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 π =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

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

a) infinitely many lines

b) two lines

c) a point

d) a line

6. A point C is called the midpoint of a line segment $\overrightarrow{AB}$ if **[1]**

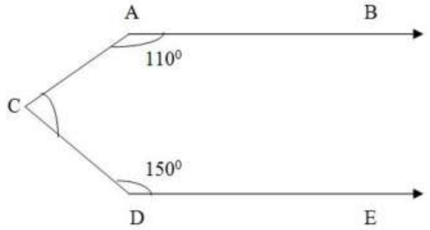
a) AC + CB = AB

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

c) C is an interior point of AB

d) $\overrightarrow{AC} = \overrightarrow{CB}$

7. In the adjoining figure, if AB || DE, then the measure of $\angle$ACD is :- **[1]**



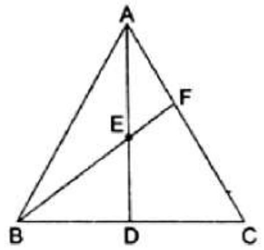
a) 90°

b) 100^0

c) 80°

d) 70°

8. In the given figure, AD is a median of $\triangle$ABC and E is the midpoint of AD. If BE is joined and produced to meet AC in F then AF = ? **[1]**



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

b) $\frac{3}{4}AC$

c) $\frac{2}{3}AC$

d) $\frac{1}{2}AC$

9. The value of $\frac{0.75\times0.75\times0.75+0.25\times0.25\times0.25}{0.75\times0.75-0.75\times0.25+0.25\times0.25}$ is **[1]**

a) 0

b) 1

c) 2

d) -1

10. The equation x = 7 in two variables can be written as **[1]**

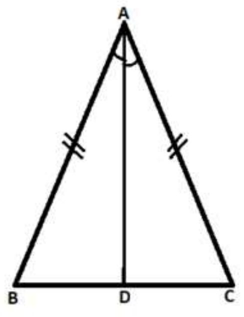
a) 1.x + 1.y = 7

b) 1.x + 0.y = 7

c) 0.x + 1.y = 7

d) 0.x + 0.y = 7

11. In the adjoining figure, AB = AC and AD is bisector of $\angle$A. The rule by which $\triangle ABD \cong \triangle ACD$ **[1]**



a) SSS

b) SAS

c) AAS

d) ASA

12. In Quadrilateral $\angle A = 38°$, $\angle C = 3\angle A$, $\angle D = 4\angle A$. Find the value of $\angle B$? **[1]**

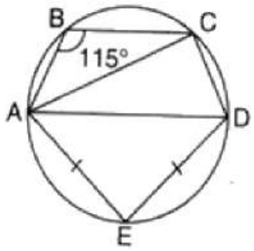
a) 57^o

b) 56^o

c) 80^o

d) 55^o

13. In the given figure, AD is the diameter of the circle and AE = DE. If $\angle ABC = 115^o$, then the measure of $\angle CAE$ is **[1]**



a) 60^o

b) 80^o

c) 70^o

d) 90^o

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]**

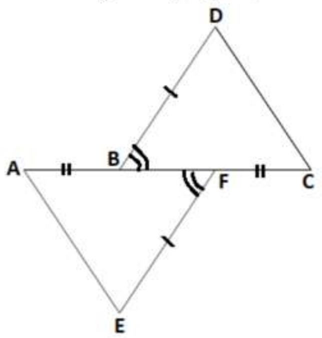
a) one zero

b) n zeroes

c) at most n zeroes

d) at least n zeroes

16. In the adjoining figure, AB = FC, EF = BD and ∠AFE = ∠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 cm^2. Its base is 8 cm. **[1]**

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

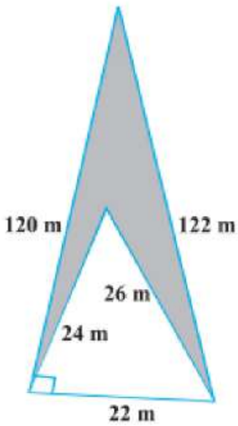
Section C

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]**



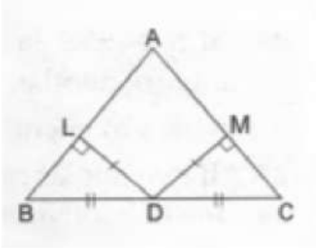
OR

A traffic signal board, indicating 'SCHOOLAHEAD', 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]**

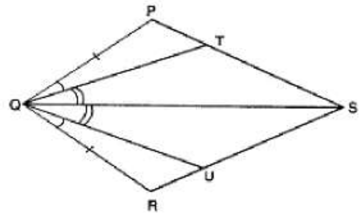
3x + 2y = 6 and 5x + 2y = 10

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

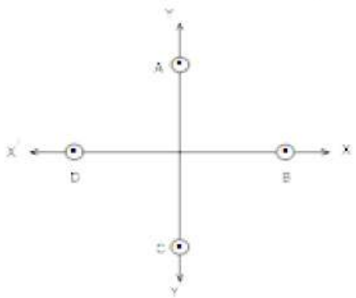


OR

In figure, PQRS is a quadrilateral and T and U are respectively points on PS and RS such that PQ = RQ, ∠PQT = ∠RQU and ∠TQS = ∠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

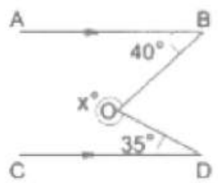
32. If $\frac{9^n \times 3^2 \times \left(3^{-n/2}\right)^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$, prove that m - n = 1. **[5]**

OR

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

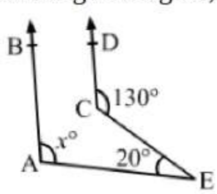
33. In a line segment AB point C is called a mid-point of line segment AB, prove that every line segment has one and only one mid-point. **[5]**

34. In the given figure, AB || CD, $\angle ABO = 40^\circ$, $\angle CDO = 35^\circ$. Find the value of the reflex ∠BOD and hence the value of x. **[5]**



OR

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



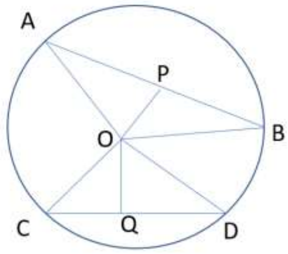
35. Draw a histogram with frequency polygon for the following data: **[5]**

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.



(i) Show that the perpendicular drawn from the Centre of a circle to a chord bisects the chord.

(ii) What is the length of CD?

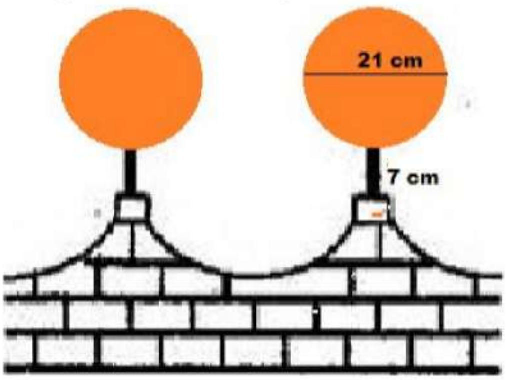
(iii) What is the length of AB?

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.



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

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

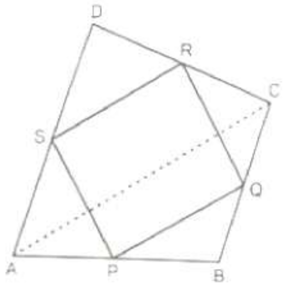
OR

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

(iii) How much orange paint in liters is required for painting the supports if the paint required is 3 ml per 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^{th} 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 $\angle RSP = 30^o$, then find $\angle RQP$.

OR

If SP = 3 cm, Find the RQ.

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

Solution

CBSE SAMPLE PAPER - 08

Class 09 - Mathematics

Section A

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

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

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

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

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

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

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

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

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

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

= $\frac{1}{2}$

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

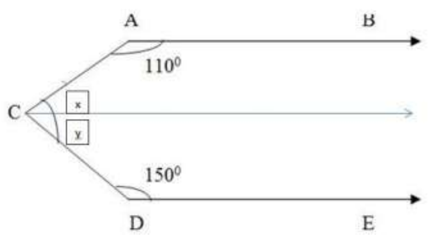
x = 2 is a point on the number line

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)** 100^0

Explanation:



x + 110° = 180° (Supplimentary angles)

x = 70°

y + 150° = 180° (Supplimentary angles)

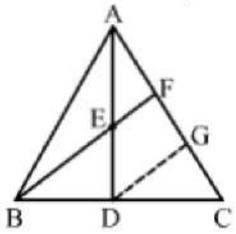
y = 30°

∠ACD = 70° + 30° = 100°

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

Explanation:

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



In ΔBCF,

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

Thus, DG|| BF

DG || EF

Now, In Δ 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: $\frac{0.75\times0.75\times0.75+0.25\times0.25\times0.25}{0.75\times0.75-0.75\times0.25+0.25\times0.25}$

$= \frac{(0.75)^3+(0.25)^3}{(0.75)^2-0.75\times0.25+(0.25)^2}$

$= \frac{(0.75+0.25)\left[(0.75)^2-0.75\times0.25+(0.25)^2\right]}{(0.75)^2-0.75\times0.25+(0.25)^2}$

= 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 contain two variable 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)

∠BAD = ∠DAC (Since AD, bisects ∠A)

AD = AD (common in both)

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

12. **(b)** 56^o

Explanation: angle A + angle B + angle C + angle D = 360^o (angle sum property)

angle C = 3 (38) = 114^o

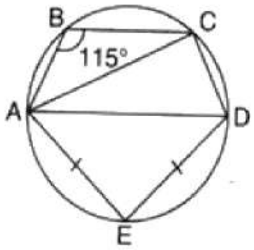
angle D = 4 (38) = 152^o

So, 38^o + angle B + 114^o + 152^o = 360^o

angle B = 360^o - 304^o = 56^o

13. **(c)** 70^o

Explanation:



Since, AE = DE,

therefore, $\angle DAE = \angle ADE = 45^0$ (In $\Delta AED, \angle E = 90^0$ And other two angles are equal.)

Now, BADC is a cyclic quadrilateral,

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

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

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

Also, $\angle ACD = 90^0$ (Angle in a semicircle)

So, we have:-

In $\triangle$ACD,

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

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

$\Rightarrow \angle CAD = 25^o$

Finally,

$\angle CAE = \angle CAD + \angle DAE = 25^0 + 45^0 = 70^0$

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

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

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

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

$=(256)^{-(2)^{-3}}$

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

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

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

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

$= 2^{-1}$

$=\frac{1}{2}$

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

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

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

If the height of the cone is double the

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

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

% 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 $\triangle = \frac{1}{2} \times$ base $\times$ height

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

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

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. The perimeter of the given equilateral triangle = 60 cm

As every side of the equilateral triangle is equal.

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

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

Hence, the area of the given triangle is 173.2 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,

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

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

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

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

= 4 - 2

= 2 $\neq$ 0

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

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

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

= 4 - 2

= 2 $\neq$ 0

Therefore,we conclude that,

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

23. Slant height (l) = 25 m

Base diameter (d) = 14 m

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

∴ Curved surface area of the tomb = πrl

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

∴ Cost of white-washing the curved surface of the tomb at the rate of Rs. 210 per 100 m^2

$= \frac{210}{100} \times 550$ = 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, -4*x* +3*y* =12 .....(1)

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

⇒ 0 + 3y = 12

⇒ y = 4

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

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

⇒ -4x + 0 = 12

⇒ x = -3

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

OR

2x + y = 7

⇒ y = 7 – 2x

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

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

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

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

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

Section C

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

$=3\sqrt{16 \times 3} - \frac{5}{2}\sqrt{\frac{3}{3\times3}} + 4\sqrt{3}$

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

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

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

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

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

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

$(4a - 3b)^3$

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

28. 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

OR

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

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

∴ Area of the signal board

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

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

$= \sqrt{\frac{3a}{2}\left(\frac{a}{2}\right)\left(\frac{a}{2}\right)\left(\frac{a}{2}\right)} = \sqrt{\frac{3a^4}{16}} = \frac{\sqrt{3}}{4}a^2$

Perimeter = 180 cm

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

∴ a + a + a = 180

∴ 3a = 180

∴ a = 60 cm.

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

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

Alternatively,

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

Area of the signal board

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

$= \sqrt{90(90-60)(90-60)(90-60}$

$= \sqrt{90(30)(30(30)}$

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

29. 3x + 2y = 6

Put y = 0, we get

3x + 2(0) = 6

⇒ 3x = 6

⇒ $x = \frac{6}{3} = 2$

∴ (2, 0) is a solution.

3x + 2y = 6

put x = 0, we get

3(0) + 2y = 6

⇒ 2y = 6

⇒ $y = \frac{6}{2} = 3$

∴ (0, 3) is a solution.

5x+ 2y = 10

Put y = 0, we get

5x + 2(0) = 10

⇒ 5x = 10

⇒ $x = \frac{10}{5} = 2$

∴ (2, 0) is a solution.

5x + 2y = 10

Put x = 0, we get

5(0) + 2y = 10

⇒ 2y = 10

⇒ $y = \frac{10}{2} = 5$

∴ (0, 5) is a solution.

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

30. Given that in a $\triangle \mathrm{ABC}, \mathrm{D}$ 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 ΔBLD and ΔCMD

$\angle \mathrm{BLD} = \angle \mathrm{CMD} = 90^\circ$

BD = CD

DL = DM

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

$\Delta \mathrm{BLD} \cong \Delta \mathrm{CMD}$

The corresponding parts of the congruent triangled are equal.

$\angle \mathrm{ABD} = \angle \mathrm{ACD}$

In $\triangle \mathrm{ABC}$, we have

⇒ AB = AC

sides opposite to equal angles are equal

OR

In DPQS and DRQS,

PQ = RQ ...[Given]

QS = QS ...[Common]

∠PQT = ∠RQU and ∠TQS = ∠UQS ...[Given]

∠PQT + ∠TQS = ∠RQU + ∠UQS ...[By addition]

∴ ∠PQS = ∠RQS

∴ DPQS = DRQS ...[By SAS property]

∴ ∠QPS = ∠QRS ...[c.p.c.t.]

⇒ ∠QPT = ∠QRU

In DPQT and DRQU,

PQ = RQ and ∠PQT = ∠RQU ...[Given]

∠QPT = ∠QRU ...[As proved]

∴ DPQT ≅ DRQU ...[By ASA property]

∴ QT = QU ...[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

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

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

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

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

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

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

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

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

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

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

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

$\Rightarrow$ 3+3n = 3m

$\Rightarrow$ 3m - 3n = 3

$\Rightarrow$ m - n = 1

OR

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

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

$=\frac{9+5+6\sqrt{5}}{4}=\frac{14+6\sqrt{5}}{4}=\frac{7+3\sqrt{5}}{2}$

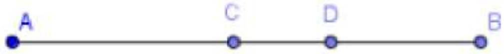
Now, $\frac{1}{a^{2}}=\frac{2}{7+3\sqrt{5}}=\frac{2}{7+3\sqrt{5}}\times\frac{7-3\sqrt{5}}{7-3\sqrt{5}}=\frac{2(7-3\sqrt{5})}{(7)^{2}-(3\sqrt{5})^{2}}$

$=\frac{2(7-3\sqrt{5})}{49-45}=\frac{2(7-3\sqrt{5})}{4}=\frac{7-3\sqrt{5}}{2}$

$\therefore a^{2}+\frac{1}{a^{2}}=\frac{7+3\sqrt{5}}{2}+\frac{7-3\sqrt{5}}{2}$

$=\frac{7+3\sqrt{5}+7-3\sqrt{5}}{2}=\frac{14}{2}=7$

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....(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....(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, 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....(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....(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, or

2AD = AB....(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 || AB || CD

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

Now, AB || 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 || EO and OD is the transversal.

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

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

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

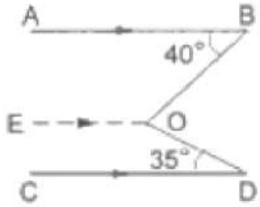
$\Rightarrow \angle EOD = 145^\circ$

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

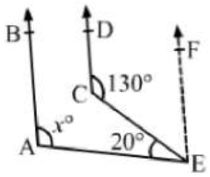
$= (140^\circ + 145^\circ) = 285^\circ$

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

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



OR



Draw EF || AB || CD

EF || CD and CE is the transversal

Then,

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

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

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

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

Again EF || AB and AE is the transversal

Then,

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

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

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

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

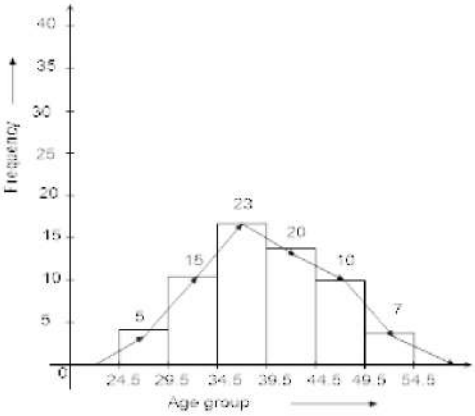
$\Rightarrow x^\circ = 110^\circ$

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.

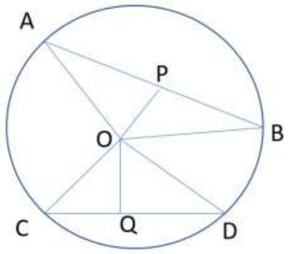
class interval	24.5 - 29.5	29.5 - 34.5	34.5 - 39.5	39.5 - 44.5	44.5 - 49.5	49.5 - 54.5
frequency	5	15	23	20	10	7



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 ΔAOP and ΔBOP

$\angle$APO = $\angle$BPO (Given)

OP = OP (Common)

AO = OB (radius of circle)

$\Delta AOP \cong \Delta BOP$

AP = BP (CPCT)

(ii) In right ΔCOQ

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

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

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

$\Rightarrow CQ = 6$

CD = 2CQ

$\Rightarrow$ CD = 12 cm

(iii) In right ΔAOB

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

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

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

$\Rightarrow AP = 8$

AB = 2AP

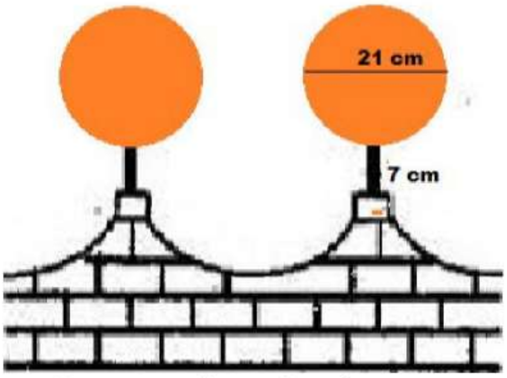
$\Rightarrow$ AB = 16 cm

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

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

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

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

(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

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

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

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

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

Thus total cost

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

OR

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

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

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

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

$= 121275 \text{ cm}^3$

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

Height of support (h) = 7 cm

The surface area of 25 supports

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

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

$= 8800 \text{ cm}^2$

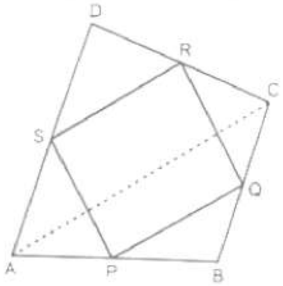
The cost of orange paint = 10 paise per cm^2

Thus total cost

= 0.1×8800 = ₹ 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^{th} 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 ΔADC, P and Q are mid points of sides AB and BC of ΔABC, then by mid-point theorem SR || AC and SR = $\frac{1}{2}$AC similarly PQ || AC and PQ = $\frac{1}{2}$AC.

Therefore SR || PQ and SR = PQ

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

Hence PQRS is parallelogram.

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

OR

RQ = 3 cm

Opposite side of a parallelogram are equal.

(iii) Adjacent angles of a parallelogram are supplementary.

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

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

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

$= 130^o$