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) Four alternative answers are given for every sub-question. Select the correct alternative and write the alphabet of that answer: **[4]**

i. From the following points _____ point lies to the right side of the origin on X-axis.
(A) (–2, 0) (B) (0, 2)
(C) (2, 3) (D) (2, 0)

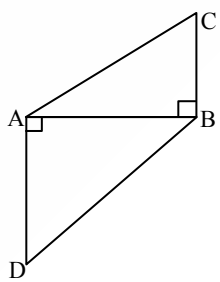
ii. $\Delta PQR \sim \Delta STU$ and $A(\Delta PQR) : A(\Delta STU) = 64 : 81$, then what is the ratio of corresponding sides?
(A) 8 : 9 (B) 64 : 81
(C) 9 : 8 (D) 16 : 27

iii. In a right angled triangle; if the sum of the squares of sides making right angle is 169, then what is the length of hypotenuse?
(A) 15 (B) 13
(C) 5 (D) 12

iv. If $\tan\theta = \sqrt{3}$, then the value of θ is _____
(A) 60° (B) 30°
(C) 90° (D) 45°

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

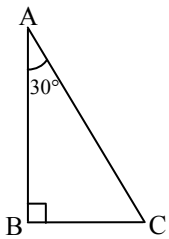
i. In the given figure, seg CB ⊥ seg AB, seg AD ⊥ seg AB.
If BC = 4, AD = 8,
then find $\frac{A(\Delta ABC)}{A(\Delta ADB)}$.



ii. Find the coordinates of the midpoint of the segment joining the points (22, 20) and (0, 16).

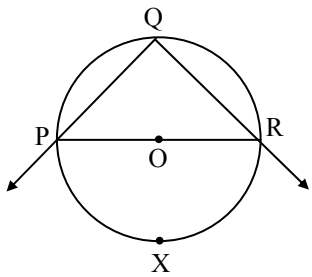
iii. Two circles having radii 7 cm and 4 cm touch other internally. Find the distance between their centres.

iv. In ΔABC, $\angle B = 90°$, $\angle A = 30°$, AC = 14, then find BC.



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

i. In the above figure, ∠PQR is inscribed in the semicircle PQR.
Complete the following activity to find measure of ∠PQR.



Activity:

m(arc PQR) = 180° …(measure of semicircle)

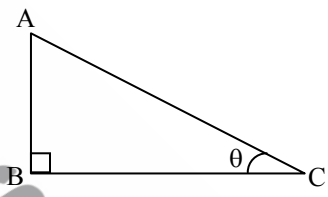
∴ m(arc PXR) = ☐

∴ ∠PQR = $\frac{1}{2}$ m(arc ☐) … ☐

$= \frac{1}{2} \times 180°$

∴ ∠PQR = ☐

ii. In ΔABC, ∠B = 90°, ∠C = θ° then
complete the activity to derive the trigonometric identity.



Activity:

$AB^2 + BC^2 =$ ☐ …(Pythagoras theorem)

∴ $\frac{AB^2}{AB^2} + \frac{BC^2}{AB^2} = \frac{AC^2}{AB^2}$ …(dividing by AB^2)

∴ $1 + \frac{BC^2}{AB^2} = \frac{AC^2}{AB^2}$

But $\frac{\square}{AB^2} = \cot^2\theta$ and $\frac{AC^2}{\square} = \operatorname{cosec}^2\theta$

∴ $1 + \square = \operatorname{cosec}^2\theta$

iii. In ΔPQR, if PN = 12, NR = 8, PM = 15, MQ = 12, then complete the following activity to justify whether seg NM is parallel to side RQ or not.

Activity:

In ΔPQR,

$\frac{PN}{NR} = \frac{12}{\square} = \frac{3}{2}$ …(i)

and $\frac{PM}{MQ} = \frac{15}{12} = \frac{\square}{4}$ …(ii)

∴ $\frac{PN}{NR} \neq \frac{PM}{MQ}$ …[from (i) and (ii)]

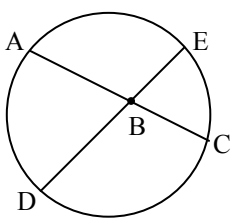
∴ By ☐

seg NM is ☐ to side RQ.

[Note : The activity has been modified.]

(B) Solve the following sub-questions (Any *four*): **[8]**

i. In the given figure,
chord AC and chord DE intersect each other at point B.
If ∠ABE = 108° and m(arc AE) = 95°,
Then fine m(arc DC).



ii. Find the distance between the points P(–1, 1) and Q(5, –7).

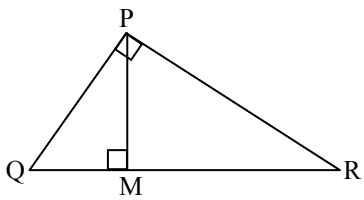
iii. Construct a tangent to a circle with centre P and radius 3.5 cm at any point M on it.

iv. Find the length of diagonal of rectangle having sides 11 cm and 60 cm.

v. If $\sin\theta = \frac{7}{25}$, then find values of $\cos\theta$ and $\tan\theta$.

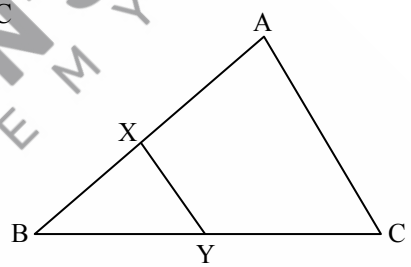
Q.3. (A) Complete the following activities and rewrite it (any *one*): **[3]**

i. In the above figure
∠QPR = 90°, seg PM ⊥ seg QR and Q-M-R. PM = 10, QM = 8. Complete the following activity to find the value of QR.



Activity:
In ΔPQR, ∠QPR = 90° and
seg PM ⊥ seg QR ….(Given)
∴ $PM^2 =$ ☐ × MR …. ☐
∴ $(\square)^2 = 8 \times MR$
∴ $\frac{100}{8} = MR$
∴ ☐ = MR
Now QR = QM + MR ….(∵ Q-M-R)
∴ QR = 8 + ☐
∴ QR = ☐

ii. In the above figure, in ΔABC seg XY || side AC, A-X-B, B-Y-C
If 2AX = 3BX and XY = 9,
then complete the following activity to find value of AC.



Activity:
2AX = 3BX …(Given)
∴ $\frac{AX}{BX} = \frac{\square}{\square}$
∴ $\frac{AX+BX}{BX} = \frac{3+2}{A(\Delta PQR)}$ …(Componendo)
∴ $\frac{AB}{BX} = \frac{5}{2}$ …(i)
ΔABC ~ ΔBYX …(☐ test of similarity)
∴ $\frac{BA}{BX} = \frac{AC}{\square}$ …(c.s.s.t)
∴ $\frac{BA}{BX} = \frac{AC}{\square}$ …[from (i)]
∴ AC = ☐

(B) Solve the following sub-questions (any *two*): **[6]**

i. Prove that $\sec\theta + \tan\theta = \frac{\cos\theta}{1-\sin\theta}$.

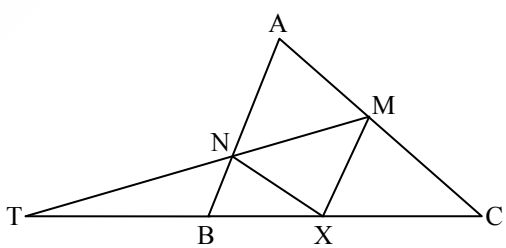
ii. Find the coordinates of centroid of the triangle whose vertices are (4, 7), (8, 4), (7, 11).

iii. Prove that "Opposite angles of a cyclic quadrilateral are supplementary".

iv. Draw a circle with centre O and radius 3.5 cm. take a point P at a distance 7.5 cm from the centre. Draw tangents to the circle from point P.

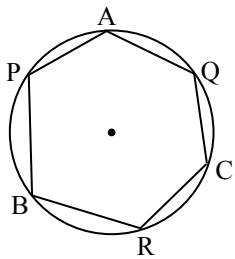
Q.4. Solve the following sub-questions (any *two*): **[8]**

i. In ΔABC, point X is any point on side BC.
seg XM || seg AB and seg XN || seg AC.
Extend seg MN such that it intersects extended side CB in point T.
Then prove that $TX^2 = TB \times TC$.



ii. Draw triangle ABC, right angle at B such that AB = 3 cm, BC = 4 cm. Now construct ΔPBQ similar to ΔABC each of whose sides are $\frac{7}{4}$ times the corresponding sides of ΔABC.

iii. In the given figure, points A, P, B, R, C, Q are on the circle. After joining the given points as shown in the figure it from hexagon, then prove that ∠APB + ∠BRC = 360° – ∠AQC.



Q.5. Solve the following sub-questions (Any *one*): **[3]**

i. ΔABC and ΔPQR are equilateral triangles with altitudes $2\sqrt{3}$ and $4\sqrt{3}$ respectively, then:

a. Find the length of side AB and side PQ

b. Find $\frac{A(\Delta ABC)}{A(\Delta PQR)}$

c. Find the radio of perimeter of ΔABC to the perimeter of ΔPQR.

ii. In a circle with centre O, PA and PB are tangents from an external point P. E is the point on the circle such that O-E-P. Tangent drawn at E intersects PA and PB in point C and D respectively. If PA = 10, then write the answers to the following questions:

a. Draw the suitable figure using given information.

b. Write the relation between seg PA and seg PB

c. Find the perimeter of ΔPCD.