Class IX Session 2024-25
Subject - Mathematics
Sample Question Paper - 7

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 carrying 04 marks each.
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 2 marks questions of Section E.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

Section A

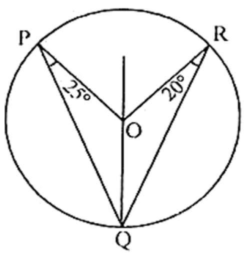
1. Abscissa of a point is negative in **[1]**

a) quadrant IV only
b) quadrant II and III
c) quadrant I and IV
d) quadrant I only

2. Each equal side of an isosceles triangle is 13 cm and its base is 24 cm Area of the triangle is : **[1]**

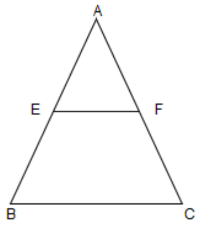
a) $40\sqrt{3}\ cm^2$
b) $25\sqrt{3}\ cm^2$
c) 60 cm^2
d) $50\sqrt{3}\ cm^2$

3. In the figure, O is the centre of the circle. If $\angle OPQ = 25^o$ and $\angle ORQ = 20^o$, then the measures of $\angle POR$ and $\angle PQR$ are respectively : **[1]**



a) $150^o, 30^o$
b) $120^o, 60^o$
c) $90^o, 45^o$
d) $60^o, 30^o$

4. E and F are the mid-points of the sides AB and AC of a △ABC. If AB = 6cm, BC = 5cm and AC = 6cm, Then EF is equal to **[1]**



a) 4 cm

b) 3 cm

c) 2.5 cm

d) 2 cm

5. The value of $\frac{2}{\sqrt{5}-\sqrt{3}}$ is **[1]**

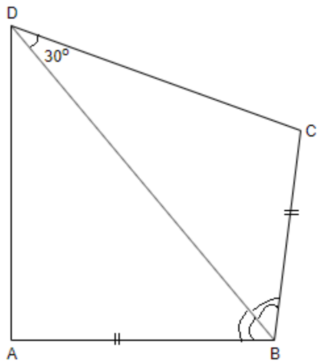
a) $\frac{1}{\sqrt{5}-\sqrt{3}}$

b) $\sqrt{5}-\sqrt{3}$

c) $\sqrt{5}+\sqrt{3}$

d) $\frac{1}{\sqrt{5}+\sqrt{3}}$

6. In the adjoining figure, AB = BC and ∠ABD = ∠CBD, then another angle which measures 30° is **[1]**



a) ∠BCA

b) ∠BCD

c) ∠BDA

d) ∠BAD

7. Express ‘x’ in terms of ‘y’ in the equation 2x – 3y – 5 = 0. **[1]**

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

b) $x = \frac{3y+5}{2}$

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

d) $x = \frac{3+5y}{2}$

8. Which of the following is a true statement? **[1]**

a) $5x^3$ is a monomial

b) $x^2 + 5x - 3$ is a linear polynomial

c) x + 1 is a monomial

d) $x^2 + 4x - 1$ is a binomial

9. If $x = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ and $y = \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$, then $x^2 + xy + y^2 =$ **[1]**

a) 102

b) 101

c) 99

d) 98

10. In which of the following figures are the diagonals equal? **[1]**

a) Rhombus

b) Rectangle

c) Parallelogram

d) Trapezium

11. The number x = 1.242424....... can be expressed in the form $x = \frac{p}{q}$, where p and q are positive integers having no common factors. Then p + q equals **[1]**

a) 41

b) 74

c) 53

d) 72

12. The graph of the linear equation y = x passes through the point **[1]**

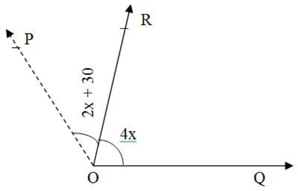
a) $\left(\frac{3}{2}, \frac{-3}{2}\right)$

b) $\left(0, \frac{3}{2}\right)$

c) $\left(\frac{-1}{2}, \frac{1}{2}\right)$

d) (1 ,1)

13. In the given figure, the value of x which makes POQ a straight line is: **[1]**



a) 40°

b) 30°

c) 35°

d) 25°

14. If $\frac{3^{5x} \times 81^2 \times 6561}{3^{2x}} = 3^7$, then x = **[1]**

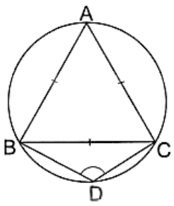
a) $-\frac{1}{3}$

b) 3

c) -3

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

15. In the given figure, equilateral $\triangle$ABC is inscribed in a circle and ABCD is a quadrilateral, as shown. Then, $\angle$BDC = ? **[1]**



a) 120°

b) 60°

c) 150°

d) 90°

16. The co-ordinates of two points A and B are (4, 3) and (4, -5) respectively. The co-ordinates of the point at which the line segment AB meets the x-axis are **[1]**

a) (-5, 0)

b) (3, 0)

c) (0, 4)

d) (4, 0)

17. The graph of x + y = 6 intersect coordinate axes at **[1]**

a) Both (0, 6) and (6, 0)

b) (6, 0)

c) (0, 6)

d) (2, 3)

18. Let f(x) be a polynomial such that $f\left(-\frac{1}{2}\right) = 0$, then a factor of f(x) is **[1]**

a) X + 1

b) 2x + 1

c) X - 1

d) 2x - 1

19. **Assertion (A):** ABCD is a square. AC and BD intersect at O. The measure of $\angle$AOB = 90^o. **[1]**
Reason (R): Diagonals of a square bisect each other at right angles.

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):** 0.271 is a terminating decimal and we can express this number as $\frac{271}{1000}$ which is of the form $\frac{p}{q}$, where p and q are integers and q $\neq$ 0. **[1]**

Reason (R): A terminating or non-terminating decimal expansion can be expressed as rational number.

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

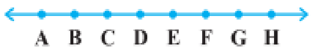
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

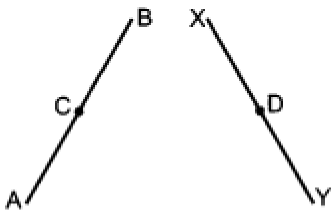
d) A is false but R is true.

Section B

21. Look at the Fig. Show that length AH > sum of lengths of AB + BC + CD. **[2]**

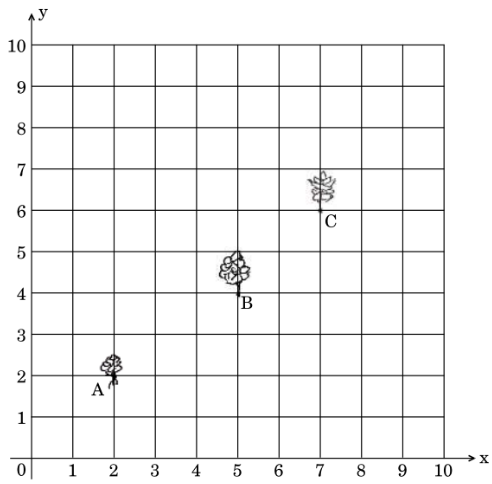


22. In fig. AC = XD, C is the mid-point of AB and D is the mid-point of XY. Using a Euclid's axiom, show that AB = XY. **[2]**



23. Seema has a 10 m $\times$ 10 m kitchen garden attached to her kitchen. She divides it into a 10 $\times$ 10 grid and wants to grow some vegetables and herbs used in the kitchen. She puts some soil and manure in that and sows a green chilly plant at A, a coriander plant at B and a tomato plant at C. **[2]**

Her friend Kusum visited the garden and praised the plants grown there. She pointed out that they seem to be in a straight line. See the below diagram carefully and answer the following questions :



i. Write the coordinates of the points A, B, and C taking the 10 $\times$ 10 grid as coordinate axes.

ii. By distance formula or some other formula, check whether the points are collinear.

24. Insert five rational numbers between $-\frac{2}{3}$ and $\frac{3}{4}$. **[2]**

OR

Evaluate: $(32)^{\frac{1}{5}} + (-7)^0 + (64)^{\frac{1}{2}}$.

25. The surface areas of two spheres are in the ratio 1 : 4. Find the ratio of their volumes. **[2]**

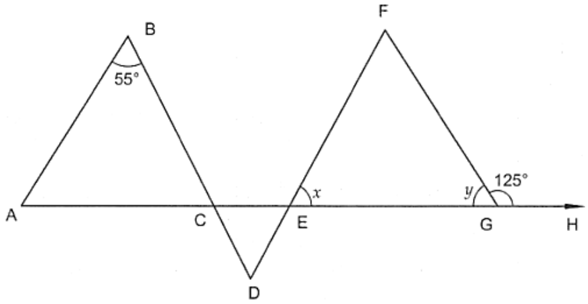
OR

A hemispherical tank is made up of an iron sheet 1 cm thick. If the inner radius is 1 m, then find the volume of the iron used to make the tank.

Section C

26. Represent $\sqrt{9.3}$ on the number line. **[3]**

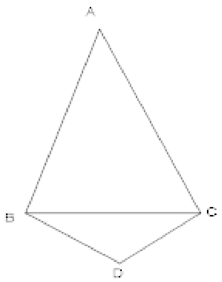
27. In Fig., if AB||DE and BD||FG such that ∠FGH = 125° and ∠B = 55°, find x and y. **[3]**



28. 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. **[3]**

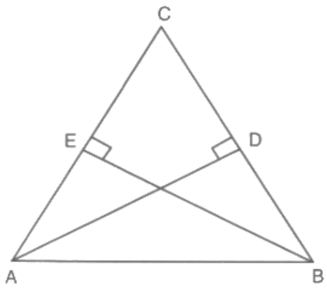
29. Find four solutions for the following equation :12x + 5y = 0 **[3]**

30. In the given figure, ABC and DBC are two triangles on the same base BC such that AB = AC and DB = DC. Prove that ∠ABD = ∠ACD, **[3]**



OR

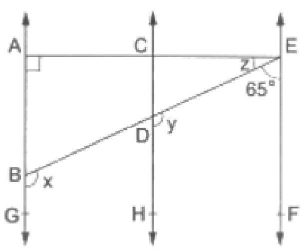
In given figure, AD and BE are respectively altitudes of a triangle ABC such that AE = BD. Prove that AD = BE.



31. Factorise: $2x^3 - 3x^2 - 17x + 30$ **[3]**

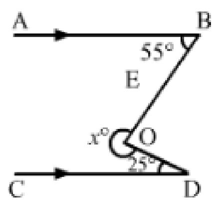
Section D

32. In the given figure, AB || CD || EF, $\angle DBG = x, \angle EDH = y$, $\angle AEB = z$, $\angle EAB = 90^\circ$ and $\angle BEF = 65^\circ$. Find the values of x, y and z. **[5]**



OR

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



33. The diagonals of a quadrilateral ABCD are perpendicular. Show that the quadrilateral, formed by joining the mid-points of its sides, is a rectangle. **[5]**

34. The difference between the sides at right angles in a right-angled triangle is 14 cm. The area of the triangle is 120 cm^2. Calculate the perimeter of the triangle. **[5]**

OR

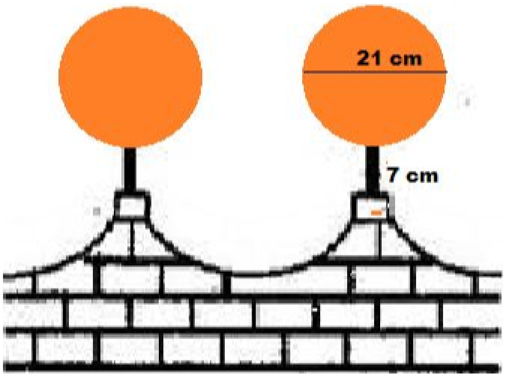
If each side of a triangle is doubled, then find the ratio of area of new triangle thus formed and the given triangle.

35. The polynomial $p(x) = x^4 - 2x^3 + 3x^2 - ax + 3a - 7$ when divided by x + 1 leave remainder 19. Find the remainder when p(x) is divided by x + 2. **[5]**

Section E

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

The front compound wall of a house is decorated by wooden spheres of diameter 21 cm, placed on small supports as shown in figure. 25 such spheres are used for this purpose and are to be painted silver. Each support is a cylinder and is to be painted black.



i. what will be the total surface area of the spheres all around the wall? (1)

ii. Find the cost of orange paint required if this paint costs 20 paise per cm^2. (1)

iii. How much orange paint in liters is required for painting the supports if the paint required is 3 ml per cm^2? (2)

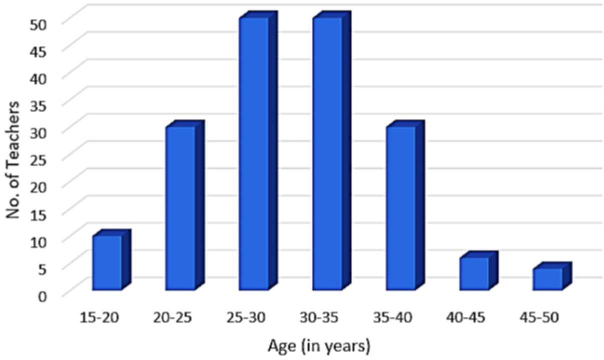
OR

What will be the volume of total spheres all around the wall? (2)

37. **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)

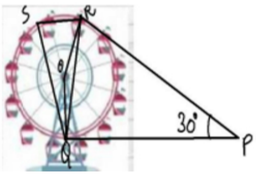
OR

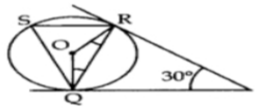
Which classes are having same no. of teachers? (2)

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

A Ferris wheel (or a big wheel in the United Kingdom) is an amusement ride consisting of a rotating upright wheel with multiple passenger-carrying components (commonly referred to as passenger cars, cabins, tubs, capsules, gondolas, or pods) attached to the rim in such a way that as the wheel turns, they are kept upright, usually by gravity.

After taking a ride in Ferris wheel, Aarti came out from the crowd and was observing her friends who were enjoying the ride . She was curious about the different angles and measures that the wheel will form. She forms the figure as given below





i. Find $\angle ROQ$. (1)
ii. Find $\angle RQP$. (1)
iii. Find $\angle RSQ$. (2)

OR

Find $\angle ORP$. (2)

Solution

Section A

1.

(b) quadrant II and III

Explanation: The abscissa (x-axis) is -ve in 2nd and 3rd quadrant only because,
Sign of point in 2nd quadrant is (-, +), and in 3rd quadrant, it is (-, -).

2.

(c) 60 cm^2

Explanation: s = $\frac{13+13+24}{2}$= 25 cm
Area of triangle = $\sqrt{s(s-a)(s-b)(s-c)}$
= $\sqrt{25(25-13)(25-13)(25-24)}$
= $\sqrt{25 \times 12 \times 12 \times 1}$
= 60 sq. cm

3.

(c) $90^o, 45^o$

Explanation: Here, given

,

OP = OQ and OR = OQ (Radius of circle)
So, {angles opposite to equal sides are also equal}
Hence,

PQR = 25^o + 20^o = 45^o

and PQR = 2 PQR = 2 45^o = 90^o

{Angle subtended by same sides on centre is double the angle at opposite vertex}

4.

(c) 2.5 cm

Explanation: since E and F are the mid points of sides AB and AC respectively.
according to mid point theorem of triangle;
EF = $\frac{1}{2} \times BC$
EF = $\frac{1}{2} \times 5$

5.

(c) $\sqrt{5} + \sqrt{3}$

Explanation: $\frac{2}{\sqrt{5}-\sqrt{3}}$

multiplying nu nominator and denominator by
$\sqrt{5} + \sqrt{3}$, we get
$\frac{2(\sqrt{5}+\sqrt{3})}{(\sqrt{5}-\sqrt{3})(\sqrt{5}+\sqrt{3})}$
$= \frac{2(\sqrt{5}+\sqrt{3})}{5-3} = \sqrt{5} + \sqrt{3}$

6.

(c) ∠BDA

Explanation: In triangle ABD and CBD
AB = BC and ∠ABD = ∠CBD (Given)
BD (Common)
Therefore In triangle ABD and CBD are congruent by SAS criteria.

Therefore, ∠BDA = 30^o (by CPCT)

7.

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

Explanation: $$\begin{aligned}2x-3y-5&=0\\2x&=3y+5\\x&=\frac{3y+5}{2}\end{aligned}$$

8. **(a)** $5x^3$ is a monomial

Explanation: $5x^3$ is a monomial as it contains only one term.

9.

(c) 99

Explanation: Given x = $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ and y= $\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$,

Consider,

x = $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

= $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}\times\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}}$

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

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

= $\frac{3+2-2\sqrt{6}}{1}$

= $5-2\sqrt{6}$

Hence x = $5-2\sqrt{6}$

$\Rightarrow$ $x^2=(5-2\sqrt{6})^2$

= $25+24-20\sqrt{6}$

= $49-20\sqrt{6}$

i.e. $x^2=49-20\sqrt{6}$ ----(i)

Again consider

y = $\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$

= $\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}\times\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

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

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

= $\frac{3+2+2\sqrt{6}}{1}$

= $5+2\sqrt{6}$

Hence $y=5+2\sqrt{6}$

$\Rightarrow$ $y^2=(5+2\sqrt{6})^2$

= $25+24+20\sqrt{6}$

= $49+20\sqrt{6}$

i.e. $y^2=49+20\sqrt{6}$ ---(ii)

Then x^2+xy+y^2

= $49-20\sqrt{6}+\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}\times\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}+49+20\sqrt{6}$ [from (i) nd (ii)]

= 98+1

= 99

10.

(b) Rectangle

Explanation: Rectangle is the correct answer. As we know that from all the quadrilaterals given in other options, diagonals of a rectangle are equal.

11.

(b) 74

Explanation: We have, x = 1.2424... ...(i)

$\Rightarrow$ 100x= 124.2424... ...(ii)

Subtracting (i) from (ii), we get

100x - x = 123

$\Rightarrow$ 99x = 123 $\Rightarrow$ x = $\frac{123}{99} = \frac{41}{33}$

$\therefore$ p = 41, q = 33 and p + q = 41 + 33 = 74

12.

(d) (1 ,1)

Explanation: y = x, $\Rightarrow$ both the coordinates are the same. Hence (1, 1) is correct option.

13.

(d) 25°

Explanation: We know that he measure of a straight angle is 180°

(2x + 30°) + 4x = 180°

2x + 30° + 4x = 180°

6x = 180° - 30°

6x = 150°

x = $\frac{150^0}{6}$ = 25°

14.

(c) -3

Explanation: $\frac{3^{5x} \times 81^2 \times 6561}{3^{2x}}$ = 3^7

$\Rightarrow$ $3^{5x} \times 81^2 \times 6561 = 3^7 \times 3^{2x}$

3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

$\Rightarrow$ $3^{5x} \times (3^4)^2 \times 3^8 = 3^7 \times 3^{2x}$

$\Rightarrow$ $3^{5x+8+8} = 3^{7+2x}$

$\Rightarrow$ 5x + 16 = 7 + 2x

$\Rightarrow$ 5x - 2x = 7 - 16

$\Rightarrow$ 3x = -9

$\Rightarrow$ x = -3

15. **(a)** 120°

Explanation: $\triangle$ABC is an equilateral triangle so $\angle$BAC = 60°

In cyclic quadrilateral ABCD, we have:

$\angle$BDC + $\angle$BAC = 180°

$\Rightarrow$ $\angle$BDC + 60° = 180°

$\therefore$ $\angle$BDC = (180° - 60°) = 120°

16.

(d) (4, 0)

Explanation: Since it will meet at x-axis and we know that any point on x-axis have ordinate equals to zero.

So point will be (4, 0).

17. **(a)** Both (0, 6) and (6, 0)

Explanation: Both (0, 6) and (6, 0)

18.

(b) 2x + 1

Explanation: Let f(x) be a polynomial such that $f\left(-\frac{1}{2}\right) = 0$

i.e., $x+\frac{1}{2}=0$ is a factor.

On rearranging $x+\frac{1}{2}=0$ can be written as (2x + 1) = 0

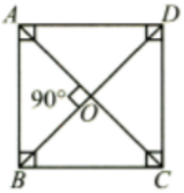
Thus, (2x + 1) is a factor of f(x).

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

Explanation:

Since, diagonals of a square bisect each other at right angles.

∠AOB = 90°



20.

(c) A is true but R is false.

Explanation: A is true but R is false.

Section B

21. From the given figure, we have

AB + BC + CD = AD [AB, SC and CD are the parts of AD] Here, AD is also the parts of AH.

By Euclid's axiom, the whole is greater than the part. i.e., AH > AD.

Therefore, length AH > sum of lengths of AB + BC + CD.

22. In the above figure, we have

AB = AC + BC = AC + AC = 2AC (Since, C is the mid-point of AB) ..(1)

XY = XD + DY = XD + XD = 2XD (Since, D is the mid-point of XY) ..(2)

Also, AC = XD (Given) ..(3)

From (1),(2)and(3), we get

AB = XY, According to Euclid, things which are double of the same things are equal to one another.

23. i. A(2, 2)

B(5, 4)

C(7, 6)

ii. AB = $\sqrt{(5-2)^2+(2-2)^2}$

= $\sqrt{9+4}$

= $\sqrt{13}$

BC = $\sqrt{(7-5)^2+(6-4)^2}$

= $\sqrt{4+4}$

= $2\sqrt{2}$

AC = $\sqrt{(7-2)^2+(6-2)^2}$

= $\sqrt{25+16}$

= $\sqrt{41}$

∵ AB + BC = $\sqrt{13}+2\sqrt{2}$

AC = $\sqrt{41}$

∴ AB + BC $\neq$ AC

∴ A, B, C are not collinear

24. $-\frac{2}{3}$ = $\frac{-2\times\ 4}{3\times\ 4}=\ \frac{-8}{12}$

$\frac{3}{4}$ = $\frac{3\times\ 3}{4\times\ 3}=\ \frac{9}{12}$

So, the five rational numbers between $-\frac{2}{3}$ and $\frac{3}{4}$ are $\frac{8}{12}$, $\frac{7}{12}$, $\frac{6}{12}$**,** $\frac{5}{12}$ **and** $\frac{4}{12}$

OR

$(32)^{\frac{1}{5}}+(-7)^0+(64)^{\frac{1}{2}}$

$\left(2^5\right)^{\frac{1}{5}}+1+\sqrt{8\times8}$ [∵ a^0=1]

$=2^{\left(5\times\frac{1}{5}\right)}$ + 1 + 8

= 2 + 1 + 8

=11

25. Suppose that the radii of the spheres are r and R.

We have:

$\frac{4\pi r^2}{4\pi R^2} = \frac{1}{4}$

$\Rightarrow \frac{r}{R} = \sqrt{\frac{1}{4}} = \frac{1}{2}$

Now, ratio of the volumes = $\frac{\frac{4}{3}\pi r^3}{\frac{4}{3}\pi R^3}$ = $\left(\frac{r}{R}\right)^3$ = $\left(\frac{1}{2}\right)^3$ = $\frac{1}{8}$

Therefore, The ratio of the volumes of the spheres is 1 : 8.

OR

Inner radius of hemispherical tank (r) = 1 m = 100 cm

Thickness of sheet = 1 cm

$\therefore$ Outer radius of hemispherical tank (R) = 100 + 1 = 101 cm

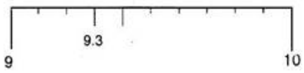
Volume of iron of hemisphere = $\frac{2}{3}\pi$ [R^3 - r^3] cm^2

= $\frac{2}{3} \times \frac{22}{7} \times \left[(101)^3 - (100)^3\right]$ cm^2

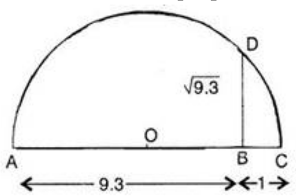
= $\frac{44}{21}$ [1030301 - 1000000] cm^2

= 0.06348 m^2

Section C

26. 

The distance 9.3 from a fixed point A on a given line to obtain a point B such that AB = 9.3 units. From B mark a distance of 1 unit and mark the new point as C. Find the mid-point of AC and mark that point as O. Draw a semi-circle with centre O and radius OC. Draw a line perpendicular to AC passing through B and interesting the semi-circle at D. Then BD = $\sqrt{9.3}$.



27. Here, as AB II DE and BD is the transversal, so according to the property, "alternate interior angles are equal", we get

$\angle$D = $\angle$B

$\angle$D = 55° ....(i)

Similarly, as BD II FG and DF is the transversal

$\angle$D = $\angle$F

$\angle$F = 55° (Using i)

Further, EGH is a straight line. So, using the property angles forming a linear pair are supplementary

$\angle$FGE + $\angle$FGH = 180°

$\Rightarrow$ y + 125° = 180°

$\Rightarrow$ y = 180° - 125°

$\therefore$ y = 55°

Also, using the property, "an exterior angle of a triangle is equal to the sum of the two opposite interior angles", we get,

In $\triangle$EFG with $\angle$FGH as its exterior angle

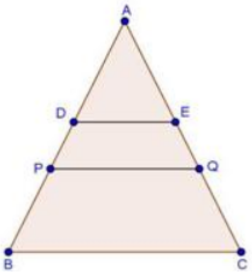
ext. $\angle$FGH = $\angle$F + $\angle$E

125°= 55° + x

$\Rightarrow$ x = 125° - 55°

$\therefore$ x = 70°

Thus, x = 70° and y = 55°

28. 

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.

29. 12x + 5y = 0

$\Rightarrow$ 5y = –12x

$\Rightarrow$ y = $\frac{-12}{5}$x

Put x = 0, then y = $\frac{-12}{5}$(0) = 0

Put x = 5, then y = $\frac{-12}{5}$(5) = -12

Put x = 10, then y = $\frac{-12}{5}$(10) = -24

Put x = 15, then y = $\frac{-12}{5}$(15) = -36

$\therefore$ (0, 0), (5, –12), (10, –24) and (15, –36) are the four solutions of the equation 12x + 5y = 0

30. In $\triangle$ABC,

AB = AC[Given]

$\therefore\ \angle ABC = \angle ACB$ [angles opposite to equal side are equals]

Similarly in, $\triangle$DBC, DB = DC [Given] ...(1)

$\therefore\ \angle DBC = \angle DCB$ ...(2)

Adding (1) and (2)

$\angle$ABC + $\angle$DBC = $\angle$ACB + $\angle$DCB

or $\angle$ABD = $\angle$ACD

OR

In DPDB and DPEA,

$\angle$PDB = $\angle$PEA . . . . [Each 90^o]

$\angle$BPD = $\angle$APE . . . [Vertically opposite angles]

AE = BD . . . . [Given]

$\therefore$ DPDB $\cong$ DPEA . . . .[By AAS property]

$\therefore$ PA = PB . . . [c.p.c.t.] . . . . (1)

PD = PE . . . [c.p.c.t.] . . . . (2)

PA + PD = PB + PE

$\Rightarrow$ AD = BE . . . [By adding (1) and (2)]

31. Let f(x) = $2x^3$ - $3x^2$ - 17x + 30 be the given polynomial. The factors of the constant term +30 are

$\pm1, \pm2, \pm3, \pm5, \pm6, \pm10, \pm15, \pm30$. The factor of coefficient of x^3 is 2. Hence, possible rational roots of f(x) are:

$\pm1, \pm3, \pm5, \pm15, \pm\frac{1}{2}, \pm\frac{3}{2}, \pm\frac{5}{2}, \pm\frac{15}{2}$

We have f(2) = $2(2)^3$ - $3(2)^2$ - 17(2) + 30

= 2(8) - 3(4) - 17(2) + 30

= 16 - 12 - 34 + 30 = 0

And f(-3) = $2(-3)^3$ - $3(-3)^2$ - 17(-3) + 30

= 2(-27) - 3(9) - 17(-3) + 30

= -54 - 27 + 51 + 30 = 0

So, (x - 2) and (x + 3) are factors of f(x).

$\Rightarrow$ x^2 + x - 6 is a factor of f(x).

Let us noe divide f(x) = $2x^3 - 3x^2 - 17x + 30$ by $x^2 + x - 6$ to get the other factors of f(x).

Factors of f(x).

By long division, we have

$$x^2 + x - 6 \overline{)\, 2x^3 - 3x^2 - 17x + 30 \,}\; 2x - 5$$
$$2x^3 + 2x^2 - 12x$$
$$- \quad - \quad +$$
$$-5x^2 - 5x + 30$$
$$-5x^2 - 5x + 30$$
$$+ \quad + \quad -$$
$$0$$

$\therefore$ $2x^3 - 3x^2 - 17x + 30 = (x^2 + x - 6)(2x - 5)$

$\Rightarrow$ $2x^3 - 3x^2 - 17x + 30 = (x - 2)(x + 3)(2x - 5)$

Hence, $2x^3 - 3x^2 - 17x + 30 = (x - 2)(x + 3)(2x - 5)$

Section D

32. EF $\parallel$ CD and ED is the transversal.

$\therefore \quad \angle FED + \angle EDH = 180^\circ$ [co-interior angles]

$\Rightarrow$ 65° + y = 180°

$\Rightarrow$ y = (180° - 65°) = 115°.

Now CH $\parallel$ AG and DB is the transversal

$\therefore$ x = y = 115° [corresponding angles]

Now, ABG is a straight line.

$\therefore \angle ABE + \angle EBG = 180^\circ$ [sum of linear pair of angles is 180°]

$\Rightarrow \angle ABE + x = 180^\circ$

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

$\Rightarrow \angle ABE = (180^\circ - 115^\circ) = 65^\circ$

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

From $\triangle$EAB, we get

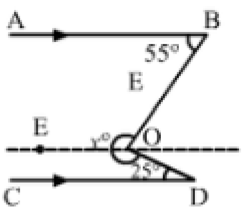
$\angle EAB + \angle ABE + \angle BEA = 180^\circ$

$\Rightarrow$ 90° + 65° + z = 180°

$\Rightarrow$ z = (180° - 155°) = 25°

$\therefore$ x = 115°, y = 115° and z = 25°

OR



Draw EO $\parallel$ AB $\parallel$ CD

Then, $\angle EOB + \angle EOD = x^\circ$

Now, EO $\parallel$ AB and *BO* is the transversal.

$\therefore \angle EOB + \angle ABO = 180^\circ$ [Consecutive Interior Angles]

$\Rightarrow \angle EOB + 55^\circ = 180^\circ$

$\Rightarrow \angle EOB = 125^\circ$

Again, EO $\parallel$ CD and DO is the transversal.

$\therefore \angle EOD + \angle CDO = 180^\circ$ [Consecutive Interior Angles]

$\Rightarrow \angle EOD + 25^\circ = 180^\circ$

$\Rightarrow \angle EOD = 155^\circ$

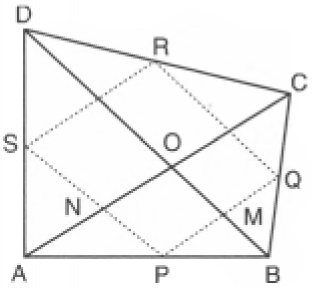
Therefore,

$x^\circ = \angle EOB + \angle EOD$

x° = (125 + 155)°

x° = 280°

33. A quadrilateral whose diagonals AC and BD are perpendicular to each other. P, Q, R, S are the mid-points of sides AB, BC, CD and DA respectively. PQ, QR, RS and SP are joined.



PQRS is a rectangle.

In $\triangle$ABC, P and Q are the mid-points of AB and BC respectively.

$\therefore$ PQ || AC and PQ = $\frac{1}{2}$ AC ...(i)

In $\triangle$ADC, R and S are the mid-points of CD and AD respectively.

$\therefore$ RS || AC and RS = $\frac{1}{2}$AC ...(ii)

From (i) and (ii), we have

PQ || RS and PQ = RS

Thus, in quadrilateral PQRS, a pair of opposite sides are equal and parallel.

So, PQRS is a parallelogram.

Suppose the diagonals AC and BD of quadrilateral ABCD intersect at O. Now in $\triangle$ABD, P is the mid-point of AB and S is the mid-point of AD.

$\therefore$ PS || BD

$\Rightarrow$ PN || MO

Also, from (i), PQ || AC

$\Rightarrow$ PM || NO

Thus, in quadrilateral PMON, we have

PN || MO and PM || NO

$\Rightarrow$ PMON is a parallelogram.

$\Rightarrow \angle$MPN = $\angle$MON [$\because$ Opposite angles of a $\|^{gm}$ are equal]

$\Rightarrow \angle$MPN = $\angle$BOA [$\because \angle$BOA = $\angle$MON]

$\Rightarrow \angle$MPN = 90^o [$\because$ AC $\perp$ BD $\therefore \angle$BOA = 90^o]

$\Rightarrow \angle$QPS = 90^o [$\because \angle$MPN = $\angle$QPS]

Thus, PQRS is a parallelogram whose one angle $\angle$QPS = 90^o

Hence, PQRS is a rectangle.

34. Given that, the difference between the sides at right angles in a right-angled triangle is 14 cm.

Let the sides containing the right angle be x cm and (x -14) cm

Then, the area of the triangle $= \left[\frac{1}{2} \times x \times (x-14)\right] \text{cm}^2$

But, area = 120 cm^2 (given).

$\therefore \frac{1}{2}$ x(x - 14) = 120

$\Rightarrow x^2$ - 14x - 240 = 0

$\Rightarrow x^2$ - 24x + 10x - 240

$\Rightarrow$ x(x - 24) + 10(x - 24)

$\Rightarrow$ (x - 24) (x + 10) = 0

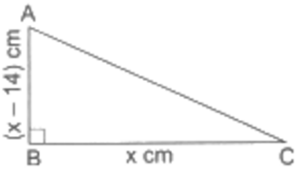
$\Rightarrow$ x = 24 (neglecting x = -10)

$\therefore$ one side = 24 cm, other side = (24 -14) cm = 10 cm

Hypotenuse $= \sqrt{(24)^2 + (10)^2}\text{cm} = \sqrt{576 + 100}\text{cm}$

$= \sqrt{676}$ cm = 26 cm

∴ perimeter of the triangle = (24 +10 + 26) cm = 60 cm.



OR

Let a, b, c be the sides of the given triangle and s be its semi-perimeter.

Then, $s=\frac{a+b+c}{2}$ ...(i)

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

As per given condition, the sides of the new triangle will be 2a, 2b, and 2c.

So, the semi-perimeter of the new triangle =

$s'=\frac{2a+2b+2c}{2}=a+b+c$ ...(ii)

From (i) and (ii), we get

s' = 2s

Area of new triangle $=\sqrt{s'\left(s'-2a\right)\left(s'-2b\right)\left(s'-2c\right)}$

$=\sqrt{2s(2s-2a)(2s-2b)(2s-2c)}$

$=\sqrt{16s(s-a)(s-b)(s-c)}$

$=4\sqrt{s(s-a)(s-b)(s-c)}=4\Delta$

The required ratio = $4\Delta:\Delta$ = 4:1

Therefore the ratio of area of new triangle thus formed and the given triangle is 4 : 1.

35. We know that if p(x) is divided by x + a, then the remainder = p(-a).

Now, p(x) = $x^4 - 2x^3 + 3x^2$ - ax + 3a - 7 is divided by x + 1, then the remainder = p(-1)

Now, p(-1) = $(-1)^4 - 2(-1)^3 + 3(-1)^2$ - a(-1) + 3a - 7

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

= 1 + 2 + 3 + 4a - 7

= -1 + 4a

Also, remainder = 19

∴ -1 + 4a = 49

⇒ 4a = 20; a = 20 ÷ 4 = 5

Again, when p(x) is divided by x + 2, then

Remainder = p(-2) = $(-2)^4 - 2(-2)^3 + 3(-2)^2$ - a(-2) + 3a - 7

= 16 + 16 + 12 + 2a + 3a - 7

= 37 + 5a

= 37 + 5(5) = 37 + 25 = 62

Section E

36. i. Diameter of a wooden sphere = 21 cm.

therefore Radius of wooden sphere (R) $=\frac{21}{2}$ cm

The surface area of 25 wooden spares

$= = 25\times 4\pi \mathrm{R}^2$

= $25\times 4\times\frac{22}{7}\times\left(\frac{21}{2}\right)^2$

=138,600 cm^2

ii. Diameter of a wooden sphere = 21 cm.

therefore Radius of wooden sphere (R) $=\frac{21}{2}$ cm

The surface area of 25 wooden spares

$=25\times 4\pi \mathrm{R}^2$

= $25\times 4\times\frac{22}{7}\times\left(\frac{21}{2}\right)^2$

= 138,600 cm^2

The cost of orange paint= 20 paise per cm^2

Thus total cost

$=\frac{138600\times 20}{100}$ = ₹ 27720

iii. Radius of a wooden sphere r = 4 cm.

Height of support (h) = 7 cm

The surface area of 25 supports

$= 25 \times \pi r^2 h$

$= 25 \times \frac{22}{7} \times 4^2 \times 7$

= 8800 cm^2

The cost of orange paint = 10 paise per cm^2

Thus total cost

= 0.1 $\times$ 8800 = ₹ 880

OR

V = $\frac{4}{3}\pi r^3 \times 25$

$V = 25 \times \frac{4}{3} \times \frac{22}{7} \times \left(\frac{21}{6}\right)^?$

$25 \times \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$

= 25 $\times$ 11 $\times$ 21 $\times$ 21

= 121275 cm^3

37. 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

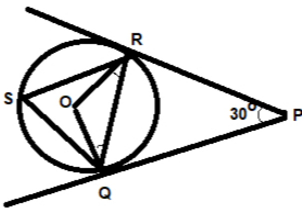
OR

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

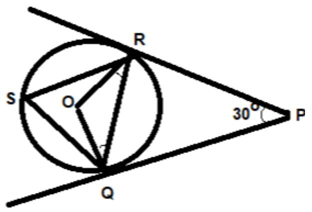
Thus the no of teacher in the class 25-30 and 30-35 is equal.

38. i. 

$\angle$ROQ + $\angle$RPQ = 180^o

$\angle ROQ + 30^o = 180^o$

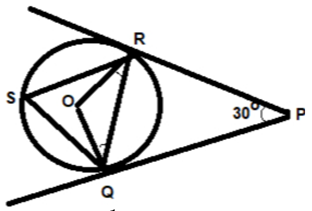
$\angle ROQ = 150^o$

ii. 

$\angle RQP = \angle OQP - \angle OQR$

$= 90^o - 15^o$

$= 75^o$

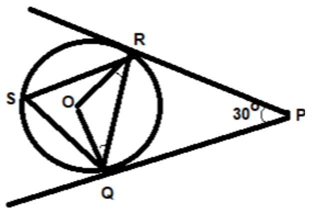
iii. 

$\angle RSQ = \frac{1}{2} \angle ROQ$

$= \frac{1}{2} \times 150^o$

$\angle RSQ = 75^o$

OR



$\angle ORP = 90^o$

$\because$ radius and tangent are $\perp$ at point of contact