

Date: 05/05/2022

Question Paper Code

430/2/1

Time: 2 Hrs.

Max. Marks: 40

Class-X

MATHEMATICS (Basic) Term-II

(CBSE 2022)

GENERAL INSTRUCTIONS

- (i) This question paper contains **14** questions. **All** questions are compulsory.
- (ii) This question paper is divided into 3 Sections – **Section A, B and C**.
- (iii) **Section-A** comprises of **6** questions (Q. Nos. **1 to 6**) of **2** marks each.
*Internal choice has been provided in **two** questions.*
- (iv) **Section-B** comprises of **4** questions (Q. Nos. **7 to 10**) of **3** marks each.
*Internal choice has been provided in **one** question.*
- (v) **Section-C** comprises of **4** questions (Q. Nos. **11 to 14**) of **4** marks each. An internal choice has been provided in **one** question. It also contains **two** case study based questions.
- (vi) Use of calculator is not permitted.

SECTION-A

Question Numbers 1 to 6 carry 2 marks each.

1. Find the nature of the roots of the quadratic equation : [2]

$$4x^2 - 5x - 1 = 0$$

Solution

$$4x^2 - 5x - 1 = 0$$

$$D = b^2 - 4ac, \text{ where } a = 4, b = -5 \text{ and } c = -1 \quad [1/2]$$

$$\Rightarrow D = 25 + 16 = 41 \quad [1/2]$$

$$\Rightarrow D > 0 \quad [1/2]$$

$\therefore$ The given equation has real and distinct roots [1/2]

2. (a) Which term of the A.P. 3, 8, 13, 18, ... is 78? [2]

OR

- (b) Find the common difference of an A.P. whose n^{th} term is given by [2]

$$a_n = 6n - 5.$$

Solution

- (a) Given A.P. is 3, 8, 13, 18,

$$\text{Here, } a = 3 \text{ and } d = 8 - 3 = 5 \quad [1/2]$$

$$a_n = a + (n - 1)d \quad [n^{\text{th}} \text{ term}] \quad [1/2]$$

$$\Rightarrow 78 = 3 + (n - 1)5$$

$$\Rightarrow \frac{75}{5} = n - 1 \quad [1/2]$$

$$\Rightarrow n = 16$$

$\therefore$ 78 is 16th term of the given A.P. [1/2]

OR

- (b) n^{th} term of A.P. is

$$a_n = 6n - 5$$

$$\text{if } n = 1,$$

$$\Rightarrow a_1 = 6 - 5 = 1 \quad [1/2]$$

$$\text{if } n_2 = 2,$$

$$a_2 = 6 \times 2 - 5 = 7 \quad [1/2]$$

$$\therefore \text{Common difference } (d) = 7 - 1 \quad [1/2]$$

$$= 6 \quad [1/2]$$

3. 3 cubes each of 8 cm edge are joined end to end. Find the total surface area of the cuboid so formed. [2]

Solution

Dimensions of cuboid are 24 cm, 8 cm, 8 cm

$$\text{T.S.A of cuboid} = 2(lb + bh + lh) \quad [1/2]$$

$$= 2[24(8) + 8(8) + 24(8)] \quad [1/2]$$

$$= 2[192 + 64 + 192] \quad [1/2]$$

$$= 2[448] = 896 \text{ cm}^2 \quad [1/2]$$

4. (a) In Fig. 1, perimeter of $\triangle PQR$ is 20 cm. Find the length of tangent PA .

[2]

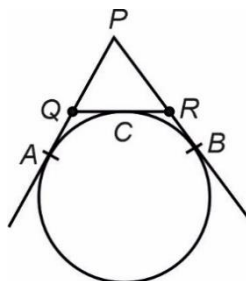


Fig. 1

OR

- (b) In Fig. 2, BC is tangent to the circle at point B of circle centred at O . BD is a chord of the circle so that $\angle BAD = 55^\circ$. Find $m\angle DBC$.

[2]

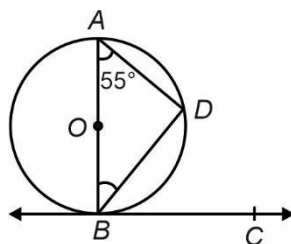
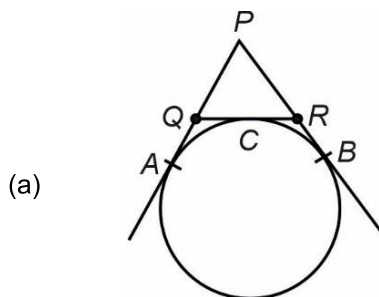


Fig. 2

Solution



$$PA = PQ + QA$$

$$= PQ + QC \quad \dots(i) \quad [\because QA = QC]$$

[1/2]

and $PB = PR + BR$

[1/2]

$$= PR + CR \quad \dots(ii) \quad [\because BR = CR]$$

Adding (i) and (ii), we get

$$PA + PB = PQ + QC + CR + PR$$

$$\Rightarrow 2PA = PQ + QR + PR \quad [\because PA = PB]$$

[1/2]

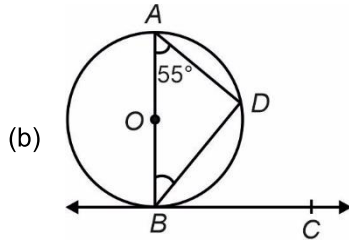
$$\Rightarrow PA = \frac{\text{Perimeter of } \triangle PQR}{2}$$

$$= \frac{20}{2}$$

[1/2]

$$= 10 \text{ cm}$$

OR



$$\angle ADB = 90^\circ \text{ [Angle in semi-circle]}$$

[½]

$$\begin{aligned} \angle ABD &= 90^\circ - \angle BAD \text{ [Angle sum property of } \triangle ABD] \\ &= 90^\circ - 55^\circ \\ &= 35^\circ \end{aligned}$$

[½]

$$\begin{aligned} \text{Now, } \angle DBC &= 90^\circ - \angle ABD \quad [\because AB \perp BC] \\ &= 90^\circ - 35^\circ \\ &= 55^\circ \end{aligned}$$

[½]

[½]

[2]

5. Find the mode of the following frequency distribution:

Class :	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
Frequency :	25	30	45	42	35

Solution

$$\text{Mode} = l + \frac{(f_m - f_1)}{(2f_m - f_1 - f_2)} \times h$$

[½]

$$\Rightarrow f_m = 45$$

$$f_1 = 30$$

$$f_2 = 42$$

$$h = 10$$

$$l = 40$$

[½]

$$\therefore \text{Mode} = 40 + \left(\frac{45 - 30}{90 - 72} \right) \times 10$$

[½]

$$= 40 + \left(\frac{15}{18} \times 10 \right) = 40 + \left(\frac{150}{18} \right) = 40 + 8.33 = 48.33$$

[½]

6. Find the sum of the first fifteen multiples of 8.

[2]

Solution

First fifteen multiples of 8 are

8, 16, 24,

[½]

Here, $a = 8$ and $d = 8$

$$S_{15} = \frac{15}{2} [2 \times 8 + (15 - 1)8]$$

[½]

$$= \frac{15}{2} [16 + 112]$$

[½]

$$= \frac{15 \times 128}{2}$$

$$= 960$$

$\therefore$ Sum of first fifteen multiples of 8 is 960.

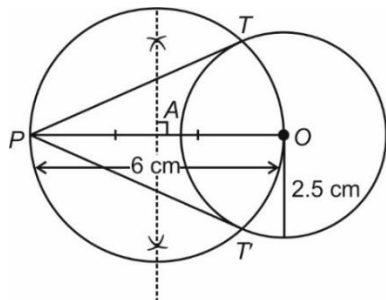
[½]

SECTION-B

Question Numbers 7 to 10 carry 3 marks each.

7. Draw a circle of radius 2.5 cm. Construct a pair of tangents from a point P at a distance of 6 cm from the centre of the circle. [3]

Solution



$\therefore PT$ and PT' are the required tangents.

[3]

8. (a) As observed from the top of a light house 100 m above sea level, the angle of depression of a ship, sailing directly towards it, changes from 30° to 45° . Determine the distance travelled by the ship during this time. [3]

(Use $\sqrt{3} = 1.73$)

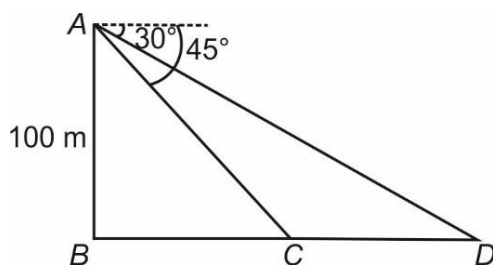
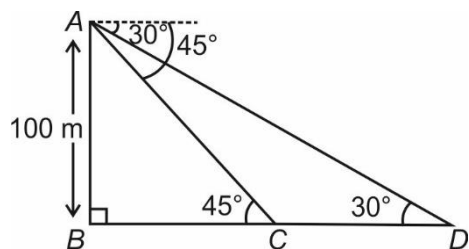


Fig. 3

Solution



In $\triangle ABC$,

$$\frac{AB}{BC} = \tan 45^\circ = 1$$

[½]

$$\Rightarrow AB = BC = 100 \text{ m}$$

...(i)

[½]

In $\triangle ABD$,

$$\frac{AB}{BD} = \tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\Rightarrow BD = AB \times \sqrt{3}$$

$$= 100\sqrt{3} \text{ m}$$

...(ii)

[½]

$$\begin{aligned}
 \therefore CD &= BD - BC \\
 &= (100\sqrt{3} - 100) \text{ m} && [\text{From (i) and (ii)}] && [\frac{1}{2}] \\
 &= 100(\sqrt{3} - 1) \text{ m} \\
 &= 100(1.73 - 1) \text{ m} \\
 &= 100 \times 0.73 \text{ m} && [\frac{1}{2}] \\
 &= 73 \text{ m}
 \end{aligned}$$

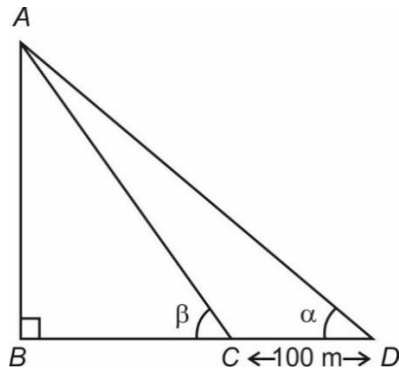
$\therefore$ Ship will travel 73 m during the given time. [$\frac{1}{2}$]

OR

(b) At a point on level ground, the angle of elevation of a vertical tower is, found to be α such that $\tan \alpha = \frac{1}{3}$.

After walking 100 m towards the tower, the angle of elevation β becomes such that $\tan \beta = \frac{3}{4}$. Find the height of the tower. [3]

Solution



Let AB represents the tower. Observer is moving from D to C .

In $\triangle ABC$,

$$\tan \beta = \frac{AB}{BC} = \frac{3}{4} \quad \dots(i) \quad [\frac{1}{2}]$$

and in $\triangle ABD$,

$$\tan \alpha = \frac{AB}{BD} = \frac{1}{3} \quad \dots(ii) \quad [\frac{1}{2}]$$

From (i) and (ii), we get

$$BC = \frac{4AB}{3} \text{ and } BD = 3AB \quad [\frac{1}{2}]$$

$$\Rightarrow CD = BD - BC \quad [\frac{1}{2}]$$

$$\Rightarrow 100 = 3AB - \frac{4AB}{3}$$

$$\Rightarrow 100 = \frac{9AB - 4AB}{3} \quad [\frac{1}{2}]$$

$$\Rightarrow 300 = 5AB$$

$$\Rightarrow AB = 60 \text{ m}$$

$\therefore$ Height of tower is 60 m. [$\frac{1}{2}$]

9. Find the mean of the following frequency distribution : [3]

Class :	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35
Frequency :	4	10	5	6	5

Solution

Class	Frequency (f_i)	Class Marks (x_i)	Product ($f_i x_i$)
10–15	4	12.5	50.00
15–20	10	17.5	175.00
20–25	5	22.5	112.50
25–30	6	27.5	165.00
30–35	5	32.5	162.50
Total	$N = 30$		$\sum f_i x_i = 665.00$

[1]

$$\text{Mean } (\bar{x}) = \frac{1}{N} \sum_{i=1}^k f_i x_i \quad [1]$$

$$= \frac{\sum_{i=1}^5 f_i x_i}{N} = \frac{665.0}{30} \quad [1]$$

$$= 22.17 \text{ (approx.)}$$

10. The median of following frequency distribution is 25. Find the value of x . [3]

Class :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency :	6	9	10	8	x

Solution

Class	Frequency	c.f.
0–10	6	6
10–20	9	15
20–30	10	25
30–40	8	33
40–50	x	$33+x$

[½]

$$\text{Median} = 25$$

$$\Rightarrow \text{Median class is } 20-30$$

$$\Rightarrow f = 10, \text{ c.f.} = 15, N = 33 + x, h = 10 \text{ and } l = 20 \quad [½]$$

$$\text{Median} = l + \left(\frac{\frac{N}{2} - \text{cf}}{f} \right) \times h \quad [½]$$

$$\Rightarrow 25 = 20 + \left(\frac{\frac{33+x}{2} - 15}{10} \times 10 \right) \quad [½]$$

$$\Rightarrow 5 = \frac{33 + x - 30}{2} \quad [1/2]$$

$$\Rightarrow 10 = 3 + x$$

$$\therefore x = 7 \quad [1/2]$$

SECTION-C

Question Numbers 11 to 14 carry 4 marks each.

11. (a) Prove that a parallelogram circumscribing a circle is a rhombus. [4]

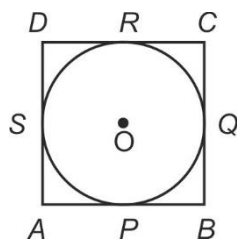
OR

- (b) Prove that the perpendicular at the point of contact to the tangent to a circle passes through the centre of the circle. [4]

Solution (a)

Given : A circle with centre O .

A parallelogram $ABCD$ touching the circle at Points P, Q, R and S



To Prove: $ABCD$ is a rhombus

Proof: A rhombus is a parallelogram with all sides equal

In parallelogram $ABCD$

$$AB = CD \text{ and } BC = AD \quad [1]$$

We know that the lengths of tangents from an external point are equal

$$\therefore AP = AS \quad \dots(i)$$

$$BP = BQ \quad \dots(ii)$$

$$CQ = CR \quad \dots(iii)$$

$$DR = DS \quad \dots(iv) \quad [1]$$

Adding (i), (ii), (iii) and (iv), we get

$$\Rightarrow AP + BP + CR + DR = AS + BQ + CQ + DS$$

$$\Rightarrow AB + (CR + DR) = AS + BQ + CQ + DS$$

$$\Rightarrow AB + CD = (AS + DS) + (BQ + CQ)$$

$$\Rightarrow AB + CD = AD + BC$$

$$\Rightarrow CD + CD = BC + BC$$

$$[\because AB = CD \text{ and } AD = BC] \quad [1]$$

$$\Rightarrow CD = BC$$

$$\therefore AB = CD = BC = AD$$

All sides are equal

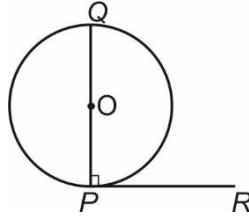
$$\Rightarrow \text{Hence, } ABCD \text{ is a rhombus} \quad [1]$$

OR

Solution (b)

Let, O is the centre of the given circle. A segment PR has been drawn touching the circle at point P . [½]

Draw $QP \perp RP$ at point P , such that point Q lies on the circle. [½]



$\angle OPR = 90^\circ$ [Radius $\perp$ Tangent] [½]

Also, $\angle QPR = 90^\circ$ [given] [½]

$\therefore \angle OPR = \angle QPR$ [½]

Now, the above case is possible only when centre O lies on the line QP . [1]

Hence, perpendicular at the point of contact to the tangent to a circle passes through the centre of the circle. [½]

12. The sum of the ages of a boy and his sister (in years) is 25 and product of their ages is 150. Find their present ages. [4]

Solution

Let age of boy be x years, then age of his sister will be $(25 - x)$ years [½]

Product of their ages, $(x)(25 - x) = 150$ [½]

$\Rightarrow 25x - x^2 = 150$ [½]

$\Rightarrow x^2 - 25x + 150 = 0$ [½]

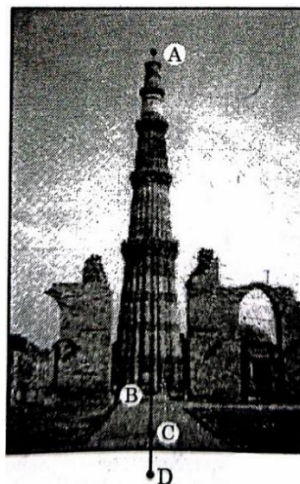
$\Rightarrow (x - 15)(x - 10) = 0$ [1]

$\Rightarrow x = 10$ and 15 [½]

Hence, their present age's are 10 years and 15 years. [½]

Case Study - 1

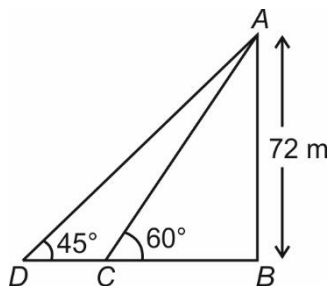
13. Qutub Minar, located in South Delhi, India, was built in the year 1193. It is 72 m high tower. Working on a school project, Charu and Daljeet visited the monument. They used trigonometry to find their distance from the tower. Observe the picture given below. Points C and D represent their positions on the ground in line with the base of tower, the angles of elevation of top of the tower (Point A) are 60° and 45° from points C and D respectively.



- (i) Based on above information, draw a well-labelled diagram. [1]
- (ii) Find the distances CD , BC and BD . (use $\sqrt{3} = 1.73$) [3]

Solution

- (i) Let positions of Charu and Daljeet be C and D respectively, [1]



Charu is nearer to Qutub Minar as its angle of elevation is greater.

- (ii) In $\triangle ABC$,

$$\tan 60^\circ = \frac{AB}{BC} \quad [1/2]$$

$$\Rightarrow \sqrt{3} = \frac{72}{BC} \quad [1/2]$$

$$\Rightarrow BC = 41.52 \text{ m} \quad [1/2]$$

In $\triangle ABD$,

$$\tan 45^\circ = \frac{AB}{BD} \quad [1/2]$$

$$\Rightarrow 1 = \frac{72}{BD}$$

$$\Rightarrow BD = 72 \text{ m} \quad [1/2]$$

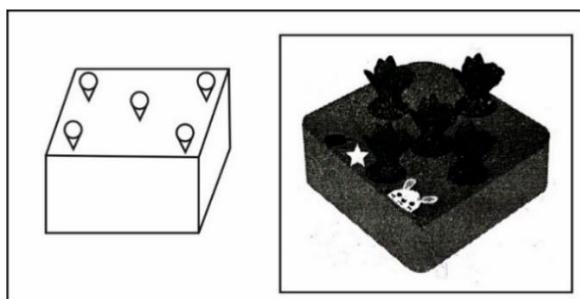
$$CD = BD - BC$$

$$CD = (72 - 41.52) \text{ m}$$

$$= 30.48 \text{ m} \quad [1/2]$$

Case Study - 2

14. A solid cuboidal toy is made of wood. It has five cone shaped cavities to hold toy carrots. The dimensions of the toy are cuboid – $10 \text{ cm} \times 10 \text{ cm} \times 8 \text{ cm}$. Each cone carved out – Radius = 2.1 cm and Height = 6 cm .



- (i) Find the volume of wood carved out to make five conical cavities. [2]
- (ii) Find the volume of the wood in the final product. [2]

Solution

- (i) Dimensions of cuboid = 10 cm × 10 cm × 8 cm

Dimensions of cone,

Radius, $R = 2.1$ cm

Height, $H = 6$ cm

$$\text{Volume of wood carved out} = \text{Volume of 5 cones} = \frac{1}{3}(\pi)R^2H \times 5 \quad [1]$$

$$= 5 \times \frac{1}{3} \times \frac{22}{7} \times (2.1)^2 \times 6 = 138.6 \text{ cm}^3 \quad [1]$$

- (ii) Volume of the wood in the final product = Volume of cuboid – Volume of wood carved out [1]

$$= (10 \times 10 \times 8 - 138.6) \text{ cm}^3 \quad [1/2]$$

$$= 661.4 \text{ cm}^3 \quad [1/2]$$

