

SSC

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Newton's Academy March 2024

Mathematics Part - II

Time: 2 Hours
Max. Marks: 40
Note:

- i. All questions are compulsory.
- ii. Use of a calculator is not allowed.
- iii. The numbers to the right of the questions indicate full marks.
- iv. In case of MCQs [Q. No. 1(A)] only the first attempt will be evaluated and will be given credit.
- v. Draw proper figures wherever necessary.
- vi. The marks of construction should be clear. Do not erase them.
- vii. Diagram is essential for writing the proof of the theorem.

Q.1. (A) Four alternative answers for each of the following sub-questions are given. Choose the alternative and write its alphabet: [4]

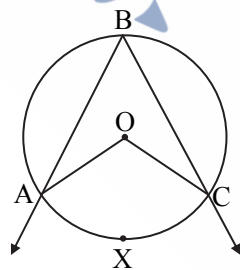
1. Out of the dates given below which date constitutes a Pythagorean triplet?
 (A) 15/8/17 (B) 16/8/16 (C) 3/5/17 (D) 4/9/15
2. $\sin \theta \times \operatorname{cosec} \theta = ?$
 (A) 1 (B) 0 (C) $\frac{1}{2}$ (D) $\sqrt{2}$
3. Slope of X-axis is _____
 (A) 1 (B) -1 (C) 0 (D) Cannot be determined
4. A circle having radius 3 cm, then the length of its largest chord is _____.
 (A) 1.5 cm (B) 3 cm (C) 6 cm (D) 9 cm

(B) Solve the following sub-questions: [4]

1. If $\triangle ABC \sim \triangle PQR$ and $AB : PQ = 2 : 3$, then find the value of $\frac{A(\triangle ABC)}{A(\triangle PQR)}$.
2. Two circles of radii 5 cm and 3 cm touch each other externally. Find the distance between their centres.
3. Find the side of a square whose diagonal is $10\sqrt{2}$ cm.
4. Angle made by the line with the positive direction of X-axis is 45° . Find the slope of that line.

Q.2. (A) Complete any two activities and rewrite it: [4]

1.



In the above figure, $\angle ABC$ is inscribed in arc ABC.

If $\angle ABC = 60^\circ$, find $m\angle AOC$.

Solution:

$$\angle ABC = \frac{1}{2} m(\text{arc AXC}) \quad \dots \boxed{}$$

$$60^\circ = \frac{1}{2} m(\text{arc AXC})$$

$$\boxed{} = m(\text{arc AXC})$$

But $m\angle AOC = \boxed{\text{m(arc.....)}}$

...[Property of central angle]

$\therefore m\angle AOC = \boxed{}$

2. Find the value of $\sin^2\theta + \cos^2\theta$.

Solution:

In ΔABC , $\angle ABC = 90^\circ$, $\angle C = \theta^\circ$.

$AB^2 + BC^2 = \boxed{}$

...[Pythagoras theorem]

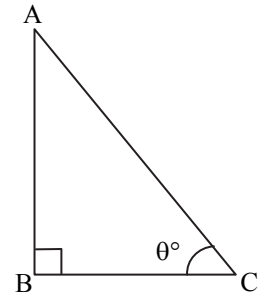
Divide both sides by AC^2

$$\frac{AB^2}{AC^2} + \frac{BC^2}{AC^2} = \frac{AC^2}{AC^2}$$

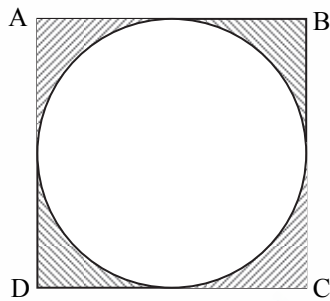
$\therefore \left(\frac{AB}{AC}\right)^2 + \left(\frac{BC}{AC}\right)^2 = 1$

But $\frac{AB}{AC} = \boxed{}$ and $\frac{BC}{AC} = \boxed{}$

$\therefore \sin^2\theta + \cos^2\theta = \boxed{}$



3.



In the figure given above, $\square ABCD$ is a square and a circle is inscribed in it. All sides of a square touch the circle.

If $AB = 14$ cm, find the area of shaded region.

Solution:

Area of square = $\left(\boxed{}\right)^2$...[Formula]
 $= 14^2$
 $= \boxed{} \text{ cm}^2$

Area of circle = $\boxed{}$...[Formula]
 $= \frac{22}{7} \times 7 \times 7$
 $= 154 \text{ cm}^2$

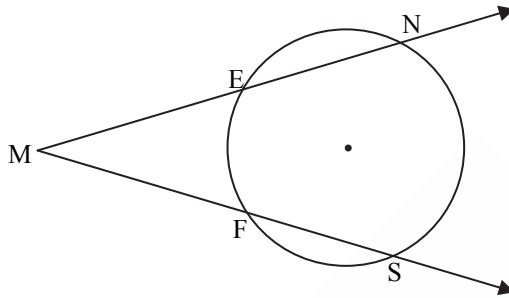
Area of shaded portion = Area of square – Area of circle
 $= 196 - 154$
 $= \boxed{} \text{ cm}^2$

(B) Solve any four of the following sub-questions:

[8]

1. Radius of a sector of a circle is 3.5 cm and length of its arc is 2.2 cm. Find the area of the sector.
2. Find the length of the hypotenuse of a right-angled triangle if remaining sides are 9 cm and 12 cm.

3.



In the above figure, $m(\text{arc NS}) = 125^\circ$, $m(\text{arc EF}) = 37^\circ$.
Find the measure of $\angle \text{NMS}$.

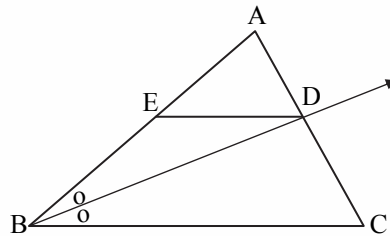
4. Find the slope of the line passing through the points A(2, 3), B(4, 7).

5. Find the surface area of a sphere of radius 7 cm.

Q.3. (A) Complete any one activity of the following and rewrite it:

[3]

1.



In $\triangle ABC$, ray BD bisects $\angle ABC$, $A - D - C$, seg $DE \parallel$ side BC , $A - E - B$, then for showing $\frac{AB}{BC} = \frac{AE}{EB}$, complete the following activity:

Proof:

In $\triangle ABC$, ray BD bisects $\angle B$

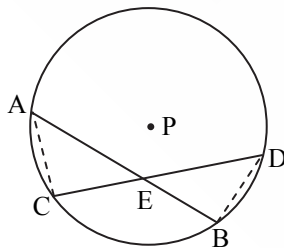
$\therefore \frac{\boxed{}}{BC} = \frac{AD}{DC} \dots(\text{I}) (\boxed{})$

In $\triangle ABC$, $DE \parallel BC$

$\therefore \frac{\boxed{}}{EB} = \frac{AD}{DC} \dots(\text{II}) (\boxed{})$

$\frac{AB}{\boxed{}} = \frac{\boxed{}}{EB} \dots[\text{From (I) and (II)}]$

2.



Given: Chords AB and CD of a circle with centre P intersect at point E.

To prove: $AE \times EB = CE \times ED$

Construction: Draw seg AC and seg BD.

Fill in the blank and complete the proof.

Proof:

In $\triangle CAE$ and $\triangle BDE$.

$\angle AEC \cong \angle DEB \dots \boxed{}$

$\boxed{} \cong \angle BDE$ (angles inscribed in the same arc)

$$\therefore \triangle CAE \sim \triangle BDE \quad \dots \boxed{}$$

$$\therefore \frac{\boxed{}}{DE} = \frac{CE}{\boxed{}} \quad \dots \boxed{}$$

$$\therefore AE \times EB = CE \times ED.$$

(B) Solve any two of the following sub-questions:

[6]

1. Determine whether the points are collinear.
A(1, -3), B(2, -5), C(-4, 7)
2. $\triangle ABC \sim \triangle LMN$. In $\triangle ABC$, AB = 5.5 cm, BC = 6 cm, CA = 4.5 cm. Construct $\triangle ABC$ and $\triangle LMN$ such that $\frac{BC}{MN} = \frac{5}{4}$.
3. Seg PM is a median of $\triangle PQR$, PM = 9 and $PQ^2 + PR^2 = 290$, then find QR.
4. Prove that, 'If a line parallel to a side of a triangle intersects the remaining sides in two distinct points, then the line divides the side in the same proportion.'

Q.4. Solve any two of the following sub-questions:

[8]

1. $\frac{1}{\sin^2 \theta} - \frac{1}{\cos^2 \theta} - \frac{1}{\tan^2 \theta} - \frac{1}{\cot^2 \theta} - \frac{1}{\sec^2 \theta} - \frac{1}{\operatorname{cosec}^2 \theta} = -3$, then find the value of θ .
2. A cylinder of radius 12 cm contains water up to the height 20 cm. A spherical iron ball is dropped into the cylinder and thus water level raised by 6.75 cm. What is the radius of iron ball?
3. Draw a circle with centre O having radius 3 cm. Draw tangent segments PA and PB through the point P outside the circle such that $\angle APB = 70^\circ$.

Q.5. Solve any one of the following sub-questions:

[3]

1. $\square ABCD$ is trapezium, AB \parallel CD diagonals of trapezium intersect in point P.
Write the answers of the following questions:
 - a. Draw the figure using given information.
 - b. Write any one pair of alternate angles and opposite angles.
 - c. Write the names of similar triangles with test of similarity.
2. AB is a chord of a circle with centre O. AOC is diameter of circle, AT is a tangent at A.
Write answers of the following questions:
 - a. Draw the figure using given information.
 - b. Find the measures of $\angle CAT$ and $\angle ABC$ with reasons.
 - c. Whether $\angle CAT$ and $\angle ABC$ are congruent? Justify your answer.