27. Prove that the ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides.
Use the above to solve the following problem:
In the given figure, $O$ is the centre of the circle and COD is a diameter. Chord CE $=$ Chord DE and $\angle \mathrm{AOB}=90^{\circ}$. Find:

$$
\frac{\operatorname{ar}(\triangle C E D)}{\operatorname{ar}(\triangle A O B)}
$$


28. The angle of elevation of a jet fighter from a point $A$ on the ground is $60^{\circ}$. After a flight of 15 seconds, the angle of elevation changes to $30^{\circ}$. If the jet is flying at a speed of $720 \mathrm{~km} / \mathrm{hr}$, find the constant height at which the jet is flying. (Use $\sqrt{ } 3=1.732$ )
29. A bucket is in the form of a frustum of a cone of height 30 cm with radii of its lower and upper ends as 10 cm and 20 cm , respectively. Find the capacity and surface area of the bucket. Also, find the cost of milk which can completely fill the container, at the rate of Rs 25 per litre (use $\pi=3.14$ ). Or
Water flows through a cylindrical pipe, whose inner radius is 1 cm , at the rate of $80 \mathrm{~cm} / \mathrm{s}$ in an empty cylindrical tank, the radius of whose base is 40 cm . What is the rise of water level in tank in half an hour?
30. The median of the distribution given below is 14.4. Find the values of $x$ and $y$, if the total frequency is 20 .

| Class Interval | $0-6$ | $6-12$ | $12-18$ | $18-24$ | $24-30$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Frequency | 4 | $x$ | 5 | $y$ | 1 |
| Or |  |  |  |  |  |

The distribution of heights (in cm ) of 96 children is given below:

| Height (cm) | $\begin{gathered} \hline 124- \\ 128 \end{gathered}$ | $\begin{aligned} & \hline 128- \\ & 132 \end{aligned}$ | $\begin{aligned} & 132- \\ & 136 \end{aligned}$ | $\begin{gathered} \hline 136- \\ 140 \end{gathered}$ | $\begin{aligned} & \hline 140- \\ & 144 \end{aligned}$ | $\begin{gathered} \hline 144- \\ 148 \end{gathered}$ | $\begin{aligned} & 148- \\ & 152 \end{aligned}$ | $\begin{aligned} & \hline 152- \\ & 156 \end{aligned}$ | $\begin{gathered} \hline 156- \\ 160 \end{gathered}$ | $\begin{aligned} & \hline 160- \\ & 164 \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number of children | 5 | 8 | 17 | 24 | 16 | 12 | 6 | 4 | 3 | 1 |

Draw a less than type cumulative frequency curve for this data and use it to compute median height of the children.


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## Mathematics

(Sample Paper - III)

Time: 3 hours
Max Marks: 80

## Section-A

## (1 mark questions)

1. State the Fundamental Theorem of Arithmetic.
2. If the zeroes of the quadratic polynomial $\mathrm{x}^{2}+(a+1) \mathrm{x}+b$ are -3 and 2 , then find the values of $a$ and $b$.
3. If the lines given by $3 x+2 k y=2$ and $2 x+5 y+1=0$ are parallel, then find the value of $k$.
4. Write the value of the expression $\left[\operatorname{cosec}\left(75^{\circ}+\theta\right)-\sec \left(15^{\circ}-\theta\right)-\tan \left(55^{\circ}+\right.\right.$ $\left.\theta)+\cot \left(35^{\circ}-\theta\right)\right]$.
5. If $\sin \mathrm{A}+\sin ^{2} \mathrm{~A}=1$, then what is the value of the expression $\left(\cos ^{2} \mathrm{~A}+\cos ^{4}\right.$ A)?
6. If the perimeter and the area of a circle are numerically equal, then what is the radius of the circle?
7. From a point $P$ which is at a distance of 13 cm from the centre O of a circle of radius 5 cm , the pair of tangents PQ and PR to the circle are drawn. What will be the area of the quadrilateral PQOR?
8. From a well shuffled pack of 52 cards, one card is drawn at random. Find the probability that it is neither a king nor a club (\%).
9. An observer, 1.5 metres tall, is 20.5 metres away from a tower, 22 metres high. What is the angle of elevation of the top of the tower from the eye of the observer?
10. Consider the following data:

| Class | $65-$ <br> 85 | $85-$ <br> 105 | $105-$ <br> 125 | $125-$ <br> 145 | $145-$ <br> 165 | $165-$ <br> 185 | $185-$ <br> 205 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Frequency | 4 | 5 | 13 | 20 | 14 | 7 | 4 |

How much is the difference between the upper limit of the median class and the lower limit of the modal class?

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## Section - B

## (2 marks questions)

11. Find the value of the middle most term(s) of the AP: $-11,-7,-3, \ldots, 49$.
12. A die has its six faces marked $0,1,1,1,6,6$. Two such dice are thrown together and the total score is recorded. What is the probability of getting a total of 7 ?
13. Solve the following system of equations by cross multiplication method:

$$
\begin{aligned}
& x-3 y-7=0 \\
& 3 x-3 y-15=0
\end{aligned}
$$

14. Find the value of $m$ if the points $(5,1),(-2,-3)$ and $(8,2 m)$ are collinear.
15. Find the zeroes of the polynomial $4 x^{2}+5 \sqrt{ } 2 x-3$ by factorisation method and verify the relations between the zeroes and the coefficients of the polynomial.

## Or

Divide $3 x^{2}-x^{3}-3 x+5$ by $x-1-x^{2}$ and verify the division algorithm.

## Section - C <br> (3 marks questions)

16. Check whether the quadratic equation $-2 x^{2}+3 x+2=0$ has real roots. If real roots exist, find them by the method of completion of square.
17. Explain why the number $6^{n}$, where $n$ is a natural number, cannot end with the digit zero?
18. If Samiksha were younger by 5 years than what she really is, then the square of her age (in years) would have been 11 more than five times her actual age. What is her age now?
19. Construct an isosceles triangle whose base is 8 cm and altitude 4 cm and then another triangle whose sides are $11 / 2$ times the corresponding sides of the isosceles triangle.
20. Show that: $(1+\cot \theta-\operatorname{cosec} \theta)(1+\tan \theta+\sec \theta)=2$.

## O

If $x=a \sec \theta+b \tan \theta$ and $y=a \tan \theta+b \sec \theta$, then prove that:

$$
x^{2}-y^{2}=a^{2}-b^{2}
$$

21. For going to a city $B$ from city $A$, there is a route via city $C$ such that $A C \perp$ $C B, A C=2 x \mathrm{~km}$ and $C B=2(x+7) \mathrm{km}$. It is proposed to construct a 26 km highway which directly connects the two cities A and B. Find how much distance will be saved in reaching city $B$ from city $A$ after the construction of the highway.
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In the adjoining figure, the tangent at a point $C$ of a circle and a diameter $A B$ when extended intersect at $P$. If $\angle \mathrm{PCA}=110^{\circ}$, find $\angle \mathrm{CBA}$.

22. If $P(9 a-2,-b)$ divides line segment joining $A(3 a+1,-3)$ and $B(8 a, 5)$ in the ratio $3: 1$, find the values of $a$ and $b$.
23. If the points $A(1,-2), B(2,3) C(a, 2)$ and $D(-4,-3)$ form a parallelogram, find the value of a. Also find the height of the parallelogram taking $A B$ as base.
24. In figure, $\mathrm{DE} \| \mathrm{AC}$ and $\mathrm{DF} \| \mathrm{AE}$. Prove that:
$\frac{B F}{F E}=\frac{B E}{E C}$.

25. Arcs are drawn by taking vertices $A, B$ and $C$ of an equilateral triangle of side 10 cm to intersect the sides $\mathrm{BC}, \mathrm{CA}$ and AB at their respective mid-points $D, E$ and $F$. Find the area of the shaded region. (Use $\pi=3.14$ ).

Or
In the given figure, OACB is a quadrant of a circle with centre O and radius 3.5 cm . If OD $=2 \mathrm{~cm}$, find the area of the shaded region.

## Section - D

( 6 marks questions)
26. A shopkeeper sold a table and a chair for Rs 1050, thereby making a profit of $10 \%$ on the table and $25 \%$ on the chair. If she had taken a profit of $25 \%$ on the table and $10 \%$ on the chair she would have got Rs 1065 . Find the cost price of each.

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