

SSC

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Newton's Academy

Mathematics Part - II

Time: 2 Hours
Max. Marks: 40
Note:

- i. All questions are compulsory.
- ii. Use of 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. For every MCQ, the correct alternative (A), (B), (C) or (D) with sub-question number is to be written as an answer.
- vi. Draw proper figures for answers wherever necessary.
- vii. The marks of construction should be clear. Do not erase them.
- viii. Diagram is essential for writing the proof of the theorem.

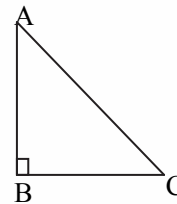
Q.1. (A) For each of the following sub-questions four alternative answers are given. Choose the correct alternative and write its alphabet: [4]

- i. If $\triangle ABC \sim \triangle DEF$ and $\angle A = 48^\circ$, then $\angle D =$ _____.
 (A) 48° (B) 83° (C) 49° (D) 132°
- ii. AP is a tangent at A drawn to the circle with center O from an external point P. $OP = 12$ cm and $\angle OPA = 30^\circ$, then the radius of a circle is _____.
 (A) 12 cm (B) $6\sqrt{3}$ cm (C) 6 cm (D) $12\sqrt{3}$ cm
- iii. Seg AB is parallel to X-axis and co-ordinates of the point A are (1, 3), then the co-ordinates of the point B can be _____.
 (A) (-3, 1) (B) (5, 1) (C) (3, 0) (D) (-5, 3)
- iv. The value of $2\tan 45^\circ - 2\sin 30^\circ$ is _____.
 (A) 2 (B) 1 (C) $\frac{1}{2}$ (D) $\frac{3}{4}$

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

- i. In $\triangle ABC$, $\angle ABC = 90^\circ$, $\angle BAC = \angle BCA = 45^\circ$.

If $AC = 9\sqrt{2}$, then find the value of AB.



- ii. Chord AB and chord CD of a circle with centre O are congruent. If $m(\text{arc AB}) = 120^\circ$, then find the $m(\text{arc CD})$.
- iii. Find the Y-co-ordinate of the centroid of a triangle whose vertices are (4, -3), (7, 5) and (-2, 1).
- iv. If $\sin\theta = \cos\theta$, then what will be the measure of angle θ ?

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

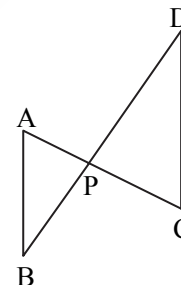
- i. In the above figure, seg AC and seg BD intersect each other in point P. If $\frac{AP}{CP} = \frac{BP}{DP}$, then complete the following activity to prove $\triangle ABP \sim \triangle CDP$.

Activity: In $\triangle APB$ and $\triangle CDP$

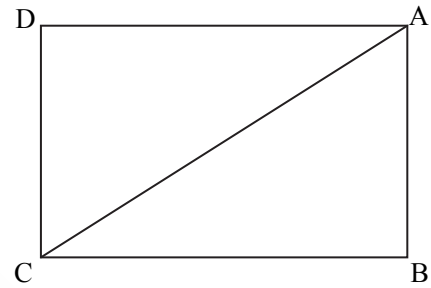
$$\frac{AP}{CP} = \frac{BP}{DP} \dots\dots \square$$

$\therefore \angle APB \equiv \square$ vertically opposite angles

$\therefore \square \sim \triangle CDP$ \square test of similarity.



- ii. In the above figure, $\square ABCD$ is a rectangle. If $AB = 5$, $AC = 13$, then complete the following activity to find BC .



Activity:

$\triangle ABC$ is triangle.

\therefore By Pythagoras theorem
 $AB^2 + BC^2 = AC^2$

$\therefore 25 + BC^2 = \square \quad \therefore BC^2 = \square$

$\therefore BC = \square$

- iii. Complete the following activity to prove: $\cot\theta + \tan\theta = \operatorname{cosec}\theta \times \sec\theta$

Activity:

L.H.S. = $\cot\theta + \tan\theta$

$$= \frac{\cos\theta}{\sin\theta} + \frac{\square}{\cos\theta} = \frac{\square + \sin^2\theta}{\sin\theta \times \cos\theta}$$

$$= \frac{1}{\sin\theta \times \cos\theta} \dots \therefore \square = \frac{1}{\sin\theta} \times \frac{1}{\cos\theta}$$

$$= \square \times \sec\theta$$

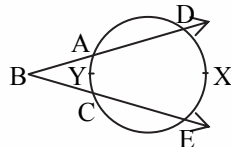
\therefore L.H.S. = R.H.S.

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

[8]

- i. If $\triangle ABC \sim \triangle PQR$, $AB : PQ = 4 : 5$ and $A(\triangle PQR) = 125 \text{ cm}^2$, then find $A(\triangle ABC)$.

ii.



In the above figure, $m(\text{arc } DXE) = 105^\circ$, $m(\text{arc } AYC) = 47^\circ$, then find the measure of $\angle DBE$.

- iii. Draw a circle of radius 3.2 cm and centre 'O'. Take any point P on it. Draw tangent to the circle through point P using the centre of the circle.

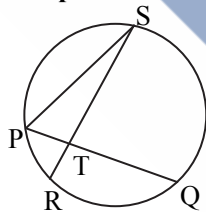
- iv. If $\sin\theta = \frac{11}{61}$, then find the value of $\cos\theta$ using trigonometric identity.

- v. In $\triangle ABC$, $AB = 9 \text{ cm}$, $BC = 40 \text{ cm}$, $AC = 41 \text{ cm}$. State whether $\triangle ABC$ is a right-angled triangle or not? Write reason.

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

[3]

i.



In the above figure, chord PQ and chord RS intersect each other at point T. If $\angle STQ = 58^\circ$ and $\angle PSR = 24^\circ$, then complete the following activity to verify: $\angle STQ = \frac{1}{2} [m(\text{arc } PR) + m(\text{arc } SQ)]$

Activity:

In $\triangle PTS$,

$\angle SPQ = \angle STQ - \square$

\therefore Exterior angle theorem

$\therefore \angle SPQ = 34^\circ$

$\therefore m(\text{arc } QS) = 2 \times \square^\circ = 68^\circ$

$\therefore \square$

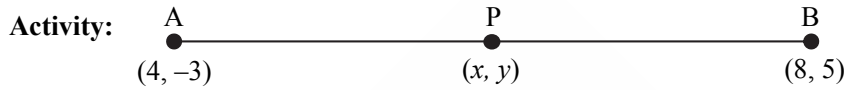
Similarly $m(\text{arc } PR) = 2\angle PSR = \square^\circ$

$\therefore \frac{1}{2} [m(\text{arc } QS) + m(\text{arc } PR)] = \frac{1}{2} \times \square^\circ = 58^\circ \dots \dots \text{(I)}$

but $\angle STQ = 58^\circ$ (II) given

$\therefore \frac{1}{2} [m(\text{arc PR}) + m(\text{arc QS})] = \boxed{\angle \dots}$ from (I) and (II)

- ii. Complete the following activity to find the co-ordinates of point P which divides seg AB in the ratio 3 : 1 where A(4, -3) and B(8, 5).



\therefore By section formula,

$$x = \frac{mx_2 + nx_1}{m+n}, y = \frac{\boxed{}}{m+n}$$

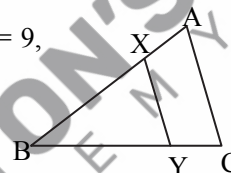
$$\therefore x = \frac{3 \times 8 + 1 \times 4}{3+1}, y = \frac{3 \times 5 + 1 \times (-3)}{3+1}$$

$$\therefore = \frac{\boxed{} + 4}{4} = \frac{\boxed{} - 3}{4}$$

$$\therefore x = \boxed{} \quad \therefore y = \boxed{}$$

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

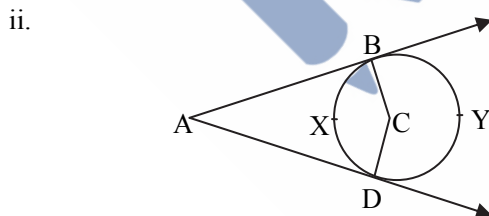
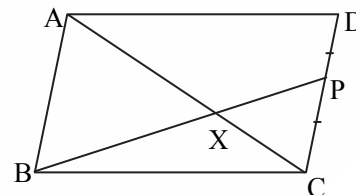
- i. In $\triangle ABC$, seg $XY \parallel$ side AC. If $2AX = 3BX$ and $XY = 9$, then find the value of AC. [6]



- ii. Prove that, "Opposite angles of cyclic quadrilateral are supplementary".
 iii. $\triangle ABC \sim \triangle PQR$. In $\triangle ABC$, $AB = 5.4$ cm, $BC = 4.2$ cm, $AC = 6.0$ cm, $AB : PQ = 3 : 2$, then construct $\triangle ABC$ and $\triangle PQR$
 iv. Show that: $\frac{\tan A}{(1 + \tan^2 A)^2} + \frac{\cot A}{(1 + \cot^2 A)^2} = \sin A \times \cos A$.

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

- i. $\square ABCD$ is a parallelogram. Point P is the midpoint of side CD. Seg BP intersects diagonal AC at point X, then prove that:
 $3AX = 2AC$



In the above figure, seg AB and seg AD are tangent segments drawn to a circle with centre C from exterior point A, then prove that: $\angle A = \frac{1}{2} [m(\text{arc BYD}) - m(\text{arc BXD})]$

- iii. Find the co-ordinates of centroid of a triangle if points D(-7, 6), E(8, 5) and F(2,-2) are the mid-points of the sides of that triangle.

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

- i. If a and b are natural numbers and $a > b$. If $(a^2 + b^2)$, $(a^2 - b^2)$ and $2ab$ are the sides of the triangle, then prove that the triangle is right angled. Find out two Pythagorean triplets by taking suitable values of a and b. [3]
 ii. Construct two concentric circles with centre O with radii 3 cm and 5 cm. Construct tangent to a smaller circle from any point A on the larger circle. Measure and write the length of tangent segment. Calculate the length of tangent segment using Pythagoras theorem.