

**Sample Question Paper - 26**  
**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. How many terms of the A.P. 27, 24, 21, ... should be taken so that their sum is zero?
2. Find the mean of the following data :

<b>Class</b>	1-3	3-5	5-7	7-9
<b>Frequency</b>	10	20	25	19

3. Which term of the progression  $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, \dots$  is the first negative term?

**OR**

For what value of  $k$ , the numbers  $x, 2x + k$  and  $3x + 6$  are three consecutive terms of an A.P.?

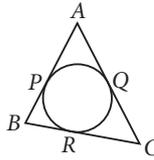
4. The dimensions of a metallic cuboid are  $100 \text{ cm} \times 80 \text{ cm} \times 64 \text{ cm}$ . It is melted and recast into a cube. Find the side of the cube.
5. If the mean of  $x, x + 3, x + 6, x + 9$  and  $x + 12$  is 10, then find the value of  $x$ .
6. Draw a circle of radius 2.4 cm. Take a point  $P$  on it. Without using the centre of the circle, draw a tangent to the circle at point  $P$ .

**OR**

Draw a line segment of length 7.8 cm and divide it in the ratio 5 : 8.

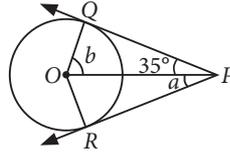
**SECTION - B**

7. The altitude of a right-angled triangle is 8 more than its base. If the hypotenuse is 40 cm, then, find the length of the base.
8. In the given figure, if  $AP = PB$ , then show that  $AC = BC$ .



OR

In the given figure,  $PQ$  and  $PR$  are tangents drawn from point  $P$  to a circle with centre  $O$ . If  $\angle OPQ = 35^\circ$ , then find the values of  $a$  and  $b$ .

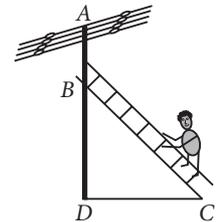


9. The angle of elevation of the top of a building from the foot of the tower is  $30^\circ$  and the angle of elevation of the top of the tower from the foot of the building is  $60^\circ$ . If the tower is 60 m high, then find the height of the building.
10. If 4 times the fourth term of an A.P. is equal to 18 times its 18<sup>th</sup> term, then find its 22<sup>th</sup> term.

### SECTION - C

11. From the top of a building 60 m high, the angles of depression of the top and bottom of a vertical lamp post are observed to be  $30^\circ$  and  $60^\circ$  respectively. Find
  - (i) the horizontal distance between the building and the lamp post.
  - (ii) the height of the lamp post.

[Use  $\sqrt{3} = 1.732$ ]



OR

An electrician has to repair an electric fault on a pole of height 5 m. He has to reach a point 1.3 m below the top of the pole to undertake the repair work (see figure). What should be the length of the ladder that he should use which, when inclined at an angle of  $60^\circ$  to the horizontal, would enable him to reach the required position? Also, how far from the foot of the pole he should place the foot of the ladder?

[Use  $\sqrt{3} = 1.73$ ].

12. The sum of the radius of base and height of a solid right circular cylinder is 37 cm. If the total surface area of the cylinder is 1628 sq. cm, then find the volume of the cylinder. (Use  $\pi = \frac{22}{7}$ )

### Case Study - 1

13. Consider the situation where we want to check the knowledge of a student studying in a renowned coaching institute. For this test scores of 100 students is collected. Take a look at the table below to understand the concept better.

Marks obtained in the test (Class interval)	0-5	5-10	10-15	15-20	20-25	25-30
Number of students (Frequency)	3	11	38	34	9	5

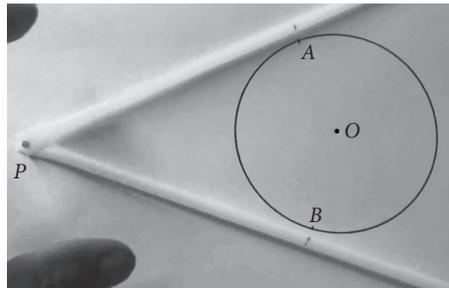
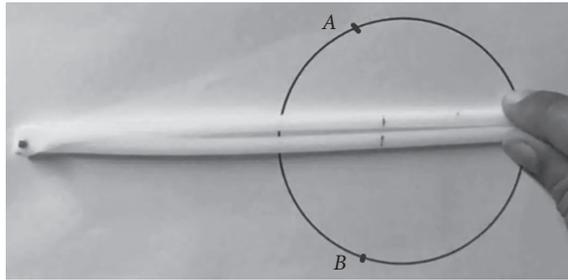


Based on the above information, answer the following questions :

- (i) What is the class mark for the interval 15-20.
- (ii) What is the median class of the given data.

## Case Study - 2

14. Prem did an activity on tangents drawn to a circle from an external point using 2 straws and a nail for maths project as shown in figure.



Based on the above information, answer the following questions :

- (i) If  $\angle AOB = 150^\circ$ , then find the measure of  $\angle APB$ .
- (ii) If  $\angle APB = 40^\circ$ , then find the measure of  $\angle BAO$ .



8. Since, the tangents drawn from an external point to a circle are equal in length.

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

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

$$\text{and } CR = CQ \quad \dots(iii)$$

$$\text{Now, } AP = PB \quad \text{[Given]}$$

$$\Rightarrow AQ = BR \quad \text{[Using (i) and (ii)]}$$

$$\Rightarrow AQ + QC = BR + QC \quad \text{[Adding QC on both sides]}$$

$$\Rightarrow AC = BR + RC \quad \text{[Using (iii)]}$$

$$\Rightarrow AC = BC$$

OR

Since,  $PQ$  is a tangent.

$$\therefore \angle OQP = 90^\circ$$

$$\text{In } \triangle PQO, \angle OQP + \angle OPQ + \angle QOP = 180^\circ$$

[By angle sum property]

$$\Rightarrow 90^\circ + 35^\circ + b = 180^\circ \Rightarrow b = 180^\circ - 125^\circ = 55^\circ$$

Clearly, the tangents from an external point  $P$  to the circle are equally inclined to  $OP$ .

$$\therefore \angle RPO = \angle OPQ \Rightarrow a = 35^\circ$$

9. Let  $AB$  be the building of height  $h$  m and  $CD$  be the tower.

$$\text{Given, } \angle ACB = 30^\circ,$$

$$\angle CBD = 60^\circ \text{ and } CD = 60 \text{ m}$$

$$\text{In } \triangle BCD, \cot 60^\circ = \frac{BC}{CD}$$

$$\Rightarrow BC = 60 \times \frac{1}{\sqrt{3}}$$

$$= 20\sqrt{3} \text{ m} \quad \dots(i)$$

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

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{20\sqrt{3}} \Rightarrow h = 20 \text{ m} \quad \text{(Using (i))}$$

Thus, the height of the building is 20 m.

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

$$\text{Given, } 4a_4 = 18(a_{18})$$

$$\Rightarrow 4(a + 3d) = 18(a + 17d) \Rightarrow 4a + 12d = 18a + 306d$$

$$\Rightarrow 14a + 294d = 0 \quad \dots(i)$$

$$\Rightarrow 14a = -294d \text{ or } a = -21d$$

$$\text{Now, } a_{22} = a + (22 - 1)d = a + 21d = -21d + 21d = 0 \quad \text{[From (i)]}$$

11. Let  $AC = 60$  m is the height of building and  $DE$  is the lamp post. Let  $x$  be the horizontal distance between the building and the lamp post and  $y$  be the height of the lamp post.

$$CD = BE = x,$$

$$ED = BC = y$$

$$\therefore AB = AC - BC = 60 - y$$

(i) Now, in  $\triangle ACD$ ,

$$\tan 60^\circ = \frac{AC}{CD} = \frac{60}{x}$$

$$\Rightarrow \sqrt{3} = \frac{60}{x} \Rightarrow x = \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$\Rightarrow x = 20\sqrt{3}$$

$$\Rightarrow x = 20 \times 1.732 = 34.64 \text{ m}$$

Thus, the horizontal distance between the building and the lamp post = 34.64 m

$$(ii) \text{ In } \triangle ABE, \tan 30^\circ = \frac{AB}{BE} = \frac{60 - y}{x}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{60 - y}{x} \Rightarrow x = \sqrt{3}(60 - y)$$

$$\Rightarrow 20 = 60 - y \Rightarrow y = 60 - 20 = 40 \text{ m} \quad [\because x = 20\sqrt{3}]$$

$\therefore$  Height of the lamp post = 40 m.

OR

In figure, the electrician is required to reach the point  $B$  on the pole  $AD$ .

$$\text{So, } BD = AD - AB = (5 - 1.3) \text{ m} = 3.7 \text{ m}$$

Here,  $BC$  represents the ladder. We need to find its length, i.e., the hypotenuse of the right triangle  $BDC$ .

In right  $\triangle BDC$ , we have

$$\sin 60^\circ = \frac{BD}{BC} \Rightarrow \frac{\sqrt{3}}{2} = \frac{3.7}{BC}$$

$$\therefore BC = \frac{3.7 \times 2}{\sqrt{3}} = 4.27 \text{ m (Approx.)}$$

i.e., the length of the ladder should be 4.27 m.

$$\text{Now, } \frac{DC}{BD} = \cot 60^\circ = \frac{1}{\sqrt{3}}$$

$$\text{i.e., } DC = \frac{3.7}{\sqrt{3}} = 2.14 \text{ m (Approx.)}$$

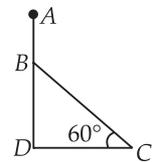
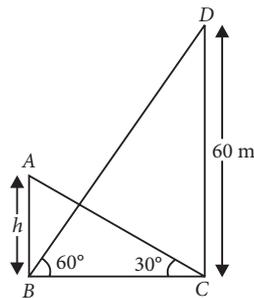
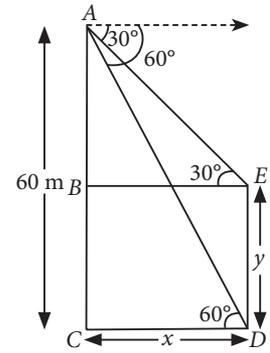
Therefore, he should place the foot of the ladder at a distance of 2.14 m from the pole.

12. Let the height of a cylinder =  $h$  cm and the radius of a cylinder =  $r$  cm

$$\text{Given, } r + h = 37 \text{ cm}$$

$$\text{Total surface area of cylinder} = 2\pi rh + 2\pi r^2$$

$$\Rightarrow 2\pi r(r + h) = 1628 \Rightarrow 2\pi r(37) = 1628$$



$$\Rightarrow r = \frac{1628 \times 7}{2 \times 22 \times 37} = 7$$

$$\therefore r + h = 37 \Rightarrow 7 + h = 37 \Rightarrow h = 30$$

Hence, volume of cylinder =  $\pi r^2 h$

$$= \frac{22}{7} \times 7 \times 7 \times 30 = 4620 \text{ cm}^3$$

13. (i) Class-mark =  $\frac{\text{lower limit} + \text{upper limit}}{2}$

$$\therefore \text{Class mark of } 15-20 = \frac{15+20}{2} = \frac{35}{2} = 17.5$$

(ii) We have the following table :

Class-interval	Frequency ( $f_i$ )	Cumulative frequency (c.f.)
0-5	3	3
5-10	11	14
10-15	38	52
15-20	34	86
20-25	9	95
25-30	5	100
Total	$\Sigma f_i = 100$	

Here,  $n = 100$

$$\Rightarrow \frac{n}{2} = 50$$

$\therefore$  Median class = 10-15

14. (i) In quadrilateral  $OAPB$ ,  $\angle AOB = 150^\circ$  [Given]

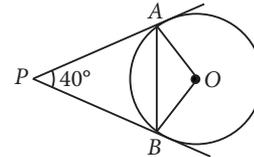
$$\angle OAP = \angle OBP = 90^\circ$$

$$\therefore \angle APB = 360^\circ - 90^\circ - 90^\circ - 150^\circ = 30^\circ$$

(ii) We have,  $\angle APB = 40^\circ$

Now,  $PA = PB$

[Since, the length of tangents drawn from an external point are equal]



In  $\triangle PAB$ ,  $\angle PAB = \angle PBA = 70^\circ$

[Angles opposite to equal sides are equal]

$$\text{Also, } \angle PAB + \angle BAO = 90^\circ$$

[Since, radius at the point of contact is perpendicular to tangent]

$$\Rightarrow \angle BAO = 90^\circ - 70^\circ = 20^\circ$$