ICSE Solved Paper 2020
Mathematics

Class-X

(Maximum Marks : 80)

(Time allowed : Two hours and a half)

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*Attempt **all** questions from **Section A** and **any four** questions from **Section B.***

All working, including rough work, must be clearly shown and must be done on the same sheet as the rest of the answer.

Omission of essential working will result in loss of marks.

The intended marks for questions or parts of question are given in brackets [ ].

Mathematical tables are provided.

SECTION-A **(40 marks)**

*Attempt **all** questions from this Section*

1. (a) Solve the following Quadratic Equation : [3]
$x^2 - 7x + 3 = 0$
Give your answer correct to two decimal places.

(b) Given A = $\begin{bmatrix} x & 3 \\ y & 3 \end{bmatrix}$

If $A^2 = 3I$, where I is the identity matrix of order 2, find x and y. [3]

(c) Using ruler and compass construct a triangle ABC where AB = 3 cm, BC = 4 cm and $\angle ABC = 90°$. Hence construct a circle circumscribing triangle ABC. Measure and write down the radius of the circle. [4]

Ans. (a) $x^2 - 7x + 3 = 0$

Compare the equation by $ax^2 + bx + c = 0$ then, $a = 1, b = -7$ and $c = 3$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{7 \pm \sqrt{49 - 4 \times 1 \times 3}}{2 \times 1}$$

$$= \frac{7 \pm \sqrt{37}}{2}$$

$$= \frac{7 \pm \sqrt{37}}{2} = \frac{7 \pm 6.08}{2}$$

$$\therefore \quad x = \frac{7 + 6.08}{2} = \frac{13.08}{2}$$

$$= 6.54$$

and $$x = \frac{7 - 6.08}{2} = \frac{0.92}{2}$$

$$= 0.46$$

Hence, x = 6.54 (Approx.) and x = 0.46 (Approx).

(b) $$A = \begin{bmatrix} x & 3 \\ y & 3 \end{bmatrix}$$

$$A^2 = A \times A$$

$$= \begin{bmatrix} x & 3 \\ y & 3 \end{bmatrix}\begin{bmatrix} x & 3 \\ y & 3 \end{bmatrix}$$

$$= \begin{bmatrix} x^2 + 3y & 3x + 9 \\ xy + 3y & 3y + 9 \end{bmatrix}$$

$A^2 = 3I$ (Given)

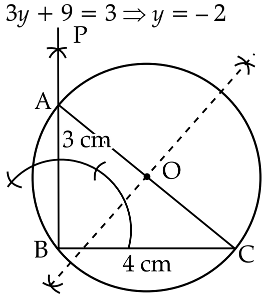
$$\begin{bmatrix} x^2 + 3y & 3x + 9 \\ xy + 3y & 3y + 9 \end{bmatrix} = 3\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$$

Comparing the elements of matrices

$3x + 9 = 0 \Rightarrow x = -3$

$3y + 9 = 3 \Rightarrow y = -2$

(c)



Steps of construction

(i) Draw BC = 4 cm

(ii) Make $\angle PBC = 90°$

(iii) Taking centre B and radius 3 cm draw an arc which intersect BP at the point A.

(iv) Join AC, ΔABC is required triangle. $\angle B = 90°$
$\therefore$ AC is the diameter of circle.

(v) Draw perpendicular bisector of AC.

(vi) Taking centre O and radius equal to BO draw a circle which passes through vertex A, B and C.
Radius of circumscribe circle = 2.5 cm.

2. (a) Use factor theorem to factorise $6x^3 + 17x^2 + 4x - 12$ completely. [3]

(b) Solve the following inequation and represent the solution set on the number line. [3]

$$\frac{3x}{5} + 2 < x + 4 \le \frac{x}{2} + 5,\ x \in R$$

Distance in (m)	Number of students	Less than	Cumulative frequency
12 -13	3	13	3
13 -14	9	14	12
14 - 15	12	15	24
15 - 16	9	16	33
16 - 17	4	17	37
17 - 18	2	18	39
18 - 19	1	19	40

(i) Median = 14.6± 0.2

(ii) Upper quartile = 15.75 ± 0.2

(iii) Number of students above 16½ m = 40–35= 5

(b) $x = \frac{\sqrt{2a+1}+\sqrt{2a-1}}{\sqrt{2a+1}-\sqrt{2a-1}}$

$$\frac{x+1}{x-1} = \frac{\sqrt{2a+1}+\sqrt{2a-1}+\sqrt{2a+1}-\sqrt{2a-1}}{\sqrt{2a+1}+\sqrt{2a-1}-\sqrt{2a+1}+\sqrt{2a-1}}$$

(Apply compodendo-dividendo $\frac{A}{B}=\frac{C}{D}$

$\Rightarrow \frac{A+B}{A-B}=\frac{C+D}{C-D}$)

$$\frac{x+1}{x-1} = \frac{2\sqrt{2a+1}}{2\sqrt{2a-1}} = \frac{\sqrt{2a+1}}{\sqrt{2a-1}}$$

Squaring both sides

$$\frac{(x+1)^2}{(x-1)^2} = \left(\frac{\sqrt{2a+1}}{\sqrt{2a-1}}\right)^2$$

$$\frac{x^2+2x+1}{x^2-2x+1} = \frac{2a+1}{2a-1}$$

Apply compodendo - dividendo

$$\frac{x^2+2x+1+x^2-2x+1}{x^2+2x+1-x^2+2x-1} = \frac{2a+1+2a-1}{2a+1-2a+1}$$

$$\frac{2(x^2+1)}{4x} = \frac{4a}{2}$$

$$\frac{x^2+1}{2x} = \frac{2a}{1}$$

$$x^2 + 1 = 4ax$$

$$x^2 - 4ax + 1 = 0$$ **Hence proved.**

10. (a) If the 6th term of an A.P. is equal to four times its first term and the sum of fist six terms is 75, find the first term and the common difference. [3]

(b) The difference of two natural numbers is 7 and their product is 450. [3]

Find the numbers.

(c) Use ruler and compass for this question. Construct a circle of radius 4.5 cm. Draw a chord AB = 6 cm.

(i) Find the locus of points equidistant from A and B.

Mark the point where it meets the circle as D.

(ii) Join AD and find the locus of points which are equidistant from AD and AB. Mark the point where it meets the circle as C.

(iii) Join BC and CD, Mesuare and write down the length of side CD of the quadrilateral $ABCD$. [4]

Ans. (a) Let the first term of an A.P. be a and common difference be d respectively

$$a_6 = 4 \times a \text{ (given)}$$

$$a_6 = 4a \quad ...(i)$$

$$a + 5d = 4a \quad \{a_n = a + (n-1)d\}$$

$$3a = 5d$$

$$a = \frac{5}{3}d \quad ...(ii)$$

$$S_6 = 75 \text{ (given)}$$

$$\frac{n}{2}[a+a_6] = 75$$

$$\frac{6}{2}(a+a_6) = 75$$

$$a + a_6 = \frac{75}{3}$$

$$a + 4a = 25$$

$$a = \frac{25}{5} = 5$$

$\therefore$ $a = 5$

From equation (i)

$$a = \frac{5}{3}d$$

$$5 = \frac{5}{3}d$$

$\therefore$ $d = \frac{5\times 3}{5} \times 3$

$\therefore$ $d = 3$

First term of an A.P. = 5 and common difference = 3

(b) Let the numbers be x and y.

According the given condition

$$x - y = 7 \Rightarrow y = x - 7 \; [x>y] \quad ...(i)$$

$$xy = 450 \quad ...(ii)$$

From (i) & (ii)

$$x(x-7) = 450$$

$$x^2 - 7x - 450 = 0$$

$$x^2 - 25x + 18x - 450 = 0$$

$x(x-25)+18(x-25)=0$

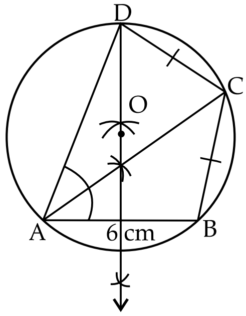
$(x-25)(x+18)=0$

If $x+18=0 \Rightarrow x=-18$ it is not a natural number.

If $x-25=0 \Rightarrow x=25,\ y=25-7=18$

Thus, numbers 25 and 18.

(c)



$BC = CD = 5.1$ cm (Approx.)

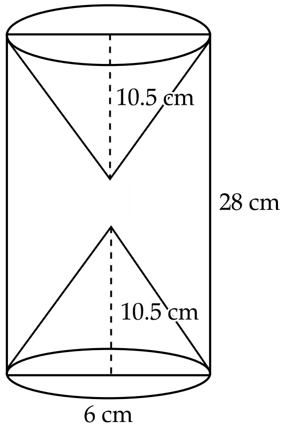
11. (a) A model of a high rise building is made to a scale of 1 : 50. [3]

(i) If the height of the model is 0.8 m, find the height of the actual building.

(ii) If the floor area of a flat in the building is 20 m^2, find the floor area of that in the model.

(b) From a solid wooden cylinder of height 28 cm and diameter 6 cm, two conical cavities are hollowed out. The diameters of the cones are also of 6 cm and height 10.5 cm.

Taking $\pi = \frac{22}{7}$ find the volume of the remaining solid.



[3]

(c) Prove the identity

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

Ans. (a) Scale = 1 : 50

Height of the model 0.8 m

$\therefore$ Height of the building = 0.8 × 50 m = 40 m

Floor area of building = 20 m^2

Floor area of the model $= \frac{20}{50\times 50}\text{m}^2$

$= \frac{1}{125}\text{m}^2$

$= 0.008 \text{ m}^2$

$\therefore$ Floor area of the model

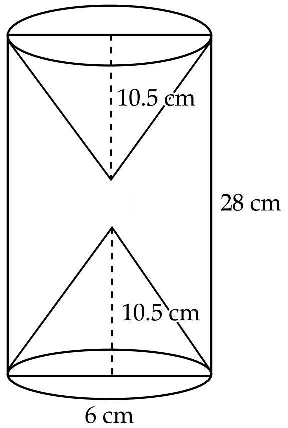
$= 0.008 \times 10000 \text{ cm}^2$

$= 80 \text{ cm}^2$

(b) Dimension of cylinder

Height (h) = 28 cm

Diameter($2r$) = 6 cm



Dimension of conical cavities

Height (H) = 10.5 cm

diameter ($2r$) = 6 cm

Volume of remaining solid = Volume of cylinder – 2 × Volume of cavity

$$= \pi r^2 h - 2\times\frac{1}{3}\pi r^2 H$$

$$= \pi r^2\left(h - \frac{2}{3}\text{H}\right)$$

$$= \frac{22}{7}\times 3\times 3(28 - \frac{2}{3}\times 10.5)$$

$$= \frac{22}{7}\times 3\times 3(28-7)$$

$$= \frac{22}{7}\times 3\times 3\times 21$$

$$= 22\times 3\times 3\times 3 = 594 \text{ cm}^3$$

Hence, volume of remaining solid = 594 cm^3

(c)

$$\left(\frac{1-\tan\theta}{1-\cot\theta}\right)^2 = \tan^2\theta$$

$$\text{L.H.S.} = \left(\frac{1-\tan\theta}{1-\cot\theta}\right)^2$$

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

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

$$= \left\{ \frac{\tan\theta\,(1-\tan\theta)}{-(1-\tan\theta)} \right\}^2$$

$$= \left\{ \frac{\tan\theta}{-1} \right\}^2 = \tan^2\theta$$

= R.H.S. **Hence proved.**

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