

Sample Question Paper - 35
Mathematics-Basic (241)
Class- X, Session: 2021-22
TERM II

Time Allowed : 2 hours

Maximum Marks : 40

General Instructions :

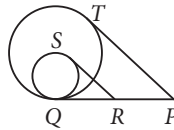
1. The question paper consists of 14 questions divided into 3 sections A, B, C.
2. Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.
3. Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in one question.
4. Section 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 mean of the following distribution :

Class	3-5	5-7	7-9	9-11	11-13
Frequency	5	10	10	7	8

2. In the given figure, PQ is the common tangent to both the circles. SR and PT are also tangents. If $SR = 16$ cm, $PT = 28$ cm, then find RP .



3. For what values of k , the quadratic equation $x^2 - 2kx + 5k = 0$ has equal roots?

OR

Solve for x : $2x^2 + 6\sqrt{3}x - 60 = 0$

4. If the numbers $2n + 1$, $3n + 4$ and $6n + 1$ are in A.P., find n and hence find the numbers.
5. Form the quadratic equation from $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}$, where x is a natural number. Also, solve the equation to find the value of x .
6. Two cubes each of volume 27 cm^3 are joined end to end to form a solid. Find the surface area of the resulting cuboid.

OR

A cuboidal solid block of metal $49 \text{ cm} \times 44 \text{ cm} \times 18 \text{ cm}$ is melted and formed into a solid sphere. Calculate the radius of the sphere.



SECTION - B

7. Find out the mode for the following data showing frequency with which profits are made:

Profit (in ₹ 10)	3-4	4-5	5-6	6-7	7-8	8-9	9-10
Frequency	83	27	25	50	75	38	18

8. The angle of depression of a car, standing on the ground, from the top of a 75 m high tower, is 30° . Find the distance of the car from the base of the tower.
9. Draw a circle with the help of a round bottle cap. Take a point outside the circle. Construct the pair of tangents from this point to the circle.

OR

Geometrically divide a line segment of length 9.6 cm internally in the ratio of 4 : 1.

10. Find the median of the following data :

Class interval	0-10	10-20	20-30	30-40	40-50	Total
Frequency	8	16	36	34	6	100

SECTION - C

11. Two ships are approaching a light-house from opposite directions. The angles of depression of the two ships from the top of the light-house are 30° and 45° . If the distance between the two ships is 100 m, find the height of the light-house. [Use $\sqrt{3} = 1.732$]

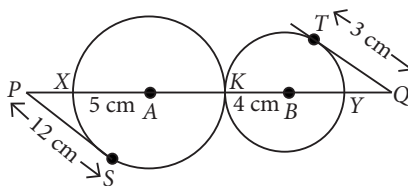
OR

Two poles of equal heights are standing opposite each other on either side of the road, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60° and 30° respectively. Find the height of the poles and the distances of the point from the poles. [Use $\sqrt{3} = 1.732$]

12. From a solid cylinder of height 20 cm and diameter 12 cm, a conical cavity of height 8 cm and radius 6 cm is hollowed out. Find the total surface area of the remaining solid. [Use $\pi = \frac{22}{7}$]

Case Study - 1

13. In a maths class, the teacher draws two circles that touch each other externally at point K with centres A and B and radii 5 cm and 4 cm respectively as shown in the figure.



Based on the above information, answer the following questions.

- (i) Find the value of PA.
- (ii) Find the value of PK.

Case Study - 2

14. While playing a treasure hunt game, some clues (numbers) are hidden in various spots collectively forms an A.P. If the number on the n^{th} spot is $5n - 1$, then answer the following questions to help the player in spotting the clues.



- (i) Which number is on the 24^{th} spot?
- (ii) Which spot is numbered as 119?



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

Class	Class marks (x_i)	Frequency (f_i)	$f_i x_i$
3-5	4	5	20
5-7	6	10	60
7-9	8	10	80
9-11	10	7	70
11-13	12	8	96
Total		40	326

$$\therefore \text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{326}{40} = 8.15$$

2. Since tangents drawn from an external point to a circle are equal in length.

$$\therefore PQ = PT = 28 \text{ cm and } RQ = RS = 16 \text{ cm}$$

$$\text{Now, } RP = PQ - RQ = (28 - 16) \text{ cm} = 12 \text{ cm}$$

3. For roots of $x^2 - 2kx + 5k = 0$ to be equal,

$$\text{Discriminant, } D = 0$$

$$\therefore (-2k)^2 - 4(1)(5k) = 0 \Rightarrow 4k^2 - 20k = 0$$

$$\Rightarrow k^2 - 5k = 0 \Rightarrow k(k - 5) = 0 \Rightarrow k = 0 \text{ or } k = 5$$

OR

$$\text{We have, } 2x^2 + 6\sqrt{3}x - 60 = 0$$

$$\Rightarrow x^2 + 3\sqrt{3}x - 30 = 0$$

$$\Rightarrow x^2 + 5\sqrt{3}x - 2\sqrt{3}x - 30 = 0$$

$$\Rightarrow x(x + 5\sqrt{3}) - 2\sqrt{3}(x + 5\sqrt{3}) = 0$$

$$\Rightarrow (x + 5\sqrt{3})(x - 2\sqrt{3}) = 0$$

$$\Rightarrow x + 5\sqrt{3} = 0 \text{ or } x - 2\sqrt{3} = 0$$

$$\Rightarrow x = -5\sqrt{3} \text{ or } x = 2\sqrt{3}.$$

4. Let $2n + 1$, $3n + 4$ and $6n + 1$ are in A.P.

$$\therefore (3n + 4) - (2n + 1) = (6n + 1) - (3n + 4)$$

$$\Rightarrow n + 3 = 3n - 3 \Rightarrow 6 = 2n \Rightarrow n = 3$$

$$\therefore \text{Numbers are } 2(3) + 1 = 7, 3(3) + 4 = 13, 6(3) + 1 = 19.$$

5. We have, $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}$

$$\text{Squaring both sides, we get } x^2 = 6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}$$

$$\Rightarrow x^2 = 6 + x$$

$$\Rightarrow x^2 - x - 6 = 0, \text{ which is the required quadratic equation.}$$

$$\text{Also, } x^2 + 2x - 3x - 6 = 0$$

$$\Rightarrow x(x + 2) - 3(x + 2) = 0 \Rightarrow (x + 2)(x - 3) = 0$$

$$\Rightarrow x = 3, -2 \text{ (} x = -2 \text{ is not possible as } x \text{ is a natural number)}$$

$$\therefore x = 3$$

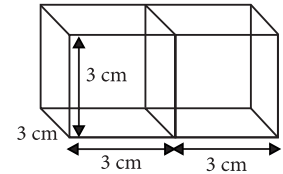
6. Let the edge of each cube be a cm.

$$\therefore \text{Volume of each cube} = a^3 \text{ cm}^3$$

$$\text{i.e., } a^3 = 27 = (3)^3 \Rightarrow a = 3$$

$$\therefore \text{Surface area of the cuboid} = 2(lb + bh + hl)$$

$$= 2(6 \times 3 + 3 \times 3 + 3 \times 6) = 2 \times 45 = 90 \text{ cm}^2$$



OR

Let r be the radius of sphere.

Now, volume of block = volume of sphere

$$\Rightarrow 49 \times 44 \times 18 = \frac{4}{3} \times \frac{22}{7} \times r^3$$

$$\Rightarrow \frac{49 \times 44 \times 18 \times 3 \times 7}{4 \times 22} = r^3$$

$$\Rightarrow (7 \times 3)^3 = r^3 \text{ or } r = 21 \text{ cm}$$

$$\therefore \text{Radius of sphere} = 21 \text{ cm}$$

7. From the given data, we observe that the highest frequency is 83, which lies in the class interval 3-4.

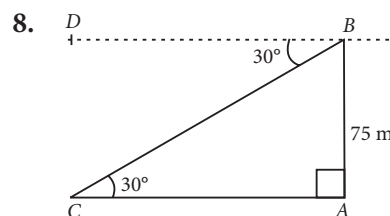
$$\therefore \text{Modal class is 3-4.}$$

$$\text{So, } l = 3, h = 1, f_1 = 83, f_0 = 0, f_2 = 27$$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 3 + \left(\frac{83 - 0}{2 \times 83 - 0 - 27} \right) \times 1 = 3 + \frac{83}{166 - 27} = 3 + \frac{83}{139}$$

$$= 3 + 0.5971 = 3.5971$$



Let $AB = 75 \text{ m}$ be the height of tower and C be the position of car.

Then, according to question,

$$\text{In right } \triangle ABC, \cot 30^\circ = \frac{AC}{AB}$$

$$\Rightarrow AC = AB \cot 30^\circ$$



$$\Rightarrow AC = 75 \times \sqrt{3} \Rightarrow AC = 75\sqrt{3} \text{ m}$$

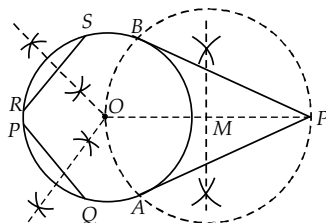
Thus, the distance of the car from the base of the tower is $75\sqrt{3}$ m.

9. Steps of construction :

Step-I : Draw the circle using a round bottle cap.

Step-II : Draw two non parallel chords PQ and RS on this circle.

Step-III : Draw the perpendicular bisectors of PQ and RS such that they intersect at O.



Therefore, O is the centre of the given circle.

Step-IV : Take a point P outside this circle.

Step-V : Join OP and bisect it. Let M be the mid-point of OP.

Step-VI : Taking M as centre and OM as radius, draw a circle intersecting the given circle at A and B.

Step-VII : Join PA and PB.

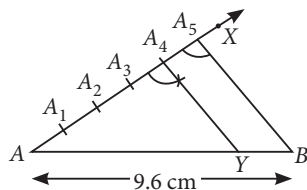
Thus, PA and PB are the required two tangents.

OR

Steps of construction :

Step-I : Draw a line segment AB = 9.6 cm.

Step-II : Draw a ray AX making an acute angle with AB.



Step-III : Locate $(4 + 1) = 5$ points A_1, A_2, \dots, A_5 on AX such that $AA_1 = A_1A_2 = \dots = A_4A_5$.

Step-IV : Join A_5B .

Step-V : Through A_4 , draw A_4Y parallel to A_5B meeting AB at point Y such that $\angle AA_5B = \angle AA_4Y$.

Thus, point Y divides AB in the ratio of 4 : 1, i.e., $AY : YB = 4 : 1$

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

Class interval	Frequency (f_i)	Cumulative frequency (c.f.)
0-10	8	8
10-20	16	24
20-30	36	60
30-40	34	94
40-50	6	100
Total	100	

Here, $N = 100$, $\frac{N}{2} = 50$, which lies in the class interval 20-30

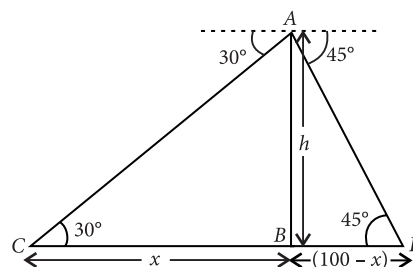
\therefore Median class is 20-30.

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

$$= 20 + \left[\frac{50 - 24}{36} \right] \times 10 = 20 + 7.22 = 27.22$$

11. Let AB be the light house and two ships C and D are 100 m apart.

Let $BC = x$ then, $BD = 100 - x$



$$\text{In } \triangle ABC, \tan 30^\circ = \frac{h}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x}$$

$$\Rightarrow h = \frac{x}{\sqrt{3}} \quad \dots(i)$$

$$\text{In } \triangle ABD, \tan 45^\circ = \frac{h}{100 - x}$$

$$\Rightarrow 1 = \frac{h}{100 - x} \Rightarrow 100 - x = h$$

$$\Rightarrow 100 - x = \frac{x}{\sqrt{3}} \quad (\text{From (i)})$$

$$\Rightarrow 100\sqrt{3} = x(\sqrt{3} + 1) \Rightarrow x = \frac{100(\sqrt{3})}{\sqrt{3} + 1}$$

$$\therefore x = \frac{100\sqrt{3}}{\sqrt{3} + 1} \times \frac{\sqrt{3} - 1}{\sqrt{3} - 1} = \frac{300 - 173.2}{2} = 63.4$$

$$\therefore h = \frac{63.4}{1.732} = 36.6 \text{ m}$$

OR

Let AB and CD be two poles of height h m.

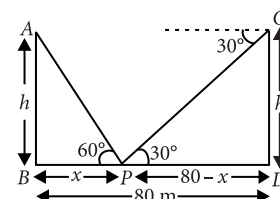
Let P be a point on road such that $BP = x$ m so that $PD = BD - BP = (80 - x)$ m

In $\triangle ABP$,

$$\frac{h}{x} = \tan 60^\circ$$

$$\Rightarrow h = \sqrt{3}x \quad \dots(i)$$

In $\triangle CDP$,



$$\frac{h}{80-x} = \tan 30^\circ \Rightarrow h = \frac{1}{\sqrt{3}}(80-x) \quad \dots(ii)$$

From (i) and (ii), we have

$$\sqrt{3}x = \frac{1}{\sqrt{3}}(80-x) \Rightarrow 3x = 80-x$$

$$\Rightarrow 4x = 80 \text{ or } x = 20$$

Distance of point P from $AB = 20$ m

Distance of point P from $CD = 80 - 20 = 60$ m

$$\begin{aligned} \text{Height of each pole, } h &= x\sqrt{3} = 20\sqrt{3} \\ &= 20 \times 1.732 = 34.64 \text{ m} \end{aligned}$$

12. Height of the cylinder, $h_1 = 20$ cm

$$\therefore \text{Radius of the cylinder, } r = \frac{12}{2} = 6 \text{ cm}$$

Height of the cone, $h_2 = 8$ cm

Radius of the cone, $r = 6$ cm

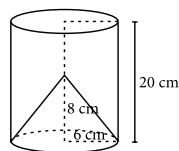
Total surface area of the remaining solid

= Area of the top face of the cylinder + CSA of the cylinder + CSA of the cone.

$$\begin{aligned} \text{Slant height of the cone, } l &= \sqrt{(8)^2 + (6)^2} \\ &= \sqrt{64 + 36} = \sqrt{100} = 10 \text{ cm} \end{aligned}$$

CSA of the cone = πrl

$$= \frac{22}{7} \times 6 \times 10 = \frac{1320}{7} \text{ cm}^2$$



CSA of the cylinder = $2\pi rh$

$$= 2 \times \frac{22}{7} \times 6 \times 20 = \frac{5280}{7} \text{ cm}^2$$

Area of the top face of the cylinder = πr^2

$$= \frac{22}{7} \times (6)^2 = \frac{792}{7} \text{ cm}^2$$

\therefore Total surface area of the remaining solid

$$\begin{aligned} &= \left(\frac{1320}{7} + \frac{5280}{7} + \frac{792}{7} \right) \text{ cm}^2 \\ &= \frac{7392}{7} \text{ cm}^2 = 1056 \text{ cm}^2 \end{aligned}$$

13. Here, $AS = 5$ cm, $BT = 4$ cm [\because Radii of circles]

(i) Since, radius at point of contact is perpendicular to tangent.

\therefore By Pythagoras theorem, we have

$$PA = \sqrt{PS^2 + AS^2} = \sqrt{12^2 + 5^2} = \sqrt{169} = 13 \text{ cm}$$

(ii) $PK = PA + AK$

$$= 13 + 5 = 18 \text{ cm.}$$

14. Number on n^{th} spot = $5n - 1$

$$\text{i.e., } t_n = 5n - 1$$

(i) Number on 24^{th} spot = t_{24}

$$= 5(24) - 1 = 119$$

(ii) Let n^{th} spot is numbered as 119.

$$\therefore t_n = 119$$

$$\Rightarrow 5n - 1 = 119 \Rightarrow 5n = 120 \Rightarrow n = 24$$