

Sample Question Paper - 28
Mathematics-Basic (241)
Class- X, Session: 2021-22
TERM II

Time Allowed : 2 hours

Maximum Marks : 40

General Instructions :

1. The question paper consists of 14 questions divided into 3 sections A, B, C.
2. Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.
3. Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in one question.
4. Section C comprises of 4 questions of 4 marks each. An internal choice has been provided in one question. It contains two case study based questions.

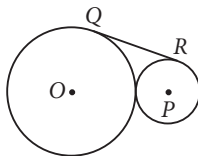
SECTION - A

1. Find the roots of the quadratic equation $\frac{11}{3+x} = 4(3-x)$
2. A circus tent is cylindrical to a certain height and conical above it. If its diameter is 105 m and its slant height is 40 m, then find the curved surface area of cone.
3. If 18, a , b , -3 are consecutive terms of an A.P., then find a , b .

OR

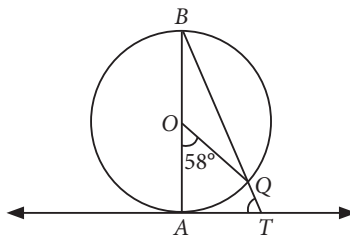
The first and the last terms of an A.P. are 8 and 65 respectively. If the sum of all its terms is 730, then find its common difference.

4. If the median of the data: 6, 7, $x-2$, x , 17, 20 written in ascending order, is 16, then find the value of x .
5. The number obtained by adding 12 to a natural number is 160 times of the multiplicative inverse of the natural number. Find the number.
6. Two circles with centres O and P , and radii 8 cm and 4 cm touch each other externally. Find the length of their common tangent QR .



OR

In the given figure, AB is a diameter of a circle with centre O , AT is a tangent and $\angle AOQ = 58^\circ$, then find $\angle ATQ$.

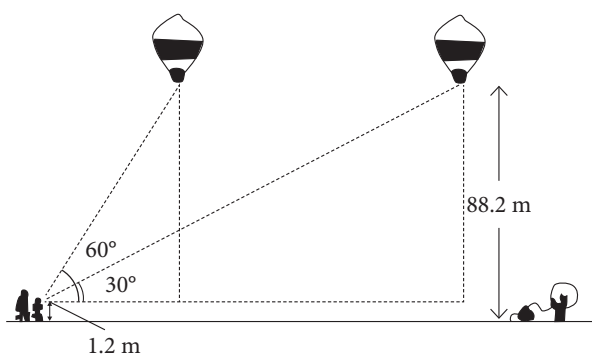


SECTION - B

7. Draw two tangents at the end points of the diameter of a circle of radius 3.5 cm. Are these tangents parallel?
8. The angles of depression of the top and bottom of a 8 m tall building from the top of a multi storied building are 30° and 45° , respectively. Find the height of the multi storied building and the distance between the two buildings.

OR

A 1.2 m tall girl spots a balloon moving with the wind in a horizontal line at a height 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60° . After sometime, the angle of elevation reduces 30° . Find the distance travelled by the balloon during the interval.



9. If the median of the following distribution is 46, find the missing frequencies p and q .

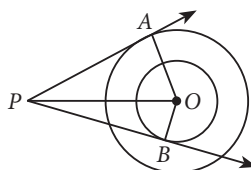
Class interval	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
Frequency	12	30	p	65	q	25	18	230

10. The mean of the following frequency distribution is 25.2. Find the missing frequency x .

Class-interval	0-10	10-20	20-30	30-40	40-50
Frequency	8	x	10	11	9

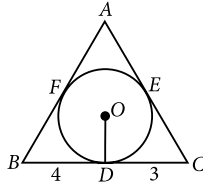
SECTION - C

11. In the given figure, if O is the centre of two concentric circles with $OA = 6$ cm, $OB = 3$ cm and $AP = 10$ cm, then find the length of BP and OP .



OR

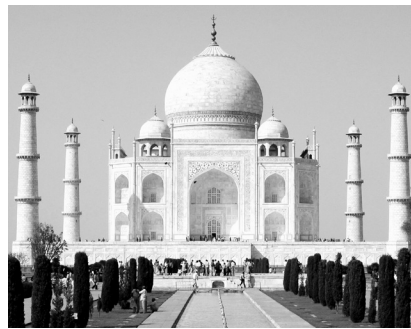
In the given figure, a triangle ABC is drawn to circumscribe a circle of radius 2 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 4 cm and 3 cm respectively. If area of $\triangle ABC = 21 \text{ cm}^2$, then find the lengths of sides AB and AC .



12. A man rowing a boat away from a lighthouse 150 m high takes 2 minutes to change the angle of elevation of the top of lighthouse from 45° to 30° . Find the speed of the boat. [Use $\sqrt{3} = 1.732$]

Case Study - 1

13. Rohan's class teacher arranged a historical trip to Tajmahal. She explained it is made of a number of solid shapes and the tomb is the central focus of entire complex. The most spectacular feature is marble dome that surmounts the tomb. Height and length of dome is approximate equal to 35 m and make more noticeable by the cylindrical drum it sits on, which is approx 7 m high. The shape of dome is emphasised by four smaller domes placed at its corner, which replicate the main dome. It is surrounded by four minarets each 40 m high.



- Find curved surface area of 4 small domes, if its base radius is about 5 m.
- Find the volume of cylindrical drum on which high dome is situated, if its radius is 4 m.

Case Study - 2

14. Uses of quadratic equations in daily life :

In real life problem, if a state government wants to open gym in every society and for that purpose they plan to distribute some rectangular plots each of area equal to 560 m^2 . The dimensions of the rectangular plots are such that their breadth are 8 m shorter than their length.

- Form the quadratic equation from above given information.
- Find the length and breadth of the plot.



Solution

MATHEMATICS BASIC 241

Class 10 - Mathematics

1. We have, $\frac{11}{3+x} = 4(3-x)$

$$\Rightarrow 4(3+x)(3-x) = 11 \Rightarrow 4(9-x^2) = 11$$

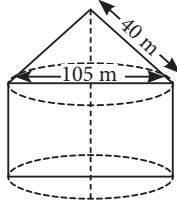
$$\Rightarrow 36 - 4x^2 = 11 \Rightarrow 4x^2 = 25$$

$$\Rightarrow x^2 = \frac{25}{4} = \left(\frac{5}{2}\right)^2 \therefore x = \pm \frac{5}{2}$$

2. Curved surface area of cone = πrl

$$= \pi \left(\frac{105}{2} \right) 40$$

$$= \frac{22}{7} \times 2100 = 6600 \text{ m}^2$$



3. We have, 18, a , b , -3 are in A.P.

$$\therefore a - 18 = b - a = -3 - b$$

$$\text{So, } a - 18 = b - a \Rightarrow 2a - b = 18 \quad \dots(i)$$

$$\text{and } b - a = -3 - b \Rightarrow a - 2b = 3 \quad \dots(ii)$$

Solving (i) and (ii), we get $a = 11$ and $b = 4$.

OR

Let a and d be the first term and common difference respectively of the A.P.

$$\text{Given, } a = 8 \text{ and } l = 65 = a + (n-1)d$$

$$\Rightarrow 65 = 8 + (n-1)d \Rightarrow 57 = (n-1)d \quad \dots(i)$$

$$\text{Also, } S_n = 730 \text{ (Given)} \Rightarrow \frac{n}{2}(a+l) = 730$$

$$\Rightarrow n[8+65] = 1460 \Rightarrow n = \frac{1460}{73} = 20$$

Putting value of n in (i), we get $57 = (20-1)d$

$$\Rightarrow 57 = 19d \Rightarrow d = 3$$

4. Here, $n = 6$, which is even,

$$\therefore \text{Median} = \frac{1}{2} \left(\left(\frac{6}{2} \right)^{\text{th}} \text{ term} + \left(\frac{6}{2} + 1 \right)^{\text{th}} \text{ term} \right)$$

$$\Rightarrow 16 = \frac{1}{2} (3^{\text{rd}} \text{ term} + 4^{\text{th}} \text{ term})$$

$$\Rightarrow 32 = x - 2 + x$$

$$\Rightarrow 2x = 34 \Rightarrow x = 17$$

5. Let the natural number be x .

According to question,

$$x + 12 = \frac{160}{x}$$

$$\Rightarrow x^2 + 12x = 160 \Rightarrow x^2 + 12x - 160 = 0$$

$$\Rightarrow x^2 + 20x - 8x - 160 = 0$$

$$\Rightarrow x(x+20) - 8(x+20) = 0$$

$$\Rightarrow (x-8)(x+20) = 0 \Rightarrow x = 8 \text{ or } x = -20$$

Since, $x = -20$ is not a natural number.

So, required natural number is 8.

6. Join O to P and Q . Join P to R .

Draw $SP \perp OQ$.

Now $SP = QR$, as they are opposite sides of rectangle $PRQS$.

$$OP = 8 \text{ cm} + 4 \text{ cm} = 12 \text{ cm}$$

$$OS = 8 \text{ cm} - 4 \text{ cm} = 4 \text{ cm}$$

$$\text{Now, in } \triangle OSP, OP^2 = OS^2 + SP^2$$

$$\Rightarrow SP = \sqrt{OP^2 - OS^2} = \sqrt{12^2 - 4^2} \text{ cm} = 8\sqrt{2} \text{ cm}$$

$$\therefore QR = 8\sqrt{2} \text{ cm.}$$

OR

$$\text{Given, } \angle AOQ = 58^\circ$$

$$\angle ABQ = \frac{1}{2} \angle AOQ \quad (\because \text{Angle subtended by an arc at the centre is double the angle subtended by the same arc at any point of circle})$$

$$\Rightarrow \angle ABQ = \frac{1}{2} \times 58^\circ = 29^\circ$$

$$\Rightarrow \angle ABQ = \frac{1}{2} \times 58^\circ = 29^\circ$$

$$\text{Now, } \angle BAT = 90^\circ$$

$$(\because OA \perp AT)$$

In $\triangle ABT$,

$$\angle ABT + \angle BAT + \angle ATB = 180^\circ$$

(Angle sum property of triangle)

$$\Rightarrow 29^\circ + 90^\circ + \angle ATB = 180^\circ$$

$$\Rightarrow \angle ATB = 180^\circ - 90^\circ - 29^\circ = 61^\circ$$

7. Steps of construction :

Step-I : Draw a circle with centre O and radius 3.5 cm.

Step-II : Draw the diameter PQ .

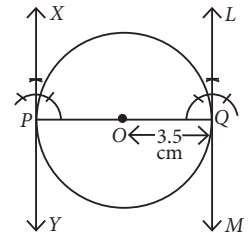
Step-III : Construct perpendiculars on PQ at both end points P and Q .

Thus, XPY and LQM are the two tangents at P and Q to the circle with centre O .

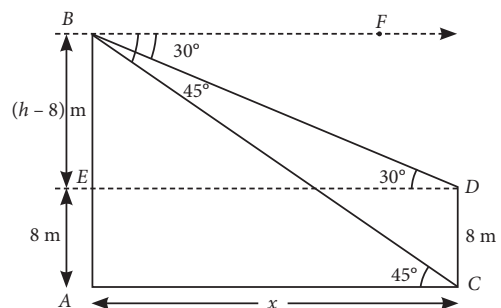
$$\text{Since } \angle XPQ + \angle PQL$$

$$= 90^\circ + 90^\circ = 180^\circ$$

$$\therefore XPY \parallel LQM$$



8. Let AB and CD be the two buildings.



Let the height of the multi-storied building be h m and the distance between the two buildings be x m.

$$AE = CD = 8 \text{ m}$$

[Given]

$$BE = AB - AE = (h - 8) \text{ m}$$

$$\text{and } AC = DE = x \text{ m}$$

Now, In $\triangle ACB$,

$$\tan 45^\circ = \frac{AB}{AC}$$

$$\Rightarrow 1 = \frac{h}{x} \Rightarrow x = h$$

...(i)

$$\text{In } \triangle BDE, \tan 30^\circ = \frac{BE}{ED}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h-8}{x}$$

$$\Rightarrow x = \sqrt{3}(h-8)$$

...(ii)

From (i) and (ii), we get

$$h = \sqrt{3}h - 8\sqrt{3} \Rightarrow \sqrt{3}h - h = 8\sqrt{3}$$

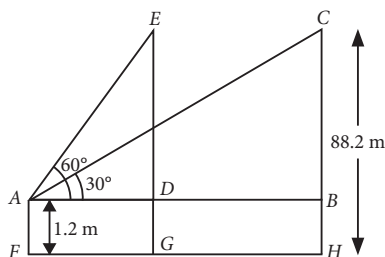
$$\Rightarrow h(\sqrt{3} - 1) = 8\sqrt{3}$$

$$\Rightarrow h = \frac{8\sqrt{3}}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} \Rightarrow h = (12 + 4\sqrt{3}) \text{ m}$$

Thus, distance between the two buildings

$$= (12 + 4\sqrt{3}) \text{ m}$$

OR



From the given figure, the angle of elevation for the first position of the balloon i.e., $\angle EAD = 60^\circ$ and for second position i.e., $\angle BAC = 30^\circ$.

$$\text{Also, } ED = CB = 88.2 - 1.2 = 87 \text{ m}$$

$$\text{Let } AD = x \text{ m and } AB = y \text{ m}$$

$$\text{Then in } \triangle ADE, \tan 60^\circ = \frac{DE}{AD}$$

$$\Rightarrow \sqrt{3} = \frac{87}{x} \Rightarrow x = \frac{87}{\sqrt{3}}$$

...(i)

$$\text{In } \triangle ABC, \tan 30^\circ = \frac{BC}{AB}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{87}{y} \Rightarrow y = 87\sqrt{3}$$

...(ii)

Subtracting (i) from (ii), we get

$$y - x = 87\sqrt{3} - \frac{87}{\sqrt{3}} = 87\left(\frac{3-1}{\sqrt{3}}\right)$$

$$\Rightarrow y - x = 58\sqrt{3} \text{ m}$$

Hence, the distance travelled by the balloon BD

$$\text{i.e., } y - x = 58\sqrt{3} \text{ m.}$$

9. The frequency distribution table for the given data can be drawn as :

Class	Frequency (f_i)	Cumulative frequency ($c.f.$)
10-20	12	12
20-30	30	42
30-40	p	$42 + p$
40-50	65	$107 + p$
50-60	q	$107 + p + q$
60-70	25	$132 + p + q$
70-80	18	$150 + p + q$
Total	230	

Since, median is 46, so 40-50 is median class.

$$\text{Median} = l + \left(\frac{\frac{N}{2} - c.f.}{f} \right) \times h$$

$$\Rightarrow 46 = 40 + \left(\frac{\frac{230}{2} - (42 + p)}{65} \right) \times 10$$

$$\Rightarrow 6 = \frac{(115 - 42 - p)}{65} \times 10$$

$$\Rightarrow 39 = 73 - p \Rightarrow p = 34$$

$$\text{Also, } 150 + p + q = 230$$

$$\Rightarrow 150 + 34 + q = 230 \Rightarrow q = 230 - 184 \Rightarrow q = 46$$

\therefore Missing frequencies p and q are 34 and 46 respectively.

10. The frequency distribution table from the given data can be drawn as :

Class-interval	Frequency (f_i)	Class Marks (x_i)	$f_i x_i$
0-10	8	5	40
10-20	x	15	$15x$
20-30	10	25	250
30-40	11	35	385
40-50	9	45	405
Total	$38 + x$		$1080 + 15x$

It is given that mean = 25.2

$$\Rightarrow \frac{\sum f_i x_i}{\sum f_i} = 25.2 \Rightarrow \frac{15x + 1080}{x + 38} = \frac{252}{10}$$

$$\begin{aligned}\Rightarrow 10 \times (15x + 1080) &= 252 \times (x + 38) \\ \Rightarrow 150x + 10800 &= 252x + 9576 \\ \Rightarrow 252x - 150x &= 10800 - 9576 \\ \Rightarrow 102x &= 1224 \Rightarrow x = 12\end{aligned}$$

11. In $\triangle APO$, $OA \perp AP$

$$\therefore OP^2 = PA^2 + OA^2 \text{ (By Pythagoras theorem) } \dots(i)$$

In $\triangle BPO$, $OB \perp BP$

$$\therefore OP^2 = BP^2 + OB^2 \text{ (By Pythagoras theorem) } \dots(ii)$$

From (i) and (ii), we get

$$PA^2 + OA^2 = BP^2 + OB^2$$

$$\Rightarrow 10^2 + 6^2 = BP^2 + 3^2$$

$$\Rightarrow 100 + 36 = BP^2 + 9$$

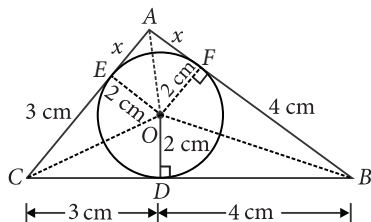
$$\Rightarrow BP^2 = 136 - 9 = 127 \Rightarrow BP = \sqrt{127} \text{ cm}$$

$$\text{Now, from (ii) } OP^2 = 127 + 3^2 = 127 + 9 = 136 \text{ cm}$$

$$\therefore OP = \sqrt{136} = 2\sqrt{34} \text{ cm}$$

OR

Let E and F be the points where the tangents AC and AB touches the circle respectively. Join OE and OF .



Now, radius is perpendicular to tangent at the point of contact.

So, $OD \perp BC$, $OE \perp AC$ and $OF \perp AB$.

Join OA , OB and OC .

Since, tangents drawn from an external point to a circle are equal.

$$\therefore BD = BF = 4 \text{ cm, } CD = CE = 3 \text{ cm and}$$

$$AE = AF = x \text{ cm (say)}$$

Now, area of $\triangle ABC$ = area of $\triangle AOB$ + area of $\triangle BOC$ + area of $\triangle AOC$

$$\Rightarrow 21 = \frac{1}{2} \times AB \times OF + \frac{1}{2} \times BC \times OD + \frac{1}{2} \times AC \times OE$$

$$\Rightarrow 21 = \frac{1}{2} \times (x + 4) \times 2 + \frac{1}{2} \times 7 \times 2 + \frac{1}{2} \times (x + 3) \times 2$$

$$\Rightarrow 21 = x + 4 + 7 + 3 + x$$

$$\Rightarrow 2x + 14 = 21 \Rightarrow 2x = 7$$

$$\Rightarrow x = \frac{7}{2} = 3.5$$

$$\therefore AB = 3.5 + 4 = 7.5 \text{ cm and } AC = 3.5 + 3 = 6.5 \text{ cm}$$

12. Let AB be the lighthouse of height 150 m.

Let initially boat is at C and after 2 minutes it reaches at D .

$$\text{In right } \triangle ABC, \frac{AB}{BC} = \tan 45^\circ$$

$$\Rightarrow \frac{150}{BC} = 1 \Rightarrow BC = 150 \text{ m}$$

$$\text{In right } \triangle ABD, \frac{AB}{BD} = \tan 30^\circ$$

$$\Rightarrow \frac{150}{BD} = \frac{1}{\sqrt{3}} \Rightarrow BD = 150\sqrt{3} \text{ m}$$

$$\therefore \text{Distance covered in 2 minutes is } CD = BD - BC$$

$$= 150\sqrt{3} - 150 = 150(\sqrt{3} - 1) \text{ m}$$

$$\therefore \text{Speed of boat} = \frac{\text{Distance covered}}{\text{Time taken}} = \frac{150(\sqrt{3} - 1)}{2}$$

$$= 75 \times (1.732 - 1) = 75 \times 0.732 = 54.9 \text{ m/minutes}$$

13. (i) Curved surface area of 4 small domes

$$= 4 \times 2\pi r^2$$

$$= 4 \times 2 \times \frac{22}{7} \times 5 \times 5 = 628.5 \text{ m}^2$$

(ii) Volume of cylindrical drum = $\pi r^2 h$

$$= \frac{22}{7} \times 4 \times 4 \times 7 \quad [\because \text{radius} = 4 \text{ m, height} = 7 \text{ m}]$$

$$= 352 \text{ m}^3$$

14. (i) Suppose length of the plot = x metres and breadth of the plot = $(x - 8)$ metres.

Area of rectangular plot = Length \times Breadth

$$= x \times (x - 8) \text{ m}^2 = (x^2 - 8x) \text{ m}^2$$

Given, area of the plot = 560 m^2

$$\Rightarrow x^2 - 8x = 560 \text{ or } x^2 - 8x - 560 = 0$$

(ii) The quadratic equation is $x^2 - 8x - 560 = 0$

Compare the quadratic equation with $ax^2 + bx + c = 0$

$$\Rightarrow a = 1, b = -8, c = -560.$$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4 \cdot 1 \cdot (-560)}}{2}$$

$$\Rightarrow x = \frac{8 \pm \sqrt{64 + 2240}}{2}$$

$$\Rightarrow x = \frac{8 \pm \sqrt{2304}}{2}$$

$$\Rightarrow x = \frac{8 \pm 48}{2}$$

$$\Rightarrow x = 28 \text{ or } x = -20 \text{ (rejected)}$$

So length is $x = 28 \text{ m}$ and breadth is $x - 8 = 20 \text{ m}$.

