# CBSE SAMPLE PAPER - 09

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

a) (0, 3) b) (3, 0)

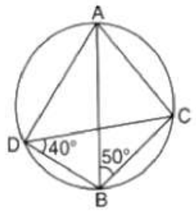
c) (0, 4) d) (-5, 0)

2. If side of a scalene $\triangle$ is doubled then area would be increased by **[1]**

a) 200% b) 25 $\%$

c) 50 $\%$ d) 300 $\%$

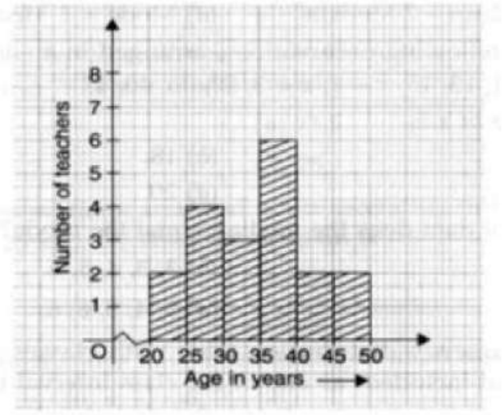
3. In the given figure, if $\angle ABC = 50^o$ and $\angle BDC = 40^o$, then $\angle BCA$ is equal to **[1]**




a) $90^o$ b) $50^o$

c) $40^o$ d) $100^o$

4. The graph given below shows the frequency distribution of the age of 22 teachers in a school. The number of teachers whose age is less than 40 years is **[1]**

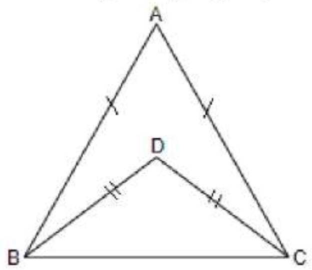



a) 17
b) 16
c) 15
d) 14

5. If $8^{x+1} = 64$, what is the value of $3^{2x+1}$? **[1]**

a) 3
b) 27
c) 1
d) 9

6. In the adjoining Figure, AB = AC and BD = CD. The ratio ∠ABD : ∠ACD is **[1]**




a) 1 : 1
b) 1 : 2
c) 2 : 3
d) 2 : 1

7. Express y in terms of x in the equation 5y - 3x - 10 = 0. **[1]**

a) $y = \frac{3-10x}{5}$
b) $y = \frac{3+10x}{5}$
c) $y = \frac{3x-10}{5}$
d) $y = \frac{3x+10}{5}$

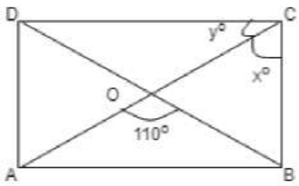
8. The factorisation of $4x^2 + 8x + 3$ is **[1]**

a) (2x –1) (2x –3)
b) (2x + 2) (2x + 5)
c) (x + 1) (x + 3)
d) (2x + 1) (2x + 3)

9. The simplest form of $0.5\overline{7}$ is **[1]**

a) $\frac{26}{45}$
b) $\frac{57}{99}$
c) $\frac{57}{100}$
d) none of these

10. In the given figure, ABCD is a Rectangle. Find the values of x and y? **[1]**




a) x = 120° and y = 120°
b) x = 50° and y = 60°

c) x = 55° and y = 35°

d) x = 60° and y = 70°

11. If $\frac{3^{2x-8}}{225} = \frac{5^3}{5^x}$, then x = **[1]**

a) 4

b) 2

c) 5

d) 3

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

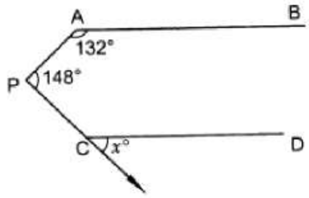
a) A unique solution

b) Two solutions

c) No solution

d) Infinitely many solutions

13. In Fig. if $AB \parallel CD$, then $x$ = **[1]**




a) 100°

b) 110°

c) 105°

d) 115°

14. The value of $\left[(81)^{\frac{1}{2}}\right]^{\frac{1}{2}}$ is **[1]**

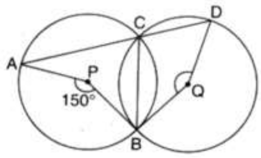
a) -3

b) 9

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

d) 3

15. In the given figure, P and Q are centers of two circles intersecting at B and C. ACD is a straight line. Then, the measure of $\angle BQD$ is **[1]**




a) $130^o$

b) $150^o$

c) $105^o$

d) $115^o$

16. The point whose abscissa is 4 and this point lies on the x-axis is: **[1]**

a) None of these

b) (4, 0)

c) (0, 4)

d) (4, 4)

17. x = 2, y = 5 is a solution of the linear equation **[1]**

a) 5 x + y = 7

b) x + y = 7

c) 5x +2y = 7

d) x + 2y = 7

18. If $a + b + c = 0$, then $a^3 + b^3 + c^3$ is equal to **[1]**

a) 1

b) 3abc

c) 2abc

d) abc

19. **Assertion (A):** In ΔABC, median AD is produced to X such that AD = DX. Then ABXC is a parallelogram. **[1]**

**Reason (R):** Diagonals AX and BC 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):** Rational number lying between two rational numbers a and b is $\frac{a+b}{2}$. **[1]**

**Reason (R):** There is one rational number lying between any two rational numbers.

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. Why is axiom 5, in the list of Euclid's axioms, considered as a 'universal truth'? **[2]**

22. If a point 'C' lies between two points A and B such that AC = BC, then prove that AC = $\frac{1}{2}$AB. Explain by drawing the figure. **[2]**

23. Which of the following points lie on the x-axis? **[2]**

A(1, 1), B(3, 0), C(0, 3), D(0, 0), E(–5, 0), F(0, –1), G(9, 0), H(0, –8).

24. Prove that: $\frac{1}{3+\sqrt{7}}+\frac{1}{\sqrt{7}+\sqrt{5}}+\frac{1}{\sqrt{5}+\sqrt{3}}+\frac{1}{\sqrt{3}+1}=1$. **[2]**

OR

Simplify: $\sqrt[4]{81}-8\sqrt[3]{216}+15\sqrt[5]{32}+\sqrt{225}$.

25. A semi-circular sheet of metal of diameter 28 cm is bent to form an open conical cup. Find the capacity of the cup. **[2]**

OR

A conical pit of top diameter 3.5 cm is 12 m deep. What is its capacity in kilolitres?

**Section C**

26. If $\sqrt{2}=1.414$ and $\sqrt{3}=1.732$, find the value of $\frac{5}{\sqrt{2}+\sqrt{3}}$ **[3]**

27. The investment (in ten crores of rupees) of Life Insurance Corporation of India in different sectors are given below: **[3]**

| Sectors | Investment<br>(in ten crores of rupees) |
|---|---|
| Central Government Securities | 45 |
| State Government Securities | 11 |
| Securities guaranteed by the Government | 23 |
| Private Sectors | 18 |
| Socially oriented sectors (Plan) | 46 |
| Socially oriented sectors (Non-Plan) | 11 |

Represent the above data with the help of a bar graph.

28. ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallels to BC intersects AC at D.Show that : **[3]**

i. D is the mid-point of AC
ii. MD $\perp$ AC
iii. CM = MA = $\frac{1}{2}$AB

29. For what value of c, the linear equation 2x + cy = 8 has equal values of x and y for its solution? **[3]**

30. The marks obtained (out of 100) by a class of 80 students are given below: **[3]**

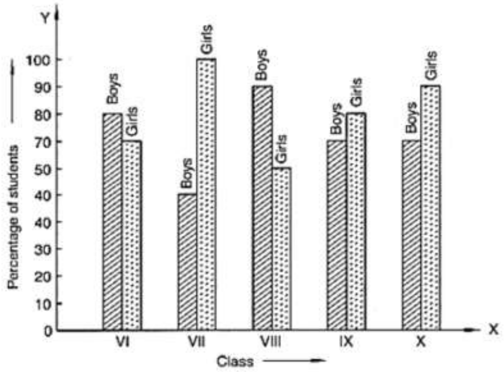
| **Marks** | 10-20 | 20-30 | 30-50 | 50-70 | 70-100 |
|---|---|---|---|---|---|
| **Number of students** | 6 | 17 | 15 | 16 | 26 |

Construct a histogram to represent the data above.

OR

The following bar graph shows the results of an annual examination in a secondary school.

Read the bar graph (Figure) and choose the correct alternative in each of the following:




i. The pair of classes in which the results of boys and girls are inversely proportional are:

a. VI, VIII

b. VI, IX

c. VIII,IX

d. VIII, X

ii. The class having the lowest failure rate of girls is

a. VII

b. X

c. IX

d. VIII

iii. The class having the lowest pass rate of students is

a. VI

b. VII

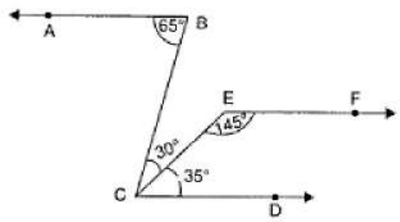
c. VIII

d. IX

31. Prove that: $a^3 + b^3 + c^3 - 3abc = \frac{1}{2}(a+b+c)\left\{(a-b)^2 + (b-c)^2 + (c-a)^2\right\}$ **[3]**

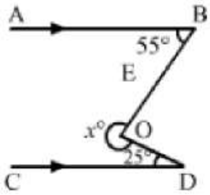
**Section D**

32. In figure, ∠ABC = 65°, ∠BCE = 30°, ∠DCE = 35° and ∠CFE = 145°. Prove that AB || EF. **[5]**




OR

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




33. The volume of a right circular cone is 9856 $cm^3$. If the diameter of the base is 28 cm, find **[5]**

i. height of the cone,

ii. slant height of the cone,

iii. curved surface area of the cone.

34. The perimeter of a right triangle is 24 cm. If its hypotenuse is 10 cm, find the other two sides. Find its area by using the formula area of a right triangle. Verify your result by using Heron's formula. **[5]**

OR

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.

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

**Section E**

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

Ajay is writing a test which consists of 'True' or 'False' questions. One mark is awarded for every correct answer while ¼ mark is deducted for every wrong answer. Ajay knew answers to some of the questions. Rest of the questions he attempted by guessing.

(i) If he answered 110 questions and got 80 marks and answer to all questions, he attempted by guessing were wrong, then how many questions did he answer correctly?

(ii) If he answered 110 questions and got 80 marks and answer to all questions, he attempted by guessing were wrong, then how many questions did he guess?

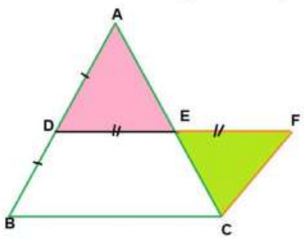
(iii) If answer to all questions he attempted by guessing were wrong and answered 80 correctly, then how many marks he got?

**OR**

If answer to all questions he attempted by guessing were wrong, then how many questions answered correctly to score 95 marks?

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

Haresh and Deep were trying to prove a theorem. For this they did the following




i. Draw a triangle ABC

ii. D and E are found as the mid points of AB and AC

iii. DE was joined and DE was extended to F so DE = EF

iv. FC was joined.

(i) $\triangle$ADE and $\triangle$EFC are congruent by which criteria?

(ii) Show that CF$\|$ AB.

**OR**

Show that DF = BC and DF$\|$ BC.

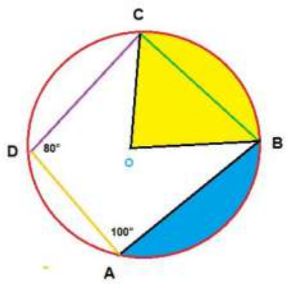
(iii) Show that CF = BD.

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

There was a circular park in Defence colony at Delhi. For fencing purpose poles A, B, C and D were installed at the circumference of the park.

Ram tied wires From A to B, B to C and C to D, and he managed to measure the $\angle$A = 100° and $\angle$D = 80°

Point O in the middle of the park is the center of the circle.




(i) Name the quadrilateral ABCD.

(ii) What is the value of $\angle$C?

**OR**

Write any three properties of cyclic quadrilateral?

(iii) What is the value of $\angle B$.

## Solution

## CBSE SAMPLE PAPER - 09

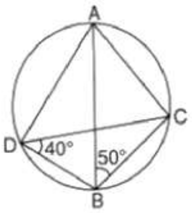
## Class 09 - Mathematics

### Section A

1. **(a)** (0, 3)
   **Explanation:** Since it meets at y-axis, so , abscissa will be zero and we have ordinate=3 in common so,point will be (0,3)

2. **(d)** 300 $\%$
   **Explanation:** Area of triangle with sides a, b, c (A) = $\sqrt{s(s-a)(s-b)(s-c)}$
   New sides are 2a, 2b and 2c
   Then $s' = \frac{2a+2b+2c}{2} = a+b+c$
   $\Rightarrow$ s' = 2s .....(i)
   New area = $\sqrt{s'(s'-2a)(s'-2b)(s'-2c)}$
   = $\sqrt{2s(2s-2a)(2s-2b)(2s-2c)}$
   = $4\sqrt{s(s-a)(s-b)(s-c)}$
   = 4A
   Increased area = 4A - A = 3A
   % of increased area = $\frac{3A}{A} \times 100$ = 300%

3. **(a)** $90^o$
   **Explanation:**




   $\angle BDC = \angle BAC = 40^0$
   In triangle ABC,
   $\angle A + \angle B + \angle C = 180^0$ ( angles of a triangle)
   $50^0 + 40^0 + \angle C = 180^0$
   $\angle C = 90^0$

4. **(c)** 15
   **Explanation:** Add the values corresponding to the height of the bar before 40.
   6 + 3 + 4 + 2 = 15

5. **(b)** 27
   **Explanation:** Given $8^{x+1} = 64$
   $8^{x+1} = 64$
   $8^{x+1} = 8^2$
   $\Rightarrow$ x+1=2
   $\Rightarrow$ x=2-1
   $\Rightarrow$ x=1
   Now $3^{2x+1} = 3^{2(1)+1}$
   = $3^{2+1}$
   = $3^3$
   = 27

6. **(a)** 1 : 1
   **Explanation:** In $\triangle$ABC
   AB = AC
   $\therefore$ $\angle$ABC = $\angle$ACB(angles opposite to equal sides of a triangle are equal) ......1

in $\triangle$DBC,

DB = DC,

$\therefore \angle$DBC = $\angle$DCB(angles opposite to equal sides of a triangle are equal) ......2

subtract 2 from 1

$\angle$ABC - $\angle$DBC = $\angle$ACB - $\angle$DCB(equals subtracted from equals gives equal)

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

divide both the sides by $\angle$ACD

$\Rightarrow \frac{\angle ABD}{\angle ACD}$ = 1

$\therefore \angle$ABD : $\angle$ACD = 1 : 1

7. **(d)** $y = \frac{3x+10}{5}$

**Explanation:** 5y - 3x - 10 = 0

5y - 3x = 10

5y = 10 + 3x

y = $\frac{10+3x}{5}$

8. **(d)** (2x + 1) (2x + 3)

**Explanation:** Now, $4x^2 + 8x + 3 = 4x^2 + 6x + 2x + 3$ [by splitting middle term]

= 2x(2x+ 3) + 1 (2x+ 3)

= (2x + 3) (2x + 1)

9. **(a)** $\frac{26}{45}$

**Explanation:** $0.5\overline{7} = \frac{57-5}{90}$

= $\frac{52}{90} = \frac{26}{45}$

10. **(c)** x = 55° and y = 35°

**Explanation:** Given $\angle AOB = 110^0$

$\Rightarrow \angle DOC = 110^0$ vertically opposite angles

$\triangle$DOC we have:

DO = OC

Now, $\angle$ODC = $\angle$OCD = y

now in $\triangle ODC$

$y + y + 110^0 = 180^0$ (angle sum property of triangle)

$\Rightarrow 2y = 180^0 - 110^0 = 70^0$

$\Rightarrow y = 35^0$

Also, x = 90° – y

x = 90° – 35° = 55°

Hence, x = 55° and y = 35°

11. **(c)** 5

**Explanation:** $\frac{3^{2x-8}}{225} = \frac{5^3}{5^x}$

$\Rightarrow 3^{2x-8} \times 5^x = 5^3 \times 225$

$\Rightarrow \frac{3^{2x}}{3^8} \times 5^x = 5^3 \times 5 \times 5 \times 3 \times 3$

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

$\Rightarrow (3^2)^x \times 5^x = 3^{10} \times 5^5$

$\Rightarrow 9^x \times 5^x = 9^5 \times 5^5$

$\Rightarrow (45)^x = (45)^5$

Comparing, we get

x = 5

12. **(d)** Infinitely many solutions

**Explanation:** 3x - y = x-1

y = 3 x - x +1

y = 2 x + 1

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

13. **(a)** 100°

**Explanation:** Given that,

AB ∥ CD

Produce P to Q so that PQ ∥ AB ∥ CD

$\angle$BAP + $\angle$APQ = $180^o$ (Interior angle)

$132^o$ + $\angle$APQ = $180^o$

$\angle$APQ = $48^o$ (i)

$\angle$APC = $\angle$APQ + $\angle$QPC

$148^o$ = $48^o$ + $\angle$QPC [From (i)]

$\angle$QPC = $100^o$

$\angle$QPC + $\angle$PCD = $180^o$ (Interior angles)

$100^o$ + $\angle$PCD = $180^o$

$\angle$PCD = $80^o$

$\angle$PCD + x = $180^o$ (Linear pair)

$80^o$ + x = $180^o$

x = $100^o$

14. **(d)** 3

**Explanation:** $\left[(81)^{\frac{1}{2}}\right]^{\frac{1}{2}}$

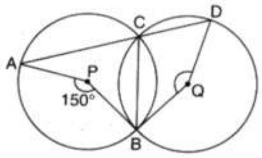
= $(3^4)^{\frac{1}{2}\times\frac{1}{2}}$

= $(3^4)^{\frac{1}{4}}$

= 3

15. **(b)** $150^o$

**Explanation:**




$\angle APB$ = 150°, so, $\angle ACB$ = 75° {Angle subtended by an arc at centre is twice the angle subtended at any point on circumference}

Now, ACD is straight line, so, $\angle ACB + \angle DCB = 180^{\circ}$

$\angle DCB$ = 180 - 75 = 105°

Now, angle subtended by arc BD on centre is twice of $\angle DCB$ = 2 × 105 = 210°

Now, $\angle BQD$ = 360°- 210° = 150°

16. **(b)** (4, 0)

**Explanation:** Since the abscissa or x-coordinate of a point is 4 and this point lies on the x-axis. And the ordinate or y-coordinate of a point lying on the x-axis is 0.

Therefore the coordinate of the point is (4, 0).

17. **(b)** x + y = 7

**Explanation:** x = 2 and y = 5 satisfy the given equation.

18. **(b)** 3abc

**Explanation:** If $a + b + c = 0$ , then

$a^3 + b^3 + c^3 \; - 3abc = 0$

$\Rightarrow a^3 + b^3 + c^3 \; = 3abc$

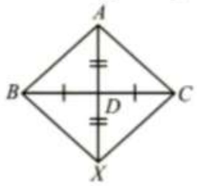
19. **(c)** A is true but R is false.

**Explanation:**

In quadrilateral ABXC, we have

AD = DX [Given]

BD = DC [Given]




So, diagonals AX and BC bisect each other but not at right angles.

Therefore, ABXC is a parallelogram.

20. **(c)** A is true but R is false.

**Explanation:** There are infinitely many rational numbers between any two given rational numbers.

**Section B**

21. We need to prove that Euclid's fifth axiom is considered as a universal truth.

Euclid's fifth axiom states that "the whole is greater than the part."

The above given axiom is a universal truth. We can apply the fifth axiom not only mathematically but also universally in daily life.

Mathematical proof:

Let us consider a quantity z, which has different parts as a, b, x and y. .

Therefore, we can conclude that z will always be greater than its corresponding parts a, b, x and y.

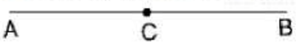
Universal proof:

We know that Mumbai is located in Maharashtra and Maharashtra is located in India.

In other words, we can conclude that Mumbai is a part of Maharashtra and Maharashtra is a part of India.

Therefore, we can conclude that whole India will be greater than Mumbai or Maharashtra or both.

Therefore, we can conclude that Euclid's fifth axiom is considered as a 'Universal truth'.

22. 


Given, AC = BC

AC + AC = BC + AC . . . . [AC are added to both the side]

2AC = AB . . . . [BC + AC coincides with AB]

$\therefore$ AC = $\frac{1}{2}$AB

23. A point lies on x-axis if the y-coordinate is zero. Hence B, D, E and G points lie on the x-axis.

24. LHS

$= \frac{1}{3+\sqrt{7}} + \frac{1}{\sqrt{7}+\sqrt{5}} + \frac{1}{\sqrt{5}+\sqrt{3}} + \frac{1}{\sqrt{3}+1}$

$= \frac{1}{3+\sqrt{7}} \times \frac{3-\sqrt{7}}{3-\sqrt{7}} + \frac{1}{\sqrt{7}+\sqrt{5}} \times \frac{\sqrt{7}-\sqrt{5}}{\sqrt{7}-\sqrt{5}} + \frac{1}{\sqrt{5}+\sqrt{3}} \times \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}-\sqrt{3}} + \frac{1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1}$

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

$= \frac{3-\sqrt{7}}{9-7} + \frac{\sqrt{7}-\sqrt{5}}{7-5} + \frac{\sqrt{5}-\sqrt{3}}{5-3} + \frac{\sqrt{3}-1}{3-1}$

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

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

$= \frac{2}{2}$

= 1

= RHS

OR

Given, $\sqrt[4]{81} - 8\sqrt[3]{216} + 15\sqrt[5]{32} + \sqrt{225}$

$= \left(3^4\right)^{\frac{1}{4}} - 8\left(6^3\right)^{\frac{1}{3}} + 15\left(2^5\right)^{\frac{1}{5}} + \left(15^2\right)^{\frac{1}{2}}$

$= 3 - 8 \times 6 + 15 \times 2 + 15$

$= 3 - 48 + 30 + 15$

$= 48 - 48$

$= 0$

25. Diameter of semicircular sheet is 28 cm. It is bent to from an open conical cup. The radius of sheet becomes the slant height of the cup. The circumference of the sheet becomes the circumference of the base of the cone.

$\therefore\ l =$ Slant height of conical cup = 14 cm.

Let r cm be the radius and h cm be the height of the conical cup circumference of conical cup of the semicircular sheet

$\therefore\ 2\pi r = \pi \times 14 \Rightarrow r = 7cm$

Now, $l^2 = r^2 + h^2 \Rightarrow h = \sqrt{l^2 - r^2}$

$= \sqrt{(14)^2 - (7)^2} = \sqrt{196 - 49} = \sqrt{147} = 12.12cm$

$\therefore$ Capacity of the cup

$= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 12.12$

= 622.16 $cm^3$

OR

For conical pit : Diameter = 3.5 cm.

$\therefore$ Radius (r) = $\frac{3.5}{2}$m = 1.75 m

Depth (h) = 12 m

$\therefore$ Capacity of the conical pit $= \frac{1}{3}\pi r^2 h$

$\frac{1}{3} \times \frac{22}{7} \times (1.75)^2 \times 12\ m^3$

= 38.5 $m^3$ = 38.5 × 1000 l

= 38.5 kl.

**Section C**

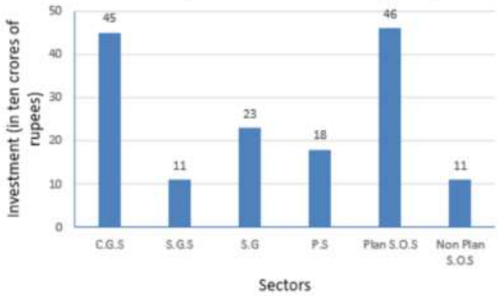
26. $\frac{5}{\sqrt{2}+\sqrt{3}} \times \frac{\sqrt{2}-\sqrt{3}}{\sqrt{2}-\sqrt{3}}$ (Rationalizing denominator)

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

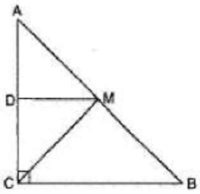
$= -5\,[1.414 - 1.732]$

$= -5 \times -0.318 = 1.59$

27. **The investment (in ten crores of rupees) of Life Insurance Corporation of India in different sectors:-**




28. Given: ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallels to BC intersects AC at D.




To Prove :

i. D is the mid-point of AC (ii) MD ⊥ AC

ii. CM = MA = $\frac{1}{2}$AB

Proof :

i. In ACB,

As M is the mid-point of AB and MD || BC

$\therefore$ D is the mid-point of AC . . . [By converse of mid-point theorem]

ii. As MD || BC and AC intersects them

∠ADM = ∠ACB . . . [Corresponding angles]

But ∠ACB = $90^o$ . . .[Given]

$\therefore$ ∠ADM = $90^o$ ⇒ MD ⊥ AC

iii. Now ∠ADM + ∠CDM = $180^o$ . . .[Linear pair axiom]

∠ADM = ∠CDM = $90^o$

In △ADM and △CDM

AD = CD . . . [As D is the mid-point of AC]

$\angle$ADM = $\angle$CDM . . .[Each $90^o$ ]

DM = DM . . .[Common]

$\therefore \triangle ADM \cong \triangle CDM$ . . .[By SAS rule]

$\therefore$ MA = MC . . .[c.p.c.t.]

But M is the mid-point of AB

$\therefore$ MA = MB = $\frac{1}{2}$AB

$\therefore$ MA = MC = $\frac{1}{2}$AB

$\therefore$ CM = MA = $\frac{1}{2}$AB

29. The value of c for which the linear equation 2x + cy = 8 has equal values of x and y

i.e., x = y for its solution is

2x + cy = 8 $\Rightarrow$ 2x + cx = 8 [$\therefore$ y = x]

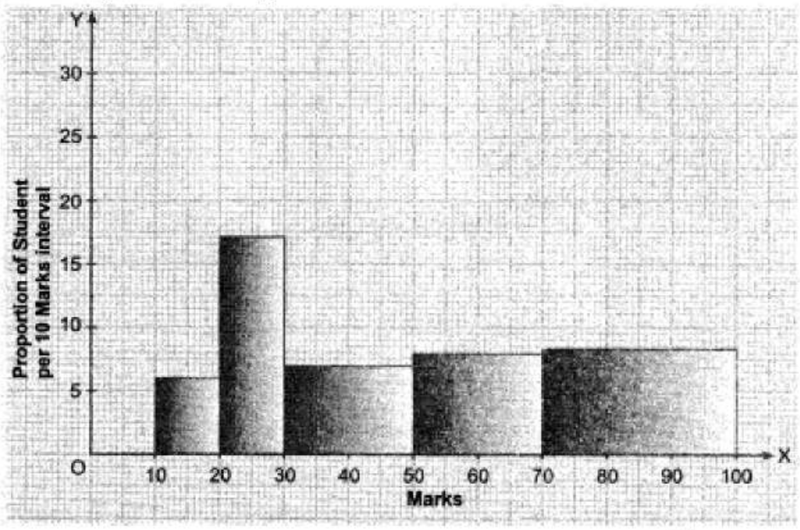
$\Rightarrow$ cx = 8 - 2x

$\therefore\ c = \frac{8-2x}{x}, x \neq 0$

30. In the given frequency distribution, the class intervals are not of equal width. $\therefore$ we would make modification in the lengths of the rectangle in the histogram so that the areas of the rectangle are proportional to the frequencies.

| **Marks** | **Frequency** | **Width of the class** | **Length of the rectangle** |
|---|---|---|---|
| $10 - 20$ | 6 | 10 | $\frac{10}{10} \times 6 = 6$ |
| $20 - 30$ | 17 | 10 | $\frac{10}{10} \times 17 = 17$ |
| $30 - 50$ | 15 | 20 | $\frac{10}{20} \times 15 = 7.5$ |
| $50 - 70$ | 16 | 20 | $\frac{10}{20} \times 16 = 8$ |
| $70 - 100$ | 26 | 30 | $\frac{10}{30} \times 26 = 8.67$ |

The histogram of data is given below:




OR

i. (b) VI, IX

ii. (a) VII

iii. (b) VII

31. We have,

$a^3 + b^3 + c^3 - 3abc$

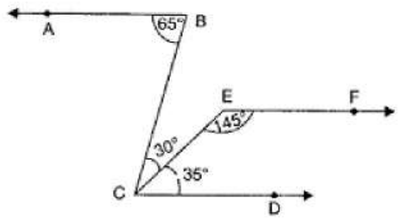
$= (a + b + c) (a^2 + b^2 + c^2 - ab - bc - ca)$

$= \frac{1}{2}(a + b + c) (2a^2 + 2b^2 + 2c^2 - 2ab - 2bc - 2ca)$

$= \frac{1}{2}(a + b + c) \{(a^2 - 2ab + b^2) + (b^2 - 2bc + c^2) + (c^2 - 2ca + a^2)\}$

$= \frac{1}{2} (a + b + c) \{(a - b)^2 + (b - c)^2 + (c - a)^2\}$

**Section D**

32. 


$\angle ABC = 65^o$

$\angle BCD = \angle BCE + \angle ECD = 30^o + 35^o = 65^o$

$\therefore \angle ABC = \angle BCD$

These angles form a pair of equal alternate angles

$\therefore$ AB || CD . . . (1)

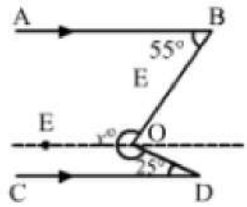
$\angle FEC + \angle ECD = 145^o + 35^o = 180^o$

These angles are consecutive interior angles formed on the same side of the transversal.

$\therefore$ CD || EF . . . . (2)

AB || EF . . . [From (1) and (2)]

OR




Draw EO $\|$ AB $\|$ CD

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

Now, EO $\|$ 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 $\|$ 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,

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

$x^\circ = (125 + 155)^\circ$

**$x^\circ = 280^\circ$**

33. i. We have, Volume = 9856 $cm^3$ and r = 14 cm.
    Let the height of the cone be h,cm
    Then, volume of cone = $\frac{1}{3}\pi r^2 h$
    $\Rightarrow 9856 = \frac{1}{3} \times \frac{22}{7} \times 14 \times 14 \times h$
    $\Rightarrow h = \left(\frac{9856 \times 3 \times 7}{22 \times 14 \times 14}\right) = 48$
    height of the cone is 48 cm.

  ii. We have, Volume = 9856 $cm^3$ and r = 14 cm.
    Let the slant height of the cone be l, cm. Then,
    $l^2 = r^2 + h^2$
    $\Rightarrow l^2 = (14)^2 + (48)^2 = 196 + 2304 = 2500$
    $\Rightarrow l = \sqrt{2500} = 50$
    $\therefore$ slant height of the cone is 50 cm

  iii. We have, Volume = 9856 $cm^3$ and r = 14 cm.
    Curved surface area of the cone
    $= \pi r l$

$= \left(\frac{22}{7} \times 14 \times 50\right)$ $cm^2$ = 2200 $cm^2$

$\therefore$ curved surface area of the cone is 2200 $cm^2$.

34. Let x and y be the two lines of the right $\angle$

$\therefore$ AB = x cm, BC = y cm and AC = 10 cm

$\therefore$ By the given condition,

Perimeter = 24 cm

x + y +10 = 24 cm

Or x + y = 14 ... (I)

By Pythagoras theorem,

$x^2 + y^2 = (10)^2$ = 100 ... (II)

From (1), $(x + y)^2$ = $(14)^2$

Or $x^2 + y^2$ + 2xy = 196

$\therefore$100 + 2xy =196 [From (II)]

xy =$\frac{96}{2}$= 48 sq cm .... (III)

Area of $\Delta$ ABC = $\frac{1}{2}xy$ sq cm

=$\frac{1}{2} \times 48$ sq cm

=24 sq cm.... (IV)

Again, we know that

$(x\ -\ y)^2 = (x + y)^2 - 4xy$

$=\ (14)^2 - 4 \times 48$ [From (I) & (III)]

Or x - y = $\pm$ 2

(i) When, x-y = 2 and x+y = 14, then 2x = 16

or x = 8, y = 6

(ii) When, X – y = -2 and x + y = 14, then 2x = 12

Or x = 6, y = 8

Verification by using Heron's formula:

Sides are 6 cm, 8 cm and 10 cm

S =$\frac{24}{2}$ = 12 cm

Area of $\Delta$ ABC = $\sqrt{12\ (12-6)\ (12-8)\ (12-10)}$ sq cm

=$\sqrt{12 \times 6 \times 4 \times 2}$sq cm

= 24 sq cm

Which is same as found in (IV)

Thus, the result is verified.

OR

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 $= \left[\frac{1}{2} \times x \times (x-14)\right]$ $cm^2$

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

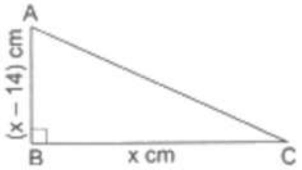
$\Rightarrow$ x = 24 (neglecting x = -10)

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

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

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

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




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

Zeros of f(x) are 0 and -1

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

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

$= 0 - 0 + 0 + b$

$= b$ .... (1)

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

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

$= -2 - 3 - a + b$

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

We need to equate equations 1 and 2 to zero

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

since, the value of b is zero

substitute b = 0 in equation 2

$\Longrightarrow -5 - a = -b$

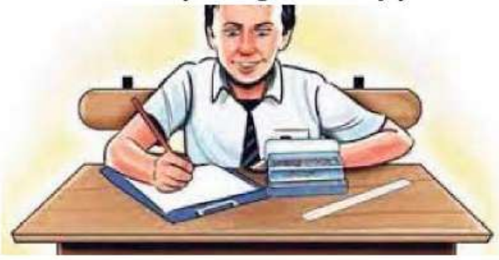
$\Longrightarrow -5 - a = 0$

$a = -5$

**Section E**

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

Ajay is writing a test which consists of ‘True’ or ‘False’ questions. One mark is awarded for every correct answer while ¼ mark is deducted for every wrong answer. Ajay knew answers to some of the questions. Rest of the questions he attempted by guessing.



(i) Let the no of questions whose answer is known to Ajay be x and number questions attempted by guessing be y.

$x + y = 110$

$x + 14y = 80 \Rightarrow 4x + y = 320x + y = 110$ ...(1)

$4x + y = 320$ ...(2)

Solving (1) and (2)

$x + y - 4x - y = 110 - 320 = -210$

$\Rightarrow -3x = -210$

$\Rightarrow x = 70$

(ii) $x + y = 110$

$x + 14y = 80 \Rightarrow 4x + y = 320$

$x + y = 110$ ...(1)

$4x + y = 320$ ...(2)

Solving (1) and (2)

$x + y - 4x - y = 110 - 320 = - 210$

$\Rightarrow - 3x = - 210$

$\Rightarrow x = 70$

Put x = 70 in (1)

$70 + y = 110$

$\Rightarrow y = 40$

40 question he answered by guessing.

(iii) $70 - 40 \times \frac{1}{4} = 70 - 10$ = 60 marks

He scored 60 marks.

OR

x - $\frac{1}{4}$(110 - x) = 95

$\Rightarrow$ 4x - 110 + x = 380

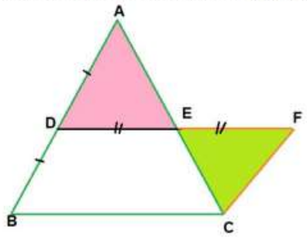
$\Rightarrow$ 5x = 380 + 110 = 490

$\Rightarrow$ x = $\frac{490}{5}$ = 98

So he answered 98 correct answers 12 by guessing.

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

Haresh and Deep were trying to prove a theorem. For this they did the following




i. Draw a triangle ABC
ii. D and E are found as the mid points of AB and AC
iii. DE was joined and DE was extended to F so DE = EF
iv. FC was joined.

(i) $\triangle$ADE and $\triangle$CFE

DE = EF (By construction)

$\angle$AED = $\angle$CEF (Vertically opposite angles)

AE = EC(By construction)

By SAS criteria $\triangle ADE \cong \triangle CFE$

(ii) $\triangle ADE \cong \triangle CFE$

Corresponding part of congruent triangle are equal

$\angle$EFC = $\angle$EDA

alternate interior angles are equal

$\Rightarrow$ AD ∥ FC

$\Rightarrow$ CF ∥ AB

OR

DE = $\frac{BC}{2}$ {line drawn from mid points of 2 sides of $\triangle$ is parallel and half of third side}

DE ∥ BC and DF ∥ BC

DF = DE + EF

$\Rightarrow$ DF = 2DE(BE = EF)

$\Rightarrow$ DF = BC

(iii) $\triangle ADE \cong \triangle CFE$

Corresponding part of congruent triangle are equal.

CF = AD

We know that D is mid point AB

$\Rightarrow$ AD = BD

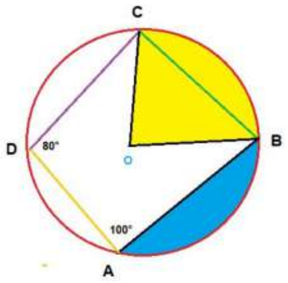
$\Rightarrow$ CF = BD

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

There was a circular park in Defence colony at Delhi. For fencing purpose poles A, B, C and D were installed at the circumference of the park.

Ram tied wires From A to B, B to C and C to D, and he managed to measure the $\angle A = 100°$ and $\angle D = 80°$

Point O in the middle of the park is the center of the circle.




(i) ABCD is cyclic quadrilateral.

A quadrilateral ABCD is called cyclic if all the four vertices of it lie on a circle.

Here all four vertices A, B, C and D lie on a circle.

(ii) We know that the sum of both pair of opposite angles of a cyclic quadrilateral is 180°.

$\angle C + \angle A = 1800$

$\angle C = 1800 - 1000 = 800$

OR

i. In a cyclic quadrilateral, all the four vertices of the quadrilateral lie on the circumference of the circle.
ii. The four sides of the inscribed quadrilateral are the four chords of the circle.
iii. The sum of a pair of opposite angles is 180° (supplementary). Let $\angle A$, $\angle B$, $\angle C$, and $\angle D$ be the four angles of an inscribed quadrilateral. Then, $\angle A + \angle C = 180°$ and $\angle B + \angle D = 180°$.

(iii)We know that

The sum of both pair of opposite angles of a cyclic quadrilateral is 180°.

$\angle B + \angle D = 1800$

$\angle B = 1800 - 800 = 1000$