

## CBSE SAMPLE PAPER - 08

### Class 09 - Mathematics

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  $\pi = 22/7$  wherever required if not stated.

#### Section A

1. The value of  $\left\{ 8^{\frac{-4}{3}} \div 2^{-2} \right\}^{\frac{1}{2}}$ , is [1]  
a) 4  
b) 2  
c)  $\frac{1}{2}$   
d)  $\frac{1}{4}$
2. If we multiply both sides of a linear equation with a non-zero number, then the solution of the linear equation: [1]  
a) Remains the same  
b) Changes in case of multiplication only  
c) Changes in case of division only  
d) Changes
3. Which of the following are the signs of abscissa and ordinate of a point in quadrant I? [1]  
a) (+, +)  
b) (-, +)  
c) (+, -)  
d) (-, -)
4. To draw a histogram to represent the following frequency distribution : [1]

Class interval	5-10	10-15	15-25	25-45	45-75
Frequency	6	12	10	8	15

The adjusted frequency for the class 25-45 is

- a) 6
- b) 5
- c) 2
- d) 3



a) SSS

b) SAS

c) AAS

d) ASA

12. In Quadrilateral  $\angle A = 38^\circ$ ,  $\angle C = 3\angle A$ ,  $\angle D = 4\angle A$ . Find the value of  $\angle B$ ?

[1]

a)  $57^\circ$

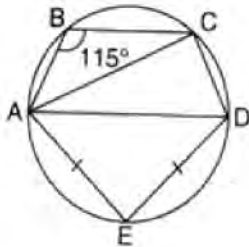
b)  $56^\circ$

c)  $80^\circ$

d)  $55^\circ$

13. In the given figure, AD is the diameter of the circle and  $AE = DE$ . If  $\angle ABC = 115^\circ$ , then the measure of  $\angle CAE$  is

[1]



a)  $60^\circ$

b)  $80^\circ$

c)  $70^\circ$

d)  $90^\circ$

14. When simplified  $(256)^{-\left(4\frac{-3}{2}\right)}$ , is

[1]

a) 2

b)  $\frac{1}{8}$

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

d) 8

15. A polynomial of degree n has

[1]

a) one zero

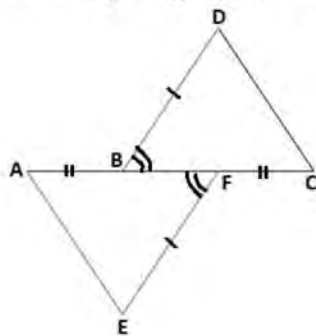
b) n zeroes

c) at most n zeroes

d) at least n zeroes

16. In the adjoining figure,  $AB = FC$ ,  $EF = BD$  and  $\angle AFE = \angle CBD$ . Then the rule by which  $\triangle AFE \cong \triangle CBD$

[1]



a) SSS

b) AAS

c) ASA

d) SAS

17. If  $a + b + c = 9$  and  $ab + bc + ca = 23$ , then  $a^2 + b^2 + c^2 =$

[1]

a) none of these

b) 35

c) 127

d) 58

18. If the height of a cone is doubled then its volume is increased by

[1]

a) 400%

b) 300%

c) 200%

d) 100%



19. **Assertion (A):** The height of the triangle is 18 cm and its area is  $72 \text{ cm}^2$ . Its base is 8 cm. [1]

**Reason (R):** Area of a triangle =  $\frac{1}{2} \times \text{base} \times \text{height}$

- 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. The perimeter of an equilateral triangle is 60 cm. Find its area. [2]

22. Verify  $x = \frac{2}{\sqrt{3}}, -\frac{2}{\sqrt{3}}$  are zeros of the polynomial  $g(x) = 3x^2 - 2$ . [2]

23. The slant height and base diameter of a conical tomb are 25 m and 14 m respectively. Find the cost of white washing its curved surface at the rate of ₹ 210 per  $100 \text{ m}^2$ . [2]

24. Simplify:  $(2x + p - c)^2 - (2x - p + c)^2$  [2]

OR

Use the factor theorem to determine whether  $g(x)$  is a factor of  $p(x) = x^3 - 4x^2 + x + 6$ ,  $g(x) = x - 3$

25. Write two solutions of the form  $x = 0, y = a$  and  $x = b, y = 0$  :  $-4x + 3y = 12$  [2]

OR

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

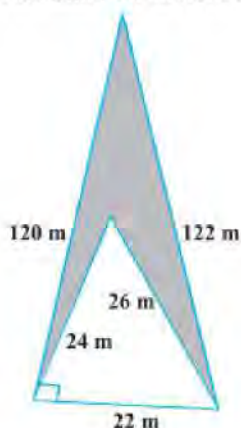
### Section C

26. Simplify  $3\sqrt{48} - \frac{5}{2}\sqrt{\frac{1}{3}} + 4\sqrt{3}$  [3]

27. Factorize the polynomial: [3]

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

28. Calculate the area of the shaded region in Fig. [3]



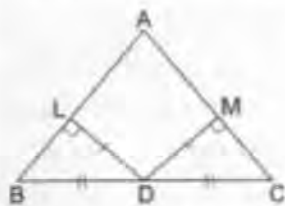
OR

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. If its perimeter is 180 cm,

29. Find solutions of the form  $x = a, y = 0$  and  $x = 0, y = b$  for the following pairs of equations. Do they have any common such solution? [3]

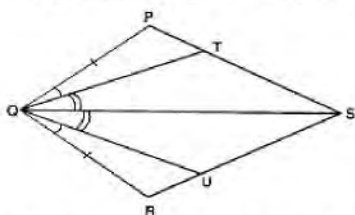
$$3x + 2y = 6 \text{ and } 5x + 2y = 10$$

30. In  $\triangle ABC$ ,  $D$  is the midpoint of  $BC$ . if  $DL \perp AB$  and  $DM \perp AC$  such that  $DL = DM$ . prove that  $AB = AC$ . [3]

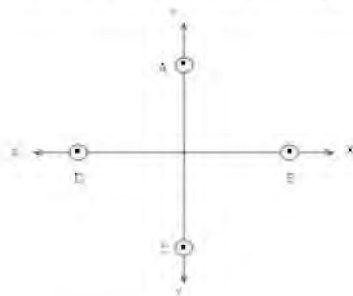


OR

In figure, PQRS is a quadrilateral and T and U are respectively points on PS and RS such that  $PQ = RQ$ ,  $\angle PQT = \angle RQU$  and  $\angle TQS = \angle UQS$ . Prove that  $QT = QU$ .



31. In fig. write the Co-ordinates of the points and if we join the points write the name of fig. formed. Also write Co-ordinate of intersection point of AC and BD. [3]



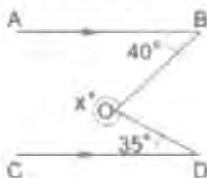
### Section D

32. If  $\frac{9^n \times 3^2 \times (3^{-n/2})^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$ , prove that  $m - n = 1$ . [5]

OR

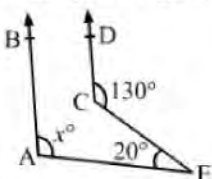
If  $a = \frac{3+\sqrt{5}}{2}$ , then find the value of  $a^2 + \frac{1}{a^2}$ .

33. In a line segment AB point C is called a mid-point of line segment AB, prove that every line segment has one and only one mid-point. [5]
34. In the given figure,  $AB \parallel CD$ ,  $\angle ABO = 40^\circ$ ,  $\angle CDO = 35^\circ$ . Find the value of the reflex  $\angle BOD$  and hence the value of  $x$ . [5]



OR

In the given figure,  $AB \parallel CD$ . Find the value of  $x^\circ$



35. Draw a histogram with frequency polygon for the following data: [5]



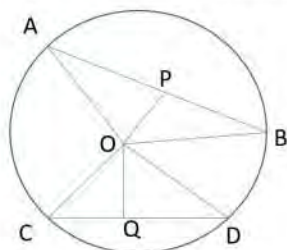
class interval	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49	50 - 54
frequency	5	15	23	20	10	7

### Section E

36. Read the text carefully and answer the questions:

[4]

Rohan draws a circle of radius 10 cm with the help of a compass and scale. He also draws two chords, AB and CD in such a way that the perpendicular distance from the center to AB and CD are 6 cm and 8 cm respectively. Now, he has some doubts that are given below.



- Show that the perpendicular drawn from the Centre of a circle to a chord bisects the chord.
- What is the length of CD?
- What is the length of AB?

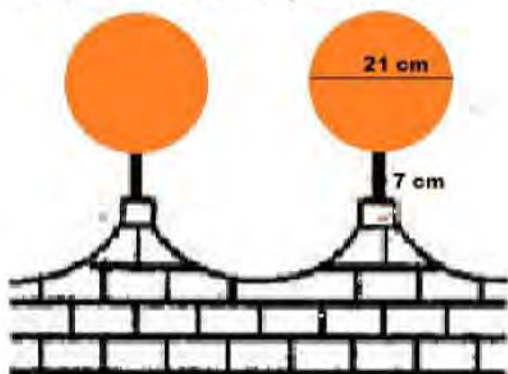
OR

How many circles can be drawn from given three noncollinear points?

37. Read the text carefully and answer the questions:

[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.



- what will be the total surface area of the spheres all around the wall?
- Find the cost of orange paint required if this paint costs 20 paise per  $\text{cm}^2$ .

OR

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

- How much orange paint in liters is required for painting the supports if the paint required is 3 ml per  $\text{cm}^2$ ?

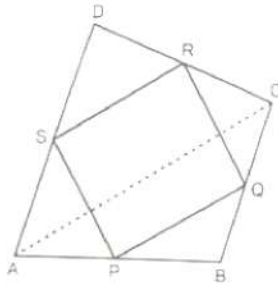
38. Read the text carefully and answer the questions:

[4]

Modern curricula include several problem-solving strategies. Teachers model the process, and students work independently to copy it. Sheela Maths teacher of class 9<sup>th</sup> wants to explain the properties of parallelograms in a creative way, so she gave students colored paper in the shape of a quadrilateral and then ask the students to make



a parallelogram from it by using paper folding.



- (i) How can a parallelogram be formed by using paper folding?
- (ii) If  $\angle RSP = 30^\circ$ , then find  $\angle RQP$ .

**OR**

If  $SP = 3$  cm, Find the  $RQ$ .

- (iii) If  $\angle RSP = 50^\circ$ , then find  $\angle SPQ$ ?

# Solution

## CBSE SAMPLE PAPER - 08

### Class 09 - Mathematics

#### Section A

1. (c)  $\frac{1}{2}$

**Explanation:**  $\left\{ 8^{\frac{-4}{3}} \div 2^{-2} \right\}^{\frac{1}{2}}$

$$= \left[ (2^3)^{\frac{-4}{3}} \div 2^{-2} \right]^{\frac{1}{2}}$$

$$= \left[ 2^{3 \times \frac{-4}{3}} \div 2^{-2} \right]^{\frac{1}{2}}$$

$$= \left[ 2^{-4} \div 2^{-2} \right]^{\frac{1}{2}}$$

$$= \left[ 2^{-4 - (-2)} \right]^{\frac{1}{2}}$$

$$= \left[ 2^{-4+2} \right]^{\frac{1}{2}}$$

$$= \left[ 2^{-2} \right]^{\frac{1}{2}}$$

$$= \left( \frac{1}{2^2} \right)^{\frac{1}{2}}$$

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

$$= \frac{1}{2}$$

2. (a) Remains the same

**Explanation:** If for any c, where c is any natural number

Like addition and subtraction we can multiply and divide both sides of an equation by a number, c, without changing the equation, where c is any natural number.

3. (a) (+, +)

**Explanation:** The signs of abscissa and ordinate of a point in quadrant I are both +ve i.e. (+, +)

4. (c) 2

**Explanation:** Adjusted frequency =  $\left( \frac{\text{frequency of the class}}{\text{width of the class}} \right) \times 5$

Therefore, Adjusted frequency of 25 - 45 =  $\frac{8}{20} \times 5 = 2$

5. (c) a point

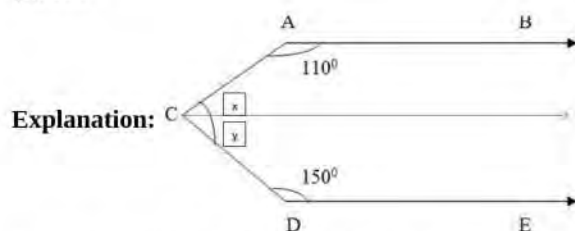
**Explanation:**  $x - 2 = 0$

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

6. (b) C is an interior point of AB such that  $\overrightarrow{AC} = \overrightarrow{CB}$

**Explanation:** A point C is called the midpoint of line segment  $\overrightarrow{AB}$ , if C is an interior point of  $\overrightarrow{AB}$  such that  $\overrightarrow{AC} = \overrightarrow{CB}$

7. (b)  $100^\circ$



$x + 110^\circ = 180^\circ$  (Supplementary angles)

$x = 70^\circ$



$$y + 150^\circ = 180^\circ \text{ (Supplementary angles)}$$

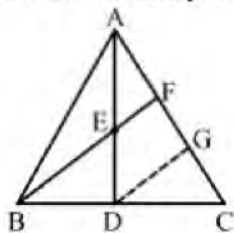
$$y = 30^\circ$$

$$\angle ACD = 70^\circ + 30^\circ = 100^\circ$$

8. (a)  $\frac{1}{3} AC$

**Explanation:**

Let G be the mid-point of FC and join DG



In  $\triangle BCF$ ,

G is the mid-point of FC and D is the mid-point of BC

Thus,  $DG \parallel BF$

$DG \parallel EF$

Now, In  $\triangle ADG$ ,

E is the mid-point of AD and EF is parallel to DG.

Thus, F is the mid-point of AG.

$AF = FG = GC$  [G is the mid-point of FC]

Hence,  $AF = \frac{1}{3} AC$

9. (b) 1

**Explanation:**  $\frac{0.75 \times 0.75 \times 0.75 + 0.25 \times 0.25 \times 0.25}{0.75 \times 0.75 - 0.75 \times 0.25 + 0.25 \times 0.25}$

$$= \frac{(0.75)^3 + (0.25)^3}{(0.75)^2 - 0.75 \times 0.25 + (0.25)^2}$$

$$= \frac{(0.75 + 0.25) [(0.75)^2 - 0.75 \times 0.25 + (0.25)^2]}{(0.75)^2 - 0.75 \times 0.25 + (0.25)^2}$$

$$= 0.75 + 0.25$$

$$= 1$$

10. (b)  $1.x + 0.y = 7$

**Explanation:** The equation  $x = 7$  in two variables can be written as exactly  $1.x + 0.y = 7$

because it contains two variables  $x$  and  $y$  and coefficient of  $y$  is zero as there is no term containing  $y$  in equation  $x = 7$

11. (b) SAS

**Explanation:** In  $\triangle ABD$  and  $\triangle ADC$ , we have

$AB = AC$  (Given)

$\angle BAD = \angle DAC$  (Since AD, bisects  $\angle A$ )

$AD = AD$  (common in both)

Hence,  $\triangle ABD \cong \triangle ACD$  by SAS

12. (b)  $56^\circ$

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

$$\text{angle C} = 3 (38) = 114^\circ$$

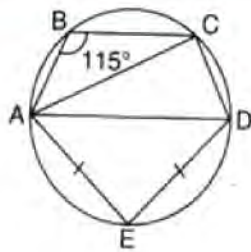
$$\text{angle D} = 4 (38) = 152^\circ$$

$$\text{So, } 38^\circ + \text{angle B} + 114^\circ + 152^\circ = 360^\circ$$

$$\text{angle B} = 360^\circ - 304^\circ = 56^\circ$$

13. (c)  $70^\circ$

**Explanation:**



Since,  $AE = DE$ ,

therefore,  $\angle DAE = \angle ADE = 45^\circ$  (In  $\triangle AED$ ,  $\angle E = 90^\circ$  And other two angles are equal.)

Now,  $BADC$  is a cyclic quadrilateral,

$$\Rightarrow \angle B + \angle D = 180^\circ$$

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

$$\Rightarrow \angle CDA = \angle D = 65^\circ$$

Also,  $\angle ACD = 90^\circ$  (Angle in a semicircle)

So, we have:-

In  $\triangle ACD$ ,

$$\Rightarrow \angle CAD + \angle ACD + \angle CDA = 180^\circ$$

$$\Rightarrow \angle CAD + 90^\circ + 65^\circ = 180^\circ$$

$$\Rightarrow \angle CAD = 25^\circ$$

Finally,

$$\angle CAE = \angle CAD + \angle DAE = 25^\circ + 45^\circ = 70^\circ$$

14. (c)  $\frac{1}{2}$

**Explanation:**  $(256)^{-\left(\frac{-3}{4 \cdot 2}\right)}$

$$= (256)^{-\left(2^2\right)^{\frac{-3}{2}}}$$

$$= (256)^{-\left(2\right)^{2 \times \frac{-3}{2}}}$$

$$= (256)^{-\left(2\right)^{-3}}$$

$$= (256)^{-\left(\frac{1}{2}\right)^3}$$

$$= (256)^{-\left(\frac{1}{8}\right)}$$

$$= (2^8)^{-\left(\frac{1}{8}\right)}$$

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

$$= 2^{-1}$$

$$= \frac{1}{2}$$

15. (c) at most  $n$  zeroes

**Explanation:** A polynomial of degree  $n$  has at most  $n$  zeroes because the degree of a polynomial is equal to the zeroes of that polynomial only.

16. (d) SAS

**Explanation:** In  $\triangle DBC$  and  $\triangle AEF$ , we have

$AB = FC$  (given) by adding  $BF$  on both sides

$AF = CB$

$\angle AFE = \angle CBD$  (given)

$EF = BD$  (given)

Hence,  $\triangle AFE \cong \triangle CBD$  by SAS as the corresponding sides and their included angles are equal.

17. (b) 35

**Explanation:**  $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

$$\text{Hence, } 9^2 = a^2 + b^2 + c^2 + 2 \times 23$$

$$\Rightarrow a^2 + b^2 + c^2 = 35$$

18. (d) 100%

**Explanation:** Let the radius of the cone is  $r$  and height is  $h$  then

$$\text{Volume of the cone} = \frac{1}{3}\pi r^2 h$$

If the height of the cone is double the

$$\text{New volume} = \frac{1}{3}\pi r^2 (2h) = \frac{2}{3}\pi r^2 h$$

$$\text{Increment of the volume} = \frac{2}{3}\pi r^2 h - \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi r^2 h$$

$$\% \text{ increase} = \frac{\frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi r^2 h} \times 100 = 100\%$$

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

**Explanation:** Assertion: Area of  $\triangle = \frac{1}{2} \times \text{base} \times \text{height}$

$$72 = \frac{1}{2} \times 18 \times b$$

$$b = \frac{72 \times 2}{18} = 8 \text{ cm}$$

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

$$\text{L.H.S} = 1 + 1 = 2 = \text{R.H.S}$$

$$\text{L.H.S} = \text{R.H.S}$$

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

### Section B

21. The perimeter of the given equilateral triangle = 60 cm

As every side of the equilateral triangle is equal.

$$\text{Length of each of its sides} = a = \frac{60}{3} \text{ cm} = 20 \text{ cm}$$

$$\text{Area of the triangle} = \left( \frac{\sqrt{3}}{4} \times a^2 \right) \text{ sq units}$$

$$= \left( \frac{\sqrt{3}}{4} \times 20 \times 20 \right) \text{ cm}^2$$

$$= (100 \times \sqrt{3}) \text{ cm}^2$$

$$= (100 \times 1.732) \text{ cm}^2$$

$$= 173.2 \text{ cm}^2$$

Hence, the area of the given triangle is  $173.2 \text{ cm}^2$ .

$$22. g(x) = 3x^2 - 2, x = \frac{2}{\sqrt{3}}, -\frac{2}{\sqrt{3}}$$

We know that

$$g(x) = 3x^2 - 2$$

Given that,

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

$$\text{Substitute } x = \frac{2}{\sqrt{3}} \text{ in } g(x)$$

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

$$= 3\left(\frac{4}{3}\right) - 2$$

$$= 4 - 2$$

$$= 2 \neq 0$$

$$\text{Now, Substitute } x = -\frac{2}{\sqrt{3}} \text{ in } g(x)$$

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

$$= 3\left(\frac{4}{3}\right) - 2$$

$$= 4 - 2$$

$$= 2 \neq 0$$

Therefore, we conclude that,

$$x = \left( \frac{2}{\sqrt{3}}, \frac{-2}{\sqrt{3}} \right) \text{ are not zeros of } g(x)$$

23. Slant height ( $l$ ) = 25 m

$$\text{Base diameter (d)} = 14 \text{ m}$$

$$\therefore \text{Base radius (r)} = \frac{14}{2} \text{ m} = 7 \text{ m}$$

∴ Curved surface area of the tomb =  $\pi rl$

$$= \frac{22}{7} \times 7 \times 25 = 550 \text{ m}^2$$

∴ Cost of white-washing the curved surface of the tomb at the rate of Rs. 210 per 100 m<sup>2</sup>

$$= \frac{210}{100} \times 550 = \text{Rs. } 1155.$$

24. Using identity,

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$$

$$(2x + p - c)^2 - (2x - p + c)^2$$

$$= \{(2x)^2 + (p)^2 + (-c)^2 + 2(2x)(p) + 2(p)(-c) + 2(2x)(-c)\} - \{(2x)^2 + (-p)^2 + (c)^2 + 2(2x)(-p) + 2(-p)(c) + 2(2x)(c)\}$$

$$= (4x^2 - 4x^2 + p^2 - p^2 + c^2 - c^2 + 4xp + 4xp - 2pc + 2pc - 4xc - 4xc)$$

$$= 8xp - 8xc$$

OR

$$p(x) = x^3 - 4x^2 + x + 6, g(x) = x - 3$$

We know that according to the factor theorem,  $(x - a)$  is a factor of  $p(x)$ , if  $p(a) = 0$ .

We can conclude that  $g(x)$  is a factor of  $p(x)$ , if  $p(3) = 0$ .

$$p(3) = (3)^3 - 4(3)^2 + (3) + 6$$

$$= 27 - 36 + 3 + 6$$

$$= 0$$

Therefore, we conclude that the  $g(x)$  is a factor of  $p(x)$ .

25. Given,  $-4x + 3y = 12$  .....(1)

Put value of  $x = 0$  in equation (1), we get

$$\Rightarrow 0 + 3y = 12$$

$$\Rightarrow y = 4$$

Thus,  **$x = 0$  and  $y = 4$  is a solution**

put value of  $y = 0$  in equation (1), we get

$$\Rightarrow -4x + 0 = 12$$

$$\Rightarrow x = -3$$

Thus,  **$x = -3$  and  $y = 0$  is a solution**

OR

$$2x + y = 7$$

$$\Rightarrow y = 7 - 2x$$

$$\text{Put } x = 0, \text{ we get } y = 7 - 2(0) = 7 - 0 = 7$$

$$\text{Put } x = 1, \text{ we get } y = 7 - 2(1) = 7 - 2 = 5$$

$$\text{Put } x = 2, \text{ we get } y = 7 - 2(2) = 7 - 4 = 3$$

$$\text{Put } x = 3, \text{ we get } y = 7 - 2(3) = 7 - 6 = 1$$

∴ Four solutions are (0, 7), (1, 5), (2, 3) and (3, 1).

### Section C

$$26. 3\sqrt{48} - \frac{5}{2}\sqrt{\frac{1}{3}} + 4\sqrt{3}$$

$$= 3\sqrt{16 \times 3} - \frac{5}{2}\sqrt{\frac{3}{3 \times 3}} + 4\sqrt{3}$$

$$= 3 \times 4\sqrt{3} - \frac{5}{2} \cdot \frac{1}{3}\sqrt{3} + 4\sqrt{3}$$

$$= 12\sqrt{3} - \frac{5}{6}\sqrt{3} + 4\sqrt{3}$$

$$= \left(12 - \frac{5}{6} + 4\right)\sqrt{3} = \left(16 - \frac{5}{6}\right)\sqrt{3}$$

$$= \frac{91}{6}\sqrt{3}$$

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

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

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

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

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

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

$$(4a - 3b)^3$$

Therefore, after factorizing the expression  $64a^3 - 27b^3 - 144a^2b + 108ab^2$  we get  $(4a - 3b)^3$



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

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

$$\begin{aligned}\text{Area of the triangle} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{132(132-122)(132-120)(132-22)} \\ &= \sqrt{132 \times 10 \times 12 \times 110} \\ &= 1320 \text{ m}^2\end{aligned}$$

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

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

$$\begin{aligned}\text{Area of the triangle} &= \sqrt{36(36-22)(36-24)(36-26)} \\ &= \sqrt{36 \times 14 \times 12 \times 10} \\ &= 24\sqrt{105} \\ &= 24 \times 10.25 \text{ m}^2 \text{ (approx.)} \\ &= 246 \text{ cm}^2\end{aligned}$$

Therefore, the area of the shaded portion.

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

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

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

OR

'a' = a, 'b' = a and 'c' = a.

$$\therefore s = \frac{'a'+'b'+'c'}{2} = \frac{a+a+a}{2} = \frac{3a}{2}$$

$\therefore$  Area of the signal board

$$\begin{aligned}&= \sqrt{s(s-a')(s-b')(s-c')} \\ &= \sqrt{\frac{3a}{2} \left( \frac{3a}{2} - a \right) \left( \frac{3a}{2} - a \right) \left( \frac{3a}{2} - a \right)} \\ &= \sqrt{\frac{3a}{2} \left( \frac{a}{2} \right) \left( \frac{a}{2} \right) \left( \frac{a}{2} \right)} = \sqrt{\frac{3a^4}{16}} = \frac{\sqrt{3}}{4} a^2\end{aligned}$$

Perimeter = 180 cm

'a' + 'b' + 'c' = 180

$$\therefore a + a + a = 180$$

$$\therefore 3a = 180$$

$$\therefore a = 60 \text{ cm.}$$

$$\therefore \text{Area of the signal board} = \frac{\sqrt{3}}{4} a^2$$

$$= \frac{\sqrt{3}}{4} (60)^2 = 900\sqrt{3} \text{ cm}^2$$

Alternatively,

$$s = \frac{3a}{2} = \frac{3}{2} (60) = 90 \text{ cm}$$

Area of the signal board

$$\begin{aligned}&= \sqrt{s(s-a')(s-b')(s-c')} \\ &= \sqrt{90(90-60)(90-60)(90-60)} \\ &= \sqrt{90(30)(30)(30)} \\ &= 900\sqrt{3} \text{ cm}^2\end{aligned}$$

29.  $3x + 2y = 6$

Put  $y = 0$ , we get

$$3x + 2(0) = 6$$

$$\Rightarrow 3x = 6$$

$$\Rightarrow x = \frac{6}{3} = 2$$

$\therefore (2, 0)$  is a solution.

$$3x + 2y = 6$$

put  $x = 0$ , we get

$$3(0) + 2y = 6$$

$$\Rightarrow 2y = 6$$

$$\Rightarrow y = \frac{6}{2} = 3$$

$\therefore (0, 3)$  is a solution.

$$5x + 2y = 10$$

Put  $y = 0$ , we get

$$5x + 2(0) = 10$$

$$\Rightarrow 5x = 10$$

$$\Rightarrow x = \frac{10}{5} = 2$$

$\therefore (2, 0)$  is a solution.

$$5x + 2y = 10$$

Put  $x = 0$ , we get

$$5(0) + 2y = 10$$

$$\Rightarrow 2y = 10$$

$$\Rightarrow y = \frac{10}{2} = 5$$

$\therefore (0, 5)$  is a solution.

The given equations have a common solution  $(2, 0)$ .

30. Given that in a  $\triangle ABC$ ,  $D$  is the midpoint of  $BC$  and  $DL \perp AB$  and  $DM \perp AC$  also,  $DL = DM$

To prove  $AB = AC$

Proof: IN right-angled triangles  $\triangle BLD$  and  $\triangle CMD$

$$\angle BLD = \angle CMD = 90^\circ$$

$$BD = CD$$

$$DL = DM$$

Thus, by right angle hypotenuse side criterion of congruence, we have

$$\triangle BLD \cong \triangle CMD$$

The corresponding parts of the congruent triangles are equal.

$$\angle ABD = \angle ACD$$

In  $\triangle ABC$ , we have

$$\Rightarrow AB = AC$$

sides opposite to equal angles are equal

OR

In  $\triangle PQS$  and  $\triangle RQS$ ,

$$PQ = RQ \text{ ...[Given]}$$

$$QS = QS \text{ ...[Common]}$$

$$\angle PQT = \angle RQU \text{ and } \angle TQS = \angle UQS \text{ ...[Given]}$$

$$\angle PQT + \angle TQS = \angle RQU + \angle UQS \text{ ...[By addition]}$$

$$\therefore \angle PQS = \angle RQS$$

$$\therefore \triangle PQS \cong \triangle RQS \text{ ...[By SAS property]}$$

$$\therefore \angle QPS = \angle QRS \text{ ...[c.p.c.t.]}$$

$$\Rightarrow \angle QPT = \angle QRU$$

In  $\triangle PQT$  and  $\triangle RQU$ ,

$$PQ = RQ \text{ and } \angle PQT = \angle RQU \text{ ...[Given]}$$

$$\angle QPT = \angle QRU \text{ ...[As proved]}$$

$$\therefore \triangle PQT \cong \triangle RQU \text{ ...[By ASA property]}$$

$$\therefore QT = QU \text{ ...[c.p.c.t.]}$$

31. i. The Co-ordinate of point  $A$  is  $(0, 2)$ ,  $B$  is  $(2, 0)$ ,  $C$  is  $(0, -2)$  and  $D$  is  $(-2, 0)$ .  
ii. If we joined them we get square.  
iii. Co-ordinate of intersection point of  $AC$  and  $BD$  is  $(0, 0)$ .

#### Section D

32. We know that

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

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

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

$$\begin{aligned}
&\Rightarrow \frac{(3)^{2n+2} \times 3^n - (3)^{3n}}{3^{3m} \times 2^3} = \frac{1}{3^3} \\
&\Rightarrow \frac{(3)^{2n+2+n} - (3)^{3n}}{3^{3m} \times 2^3} = \frac{1}{3^3} \\
&\Rightarrow \frac{(3)^{3n+2} - (3)^{3n}}{3^{3m} \times 2^3} = \frac{1}{3^3} \\
&\Rightarrow 3^3 \times [(3)^{3n+2} - (3)^{3n}] = 3^{3m} \times 2^3 \\
&\Rightarrow 3^{3+3n} \times [(3)^2 - 1] = 3^{3m} \times 2^3 \\
&\Rightarrow 3^{3+3n} \times [8] = 3^{3m} \times 2^3 \\
&\Rightarrow 3^{3+3n} \times 2^3 = 3^{3m} \times 2^3 \\
&\Rightarrow 3^{3+3n} = 3^{3m} \\
&\Rightarrow 3+3n = 3m \\
&\Rightarrow 3m - 3n = 3 \\
&\Rightarrow m - n = 1
\end{aligned}$$

OR

We have  $a = \frac{3+\sqrt{5}}{2}$

$$\begin{aligned}
&\Rightarrow a^2 = \frac{(3+\sqrt{5})^2}{4} \\
&= \frac{9+5+6\sqrt{5}}{4} = \frac{14+6\sqrt{5}}{4} = \frac{7+3\sqrt{5}}{2}
\end{aligned}$$

Now,  $\frac{1}{a^2} = \frac{2}{7+3\sqrt{5}} = \frac{2}{7+3\sqrt{5}} \times \frac{7-3\sqrt{5}}{7-3\sqrt{5}} = \frac{2(7-3\sqrt{5})}{(7)^2 - (3\sqrt{5})^2}$

$$\begin{aligned}
&= \frac{2(7-3\sqrt{5})}{49-45} = \frac{2(7-3\sqrt{5})}{4} = \frac{7-3\sqrt{5}}{2} \\
\therefore a^2 + \frac{1}{a^2} &= \frac{7+3\sqrt{5}}{2} + \frac{7-3\sqrt{5}}{2} \\
&= \frac{7+3\sqrt{5}+7-3\sqrt{5}}{2} = \frac{14}{2} = 7
\end{aligned}$$

33. We need to prove that every line segment has one and only one mid-point. Let us consider the given below line segment AB and assume that C and D are the mid-points of the line segment AB



If C is the mid-point of line segment AB, then

$$AC = CB.$$

An axiom of the Euclid says that "If equals are added to equals, the wholes are equal."

$$AC + AC = CB + AC \dots (i)$$

From the figure, we can conclude that  $CB + AC$  will coincide with AB.

An axiom of the Euclid says that "Things which coincide with one another are equal to one another."  $AC + AC = AB \dots (ii)$

An axiom of the Euclid says that "Things which are equal to the same thing are equal to one another."

Let us compare equations (i) and (ii), to get

$$AC + AC = AB, \text{ or } 2AC = AB. (iii)$$

If D is the mid-point of line segment AB, then

$$AD = DB.$$

An axiom of the Euclid says that "If equals are added to equals, the wholes are equal."

$$AD + AD = DB + AD \dots (iv)$$

From the figure, we can conclude that  $DB + AD$  will coincide with AB.

An axiom of the Euclid says that "Things which coincide with one another are equal to one another."

$$AD + AD = AB \dots (v)$$

An axiom of the Euclid says that "Things which are equal to the same thing are equal to one another."

Let us compare equations (iv) and (v), to get

$$AD + AD = AB, \text{ or }$$

$$2AD = AB \dots (vi)$$

An axiom of the Euclid says that "Things which are equal to the same thing are equal to one another." Let us compare equations (iii) and (vi), to get

$$2AC = 2AD.$$

An axiom of the Euclid says that "Things which are halves of the same things are equal to one another."  $AC = AD.$

Therefore, we can conclude that the assumption that we made previously is false and a line segment has one and only one mid-point.



34. Through O, draw  $EO \parallel AB \parallel CD$

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

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

$\therefore \angle ABO + \angle BOE = 180^\circ$  [consecutive interior angles]

$$\Rightarrow 40^\circ + \angle BOE = 180^\circ$$

$$\Rightarrow \angle BOE = (180^\circ - 40^\circ) = 140^\circ$$

$$\Rightarrow \angle BOE = 140^\circ$$

Again  $CD \parallel EO$  and  $OD$  is the transversal.

$$\therefore \angle EOD + \angle ODC = 180^\circ$$

$$\Rightarrow \angle EOD + 35^\circ = 180^\circ$$

$$\Rightarrow \angle EOD = (180^\circ - 35^\circ) = 145^\circ$$

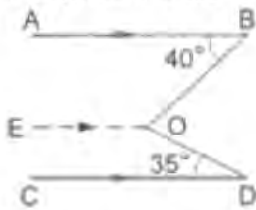
$$\Rightarrow \angle EOD = 145^\circ$$

$$\therefore \text{reflex } \angle BOD = x^\circ = (\angle BOE + \angle EOD)$$

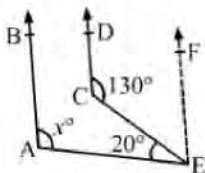
$$= (140^\circ + 145^\circ) = 285^\circ$$

Hence,  $x^\circ = 285^\circ$

$$\Rightarrow \angle BOD = x^\circ = 285^\circ$$



OR



Draw  $EF \parallel AB \parallel CD$

$EF \parallel CD$  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  $EF \parallel AB$  and  $AE$  is the transversal

Then,

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

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

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

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

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

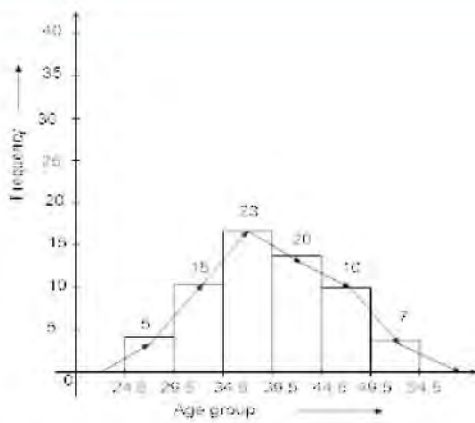
35. The given frequency distribution is not continuous. So we shall first convert it into a continuous frequency distribution.

The difference between the lower limit of a class and the upper limit of the preceding class is 1 i.e.  $h=1$ .

To convert the given frequency distribution into continuous frequency distribution, we subtract  $\frac{h}{2}$  from lower limit and Add  $\frac{h}{2}$  to upper limit  $\therefore \frac{h}{2} = 0.5$  limit.

class interval	24.5 - 29.5	29.5 - 34.5	34.5 - 39.5	39.5 - 44.5	44.5 - 49.5	49.5 - 54.5
frequency	5	15	23	20	10	7

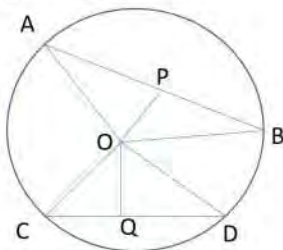




### Section E

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

Rohan draws a circle of radius 10 cm with the help of a compass and scale. He also draws two chords, AB and CD in such a way that the perpendicular distance from the center to AB and CD are 6 cm and 8 cm respectively. Now, he has some doubts that are given below.



(i) In  $\triangle AOP$  and  $\triangle BOP$

$$\angle APO = \angle BPO \text{ (Given)}$$

$$OP = OP \text{ (Common)}$$

$$AO = OB \text{ (radius of circle)}$$

$$\triangle AOP \cong \triangle BOP$$

$$AP = BP \text{ (CPCT)}$$

(ii) In right  $\triangle COQ$

$$CO^2 = OQ^2 + CQ^2$$

$$\Rightarrow 10^2 = 8^2 + CQ^2$$

$$\Rightarrow CQ^2 = 100 - 64 = 36$$

$$\Rightarrow CQ = 6$$

$$CD = 2CQ$$

$$\Rightarrow CD = 12 \text{ cm}$$

(iii) In right  $\triangle AOB$

$$AO^2 = OP^2 + AP^2$$

$$\Rightarrow 10^2 = 6^2 + AP^2$$

$$\Rightarrow AP^2 = 100 - 36 = 64$$

$$\Rightarrow AP = 8$$

$$AB = 2AP$$

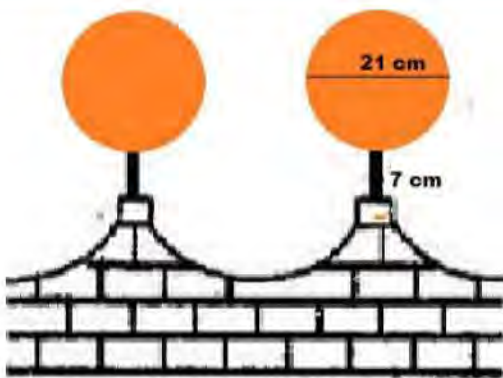
$$\Rightarrow AB = 16 \text{ cm}$$

OR

There is one and only one circle passing through three given non-collinear points.

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

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

The surface area of 25 wooden spares

$$= 25 \times 4\pi R^2$$

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

$$= 138,600 \text{ cm}^2$$

- (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

$$= 25 \times 4\pi R^2$$

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

$$= 138,600 \text{ cm}^2$$

The cost of orange paint = 20 paise per  $\text{cm}^2$

Thus total cost

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

OR

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

$$V = 25 \times \frac{4}{3} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^3$$

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

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

$$= 121275 \text{ cm}^3$$

- (iii) Radius of a wooden sphere  $r = 4$  cm.

Height of support (h) = 7 cm

The surface area of 25 supports

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

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

$$= 8800 \text{ cm}^2$$

The cost of orange paint = 10 paise per  $\text{cm}^2$

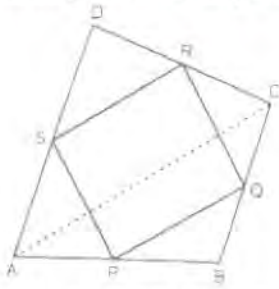
Thus total cost

$$= 0.1 \times 8800 = ₹ 880$$

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

Modern curricula include several problem-solving strategies. Teachers model the process, and students work independently to copy it. Sheela Maths teacher of class 9<sup>th</sup> wants to explain the properties of parallelograms in a creative way, so she gave students

colored paper in the shape of a quadrilateral and then ask the students to make a parallelogram from it by using paper folding.



- (i) By joining mid points of sides of a quadrilateral one can make parallelogram.

S and R are mid points of sides AD and CD of  $\triangle ADC$ , P and Q are mid points of sides AB and BC of  $\triangle ABC$ , then by mid-point theorem  $SR \parallel AC$  and  $SR = \frac{1}{2} AC$  similarly  $PQ \parallel AC$  and  $PQ = \frac{1}{2} AC$ .

Therefore  $SR \parallel PQ$  and  $SR = PQ$

A quadrilateral is a parallelogram if a pair of opposite sides is equal and parallel.

Hence PQRS is parallelogram.

- (ii)  $\angle RQP = 30^\circ$ , Opposite angles of a parallelogram are equal.

OR

$RQ = 3 \text{ cm}$

Opposite side of a parallelogram are equal.

- (iii) Adjacent angles of a parallelogram are supplementary.

Thus,  $\angle RSP + \angle SPQ = 180^\circ$

$$50^\circ + \angle SPQ = 180^\circ$$

$$\angle SPQ = 180^\circ - 50^\circ$$

$$= 130^\circ$$