

UNIVERSITY OF LAGOS

FACULTY OF EDUCATION

DEPARTMENT OF SCIENCE EDUCATION

RESEARCH INSTRUMENT ON

EFFECT OF INDUCTIVE AND DEDUCTIVE METHODS OF TEACHING ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MATHEMATICS.

SECTION A

Name of School: _____

Level of Student: _____

Sex: Male ☐

Female ☐

Age: 16-20 yrs ☐

Above 20 yrs ☐

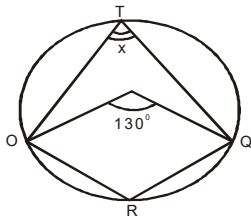
SECTION B

MATHEMATICS ACHIEVEMENT TEST

Instruction: All questions are compulsory

Duration: 40mins

- (1) From the diagram below, find the value of $\angle OTQ$



(a) 230°

(b) 55°

(c) 115°

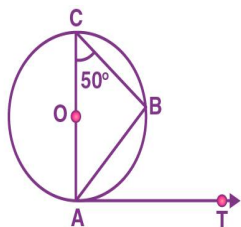
(d) 65°

- (2) A _____ is a straight line joining any two points on the circumference of a circle
 (a) segment (b) arc (c) chord (d) radius

Use the information below to answer question 3 and 4

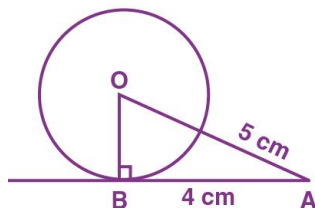
The radius of a circle with $|PQ|$ as the chord of the circle is 10cm. The distance of the mid-point of the chord from the centre O of the circle is 6cm.

- (3) Calculate the length of the chord PQ . (a) 12cm (b) 14cm (c) 16cm (d) 18cm
- (4) Calculate to the nearest whole number, the angle chord PQ subtends at the centre of the circle.
 (a) 106° (b) 100° (c) 200° (d) 140°
- (5) Angles in the same segment are ____ (a) perpendicular (b) equal (c) double (d) complementary
- (6) The angle in a semi-circle is _____ angle (a) right (b) obtuse (c) acute (d) reflex
- (7) AB is a chord of the circle and AOC is its diameter such that $\angle ACB = 50^\circ$. If AT is the tangent to the circle at the point A , then $\angle BAT$ is equal to _____



- (a) 65° (b) 60° (c) 50° (d) 40°

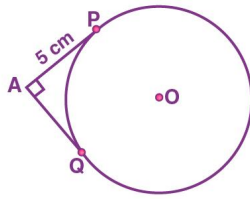
- (8) If a parallelogram circumscribes a circle, then it is a _____ (a) rhombus (b) trapezium (c) square (d) rectangle
- (9) The length of a tangent from a point A at a distance 5 cm from the centre of the circle is 4 cm. The radius of the circle is:



- (a) 3cm (b) 5cm (c) 7cm (d) 10cm

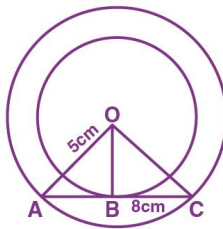
- (10) The straight line joining any two points on the circumference of the circle and passes through the center is called ____ (a) arc (b) sector (c) radius (d) diameter
- (11) If angle between two radii of a circle is 130° , the angle between the tangents at the ends of the radii is _____ (a) 90° (b) 50° (c) 70° (d) 40°

- (12) In the figure below, the pair of tangents AP and AQ drawn from an external point A to a circle with centre O are perpendicular to each other and length of each tangent is 5 cm. Then the radius of the circle is _____



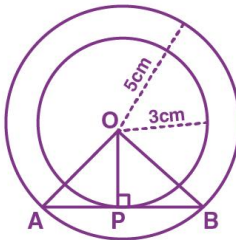
(a) 3cm (b) 4cm (c) 5cm (d) 6cm

- (13) The tangent to a circle is _____ to the radius through the point of contact. (a) Parallel (b) perpendicular (c) perpendicular bisector (d) bisector
- (14) If the length of the radius of a circle is 7cm, what is the calculated length of its diameter? (a) 14cm (b) 16cm (c) 18cm (d) 20cm
- (15) The normal to a circle is said to be _____ to the tangent of the circle (a) equal (b) parallel (c) orthogonal (d) bi-parallel
- (16) The normal to a circle will always pass through the center of the circle (a) True (b) False (c) indeterminate (d) maybe
- (17) Out of the two concentric circles, the radius of the outer circle is 5 cm and the chord AC of length 8 cm is a tangent to the inner circle. The radius of the inner circle will be _____



(a) 1cm (b) 2cm (c) 3cm (d) 4cm

- (18) The distance between two parallel tangents of a circle is 18 cm, then the radius of the circle is _____ (a) 7.5cm (b) 8cm (c) 8.5cm (d) 9cm
- (19) Two concentric circles are of radii 5 cm and 3 cm. The length of the chord of the larger circle which touches the smaller circle is _____



(a) 8cm (b) 10cm (c) 12cm (d) 14cm

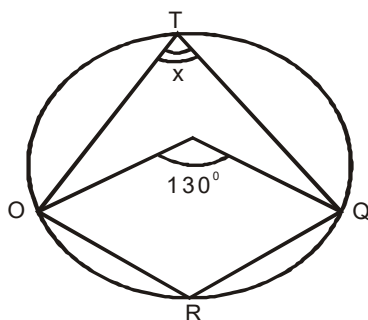
- (20) A circle can have _____ parallel tangents at the same time (a) 1 (b) 2 (c) 3 (d) 4

SOLUTIONS TO MATHEMATICS ACHIEVEMENT TEST

- | | |
|-------|-------|
| 1. D | 11. B |
| 2. C | 12. C |
| 3. C | 13. B |
| 4. A | 14. A |
| 5. B | 15. C |
| 6. A | 16. A |
| 7. C | 17. C |
| 8. A | 18. D |
| 9. A | 19. A |
| 10. D | 20. B |

WORKED SOLUTIONS TO MATHEMATICS ACHIEVEMENT TEST

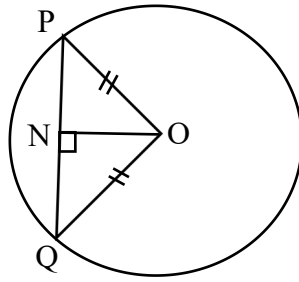
1.



The value of $\angle OTQ$ is **65 (Option D)**

Reason: *The angle which an arc of a circle subtends at the centre, is twice the angle the same arc subtends at the circumference.*

2. A CHORD is a straight line that joins any two points on the circumference of a circle.
(Option C)



3. In $\triangle ONQ$,

$$NQ^2 = OQ^2 - NO^2 \text{ (Pythagoras' Theorem)}$$

$$= 10^2 - 6^2 = 100 - 36 = 64$$

$$NQ = \sqrt{64} = 8\text{cm}, \quad \text{But } PQ = 2NQ \text{ (N is midpoint of PQ)}$$

$$= 2 \times 8 = 16\text{cm. The chord PQ is 16cm long. (Option C)}$$

4. Let $\angle QON$ be θ .

$$\text{In } \triangle NOQ, \text{ using cosine ratio: } \cos \theta = \frac{NO}{OQ} = \frac{6}{10} = 0.6$$

$$\theta = \cos^{-1}(0.6) = 53.13^\circ$$

Join point P to O. Since OP is also a radius of the circle.

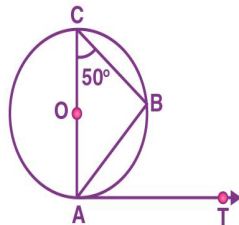
So $OP = 10\text{cm}$ and ON bisects $\angle POQ$. Therefore $\angle POQ = 2 \times \theta = 2 \times 53.13^\circ = 106.26^\circ$.

106.26° to the nearest whole number is 106° (Option A)

5. Angles in the same segment of a circle are **EQUAL**. (Option B)

6. The angle in a semi-circle is a right angle. (Option A)

- 7.



$\angle ABC = 90^\circ$ (angle in Semicircle is right angle)

$$\text{In } \triangle ACB, \quad \angle A + \angle B + \angle C = 180^\circ$$

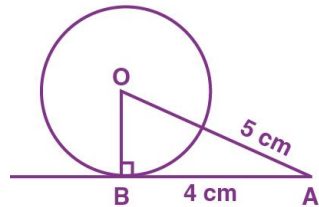
$$\angle A = 180^\circ - (90^\circ + 50^\circ)$$

$$\angle A = 40^\circ \quad \text{Or } \angle OAB = 40^\circ \quad \text{Therefore, } \angle BAT = 90^\circ - 40^\circ = 50^\circ \quad \text{(Option C)}$$

8. If a parallelogram circumscribes a circle, then it is a **RHOMBUS**. (Option A)

Reason: A RHOMBUS has all its sides equal also the radius of a circle at any point on the circumference to the center is always the same.

9.



AB is the tangent, drawn on the circle from point A.

So, $OB \perp AB$

Given, $OA = 5\text{ cm}$ and $AB = 4\text{ cm}$

Now, In $\triangle AOB$, $OA^2 = AB^2 + OB^2$ (Using Pythagoras theorem)

$$5^2 = 4^2 + BO^2$$

$$OB^2 = 25\text{cm} - 16\text{cm}$$

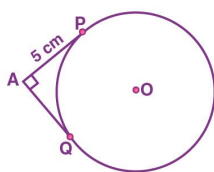
$$OB^2 = 9\text{cm}$$

$$OB = 3\text{cm} \quad (\text{Option A})$$

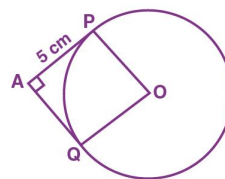
10. The **DIAMETER** of a circle is a straight line from one end on the circumference of a circle to another end on the circumference of the circle. It can also be defined as a chord that divides a circle into two equal semi-circle. (Option D)

11. The sum of the angle between two radii of a circle and the angle between the tangents at the end of the radii is 180° . Therefore, the angle between the tangents at the end of the radii = $180^\circ - 130^\circ = 50^\circ$. (Option B)

12.



Join OP and OQ



Tangents $AP = AQ$

In triangle APO and AQO ,

$AP = AQ$

$AO = AO$ (Common)

$OP = OQ$ (radius of same circle)

Thus, $\triangle APO \sim \triangle AQO$.

$POQA$ is a square

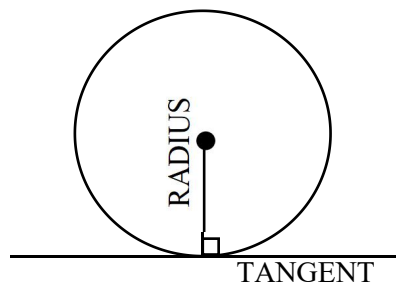
$OP = OQ = AP = AQ$

So, $AP = AQ = 5 \text{ cm}$

And $AP = OP$ (Proved)

Therefore, radius = $OP = 5 \text{ cm}$ **(Option C)**

13. The tangent to a circle is **PERPENDICULAR** to the radius through the point of contact.



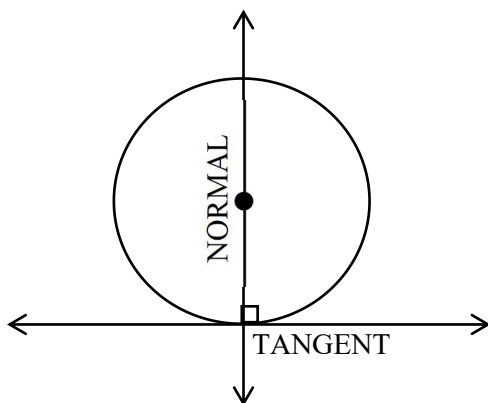
(Option B)

14. Radius = 7 cm ,

Diameter = $2 \times \text{Radius}$ *(The length of diameter is twice that of radius)*

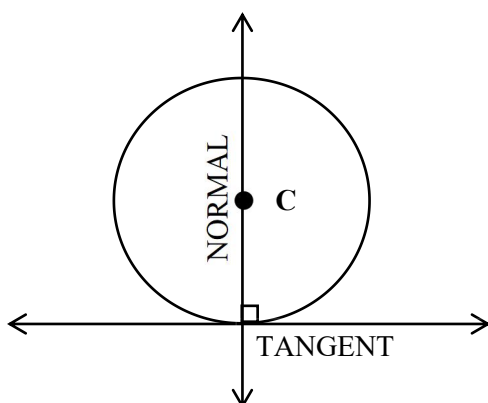
= $2 \times 7 \text{ cm} = 14 \text{ cm}$. **(Option A)**

15. **NORMAL** of a circle is a line perpendicular to the tangent at the contact point

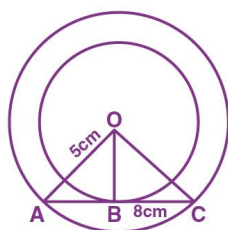


Perpendicular mean **ORTHOGONAL**
(Option C)

16. The normal to a circle will always pass through the center of the circle. **(Option A)**



17.



(Option C)

$OA = 5 \text{ cm}$ and $AC = 8 \text{ cm}$

AC is a chord which touches the inner circle at point B.

Join OB. So, $OB \perp AC$

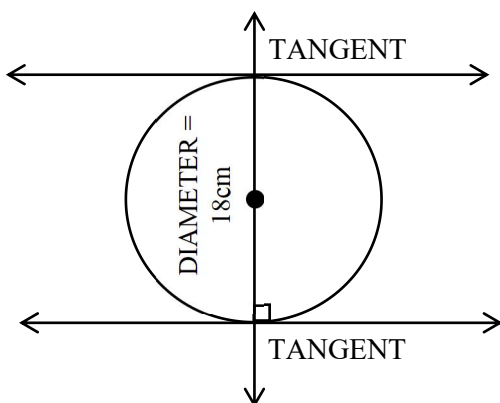
$AD = DC = 4 \text{ cm}$ {perpendicular line OB bisects the chord}

Thus, in right angled $\triangle AOB$, $OA^2 = AB^2 + OB^2$

$OB^2 = 5^2 - 4^2 = 25 - 16 = 9$, $OB = 3 \text{ cm}$

Hence, the radius of the inner circle will be **3 cm**.

18.



Given,

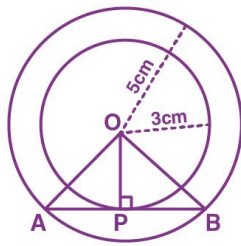
Distance between two parallel tangents = 18 cm

That means, diameter = 18 cm

Therefore, radius of the circle = $18/2 = 9\text{cm}$

(Option D)

19.



AB is tangent to the smaller circle at point P.

$\therefore OP \perp AB$

By Pythagoras theorem, in triangle OPA

$$OA^2 = AP^2 + OP^2$$

$$\Rightarrow 5^2 = AP^2 + 3^2$$

$$\Rightarrow AP^2 = 25 - 9 \quad \Rightarrow AP = 4$$

Now, as $OP \perp AB$,

Since the perpendicular from the center of the circle bisects the chord, AP will be equal to PB

So, $AB = 2AP = 2 \times 4 = 8 \text{ cm}$ **(Option A)**

20. A circle can have **TWO** parallel tangents at the same time.

(Option B)

