqrt{30}-3)}{10-3} - \frac{(2\sqrt{30}-10)}{6-5} - \frac{3\sqrt{30}-18}{15-18}$

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

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

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

OR

We know that

$\frac{9^n \times 3^2 \times \left(3^{-\frac{n}{2}}\right)^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$

$\Rightarrow \frac{(3^2)^n \times 3^2 \times \left(3^{-\frac{n}{2}}\right)^{-2} - (3^3)^n}{3^{3m} \times 2^3} = \frac{1}{3^3}$

$\Rightarrow \frac{(3)^{2n} \times 3^2 \times 3^{\frac{n}{2} \times 2} - (3)^{3n}}{3^{3m} \times 2^3} = \frac{1}{3^3}$

$\Rightarrow \frac{(3)^{2n+2} \times 3^n - (3)^{3n}}{3^{3m} \times 2^3} = \frac{1}{3^3}$

$\Rightarrow \frac{(3)^{2n+2+n} - (3)^{3n}}{3^{3m} \times 2^3} = \frac{1}{3^3}$

$\Rightarrow \frac{(3)^{3n+2} - (3)^{3n}}{3^{3m} \times 2^3} = \frac{1}{3^3}$

$\Rightarrow 3^3 \times [(3)^{3n+2} - (3)^{3n}] = 3^{3m} \times 2^3$

$\Rightarrow 3^{3+3n} \times [(3)^2 - 1] = 3^{3m} \times 2^3$

$\Rightarrow 3^{3+3n} \times [8] = 3^{3m} \times 2^3$

$\Rightarrow 3^{3+3n} \times 2^3 = 3^{3m} \times 2^3$

$\Rightarrow 3^{3+3n} = 3^{3m}$

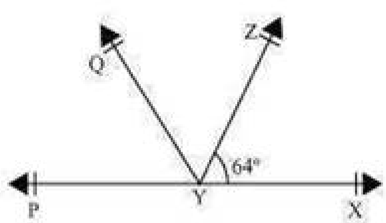
$\Rightarrow$ 3+3n = 3m

$\Rightarrow$ 3m - 3n = 3

$\Rightarrow$ m - n = 1

33. Six points: A,B,C,D,E,F
    - Five line segments: $\overline{EG}, \overline{FH}, \overline{EF}, \overline{GH}, \overline{MN}$
    - Four rays: $\overrightarrow{EP}, \overrightarrow{GR}, \overrightarrow{GB}, \overrightarrow{HD}$
    - Four lines: = $\overleftrightarrow{AB}, \overleftrightarrow{CD}, \overleftrightarrow{PQ}, \overleftrightarrow{RS}$
    - Four collinear points: M,E,G,B

34. We are given that $\angle XYZ = 64^\circ$, XY is produced to P and YQ bisects $\angle ZYP$ We can conclude the given below figure for the given situation:



We need to find $\angle XYQ$ and reflex $\angle QYP$

From the given figure, we can conclude that $\angle XYZ$ and $\angle ZYP$ form a linear pair.

We know that sum of the angles of a linear pair is 180^o.

$\angle XYZ + \angle ZYP = 180^o$

But $\angle XYZ = 64^o$

$\Rightarrow 64^o + \angle ZYP = 180^o$

$\Rightarrow \angle ZYP = 116^o$

Ray YQ bisects $\angle ZYP$,or

$\angle QYZ = \angle QYP = \frac{116^o}{2} = 58^o$

$\angle XYQ = \angle QYZ + \angle XYZ$

$= 58^o + 64^o = 122^o$.

Reflex $\angle QYP = 360^\circ - \angle QYP$

$= 360^o - 58^o$

$= 302^o$.

Therefore, we can conclude that $\angle XYQ = 122^o$ and Reflex $\angle QYP = 302^o$

OR

Given that $\angle 1 : \angle 2 = 2 : 3$

Let $\angle 1 = 2k$ and $\angle 2 = 3k$, where k is some constant

Now, $\angle 1$ and $\angle 2$ form a linear pair

$\therefore \angle 1 + \angle 2 = 180^\circ$

$\Rightarrow 2k + 3k = 180^\circ$

$\Rightarrow 5k = 180^\circ$

$\Rightarrow k = 36^\circ$

$\therefore \angle 1 = 2k = 2 \times 36^\circ = 72^\circ$

$\angle 2 = 3k = 3 \times 36^\circ = 108^\circ$

Now,

$\angle 3 = \angle 1 = 72^\circ$ (Vertically opposite angles)

$\angle 4 = \angle 2 = 108^\circ$ (Vertically opposite angles)

It is given that, $l \parallel m$ and t is a transversal

$\therefore \angle 5 = \angle 1 = 72^\circ$ (Pair of corresponding angles)

$\angle 6 = \angle 2 = 108^\circ$ (Pair of corresponding angles)

$\angle 7 = \angle 1 = 72^\circ$ (Pair of alternate exterior angles)

$\angle 8 = \angle 2 = 108^\circ$ (Pair of alternate exterior angles)

$\angle 1 = \angle 3 = \angle 5 = \angle 7 = 72^\circ$

and $\angle 2 = \angle 4 = \angle 6 = \angle 8 = 108^\circ$

35. We have, $f(x) = 2x^3 - 3x^2 + ax + b$

Zeros of f(x) are 0 and -1

Substitute x = 0 in f(x),we get,

$f(0) = 2(0)^3 - 3(0)^2 + a(0) + b$

$= 0 - 0 + 0 + b$

$= b$ ..... (1)

Substitute x = (-1) in f(x),we have,

$f(-1) = 2(-1)^3 - 3(-1)^2 + a(-1) + b$

$= -2 - 3 - a + b$

$= -5 - a + b$......(2)

We need to equate equations 1 and 2 to zero

$b = 0$ and $-5 - a + b = 0$

since, the value of b is zero

substitute b = 0 in equation 2

$\Longrightarrow -5 - a = -b$

$\Rightarrow -5 - a = 0$

$a = -5$

Section E

36. i. No of teachers in the age-group 15-20 years = 10

No of teachers in the age-group 20-25 years = 30

No of teachers in the age-group 25-30 years = 50

No of teachers in the age-group 30-35 years = 50

No of teachers in the age-group 35-40 years = 30

No of teachers in the age-group 40-45 years = 5

No of teachers in the age-group 45-50 years = 2

Thus the total no of teachers

= 10 + 30 + 50 + 50 + 30 + 5 + 2

=177

ii. Class Mark of class 15 - 20 =

$= \frac{15+20}{2} = 17.5$

Class Mark of class 25 - 30 =

$= \frac{25+30}{2} = 27.5$

Class Mark of class 45 - 50 =

$= \frac{45+50}{2} = 47.5$

iii. No of teachers in the age-group 25 - 30 years = 50

No of teachers in the age-group 30 - 35 years = 50

No of teachers in the age-group 35 - 40 years = 30

Thus the no of teachers in the age range 25 - 40 years

= 50 + 50 + 30 = 130

OR

From the observation of the bar chart we find that :

No of teachers in the age-group 25-30 years = 50

No of teachers in the age-group 30-35 years = 50

Thus the no of teacher in the class 25-30 and 30-35 is equal.

37. i. The radius of the ball= 3.5 mm

Volume of the ball

$= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 3.5$

= 179.66 mm^3

ii. Radius of one ball = 3.5 cm

The surface area of one ball

$= 4\pi r^2$

$= 4 \times \frac{22}{7} \times 3.5 \times 3.5$

= 154 mm^2

iii. Radius of one ball= 7 cm

Thus volume of 10 balls of radius 7 mm

$= 10 \times \frac{4}{3}\pi r^3$

$= 10 \times \frac{4}{3} \times \frac{22}{7} \times 7^3$

=14373.3 mm^3

OR

Volume of 10 balls of 7 mm = 14373.3 mm^3

Volume of 1 ball of 3.5 mm = 179.66 mm^3

Volume of 20 balls of 3.5 mm = 179.66 $\times$ 20= 3593.33 mm^3

Total steel required to be melted = 14373.3 + 3593.33 = 17966 mm^3(Approx)

Thus steel left over = 20,000 - 17966 = 2034 mm^3

38. i. In $\triangle ACP$ and $\triangle ABP$

AB = AC (Given)

AP = AP (common)

$\angle APB = \angle APC = 90^o$

By RHS criteria $\triangle ACP \cong \triangle ABP$

ii. In $\triangle ACP$

$\angle APC + \angle PAC + \angle ACP = 180^o$

$\Rightarrow 90^o + 30^o + \angle ACP = 180^o$ (angle sum property of $\triangle$)

$\Rightarrow \angle ACP = 180^o - 120^o = 60^o$

$\angle ACP = 60^o$

iii. $\triangle ACP \cong \triangle ABP$

Corresponding part of congruent triangle

$\angle BAP = \angle CAP$

$\angle BAP = 30^o$ (given $\angle CAP = 30^o$)

OR

$\triangle ACP$

$AC^2 = AP^2 + PC^2$

$\Rightarrow 25 = AP^2 + 16$

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

$\Rightarrow AP = 3$

Total height of the tree = AP + 5 = 3 + 5 = 8 m