AGA KHAN UNIVERSITY EXAMINATION BOARD

SECONDARY SCHOOL CERTIFICATE

CLASS X

ANNUAL EXAMINATIONS (THEORY) 2023
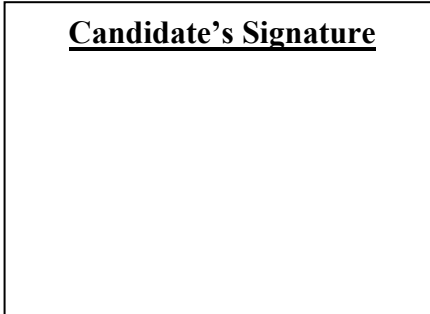
Mathematics Paper I

Time: 1 hour 20 minutes   Marks: 45

INSTRUCTIONS

1. Read each question carefully.

2. Answer the questions on the separate answer sheet provided. DO NOT write your answers on the question paper.

3. There are 100 answer numbers on the answer sheet. Use answer numbers 1 to 45 only.

4. In each question, there are four choices A, B, C, D. Choose ONE. On the answer grid, black out the circle for your choice with a pencil as shown below.

5. If you want to change your answer, ERASE the first answer completely with a rubber, before blacking out a new circle.

6. DO NOT write anything in the answer grid. The computer only records what is in the circles.

7. A formulae list is provided on page 2. You may refer to it during the paper, if you wish.

8. You may use a simple calculator if you wish.

List of Formulae

Note:

- All symbols used in the formulae have their usual meaning.

Basic Statistics

$$\overline{X} = \frac{\sum x}{n}$$

$$\text{Median} = l + \frac{1}{f}\left(\frac{n}{2} - c\right) \times h$$

$$\overline{X} = \frac{\sum fx}{n} \ \text{or} \ \overline{X} = \frac{\sum fx}{\sum f}$$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\text{variance} = \frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2$$

$$\text{Standard deviation} = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$$

Algebraic Manipulation

$$HCF \times LCM = p(x) \times q(x)$$

Linear Equations and Inequalities

$$1 \text{ mile} = \frac{8}{5} \text{ km}$$

$$1 \text{ Hectare} = 2.471 \text{ Acres}$$

$$^\circ F = \frac{9}{5} \times {}^\circ C + 32$$

Quadratic Equations

$$ax^2 + bx + c = 0, \ a \neq 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\text{Disc} = b^2 - 4ac$$

Introduction to Coordinate Geometry

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Introduction to Trigonometry

$$1^\circ = \frac{\pi}{180} \text{ rad}, \ 1 \text{ rad} = \left(\frac{180}{\pi}\right)^\circ$$

$$A = \frac{1}{2} r^2 \theta$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$l = r\theta$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

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

Algebraic Formulae

$$(a - b)^2 = a^2 - 2ab + b^2$$

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$a^2 - b^2 = (a + b)(a - b)$$

$$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

$$(a + b)^2 - (a - b)^2 = 4ab$$

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$$

$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$$

1. Consider the given table for grade 10 students' scores in a mathematics test, in a certain school. The scores were recorded out of 50.

Scores	Observations	Frequency
21 - 25	21, 23, 23, 25, 25	5
26 - 30	29, 29, 29	3
31 - 35	32, 33, 34, 35, 35	5
36 - 40	38, 38, 38, 38, 40, 39, 38, 39, 39, 40	10
41 - 45	44, 44, 44, 44, 45, 45	6
46 - 50	49, 49, 50	3

The number of students who obtained more than 60% score is

A. 0
B. 24
C. 27
D. 32

2. Kiran, a mathematics teacher, took the opinion of her students to know their favourite sections in grade 10 mathematics. Their responses are represented by the given pie chart.
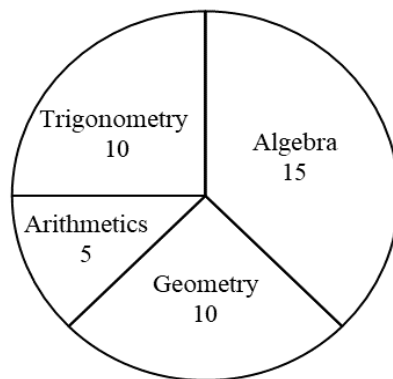
The central angle associated to the students whose favourite section is trigonometry will be

A. 10°
B. 25°
C. 90°
D. 270°

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3. The variance of 1, 0, 1 and 0 is

   A. 0.0625
   B. 0.25
   C. 0.5
   D. 1

4. In a town, the temperature recorded at different time slots on a certain day in degree centigrade (^oC) are 32, 35, 37, 39, 41, 41, 39, 37 and 36.

   The median of the given observations is

   A. 37
   B. 39
   C. 40
   D. 41

5. The given cumulative frequency curve represents number of employees and their salary in an organisation.
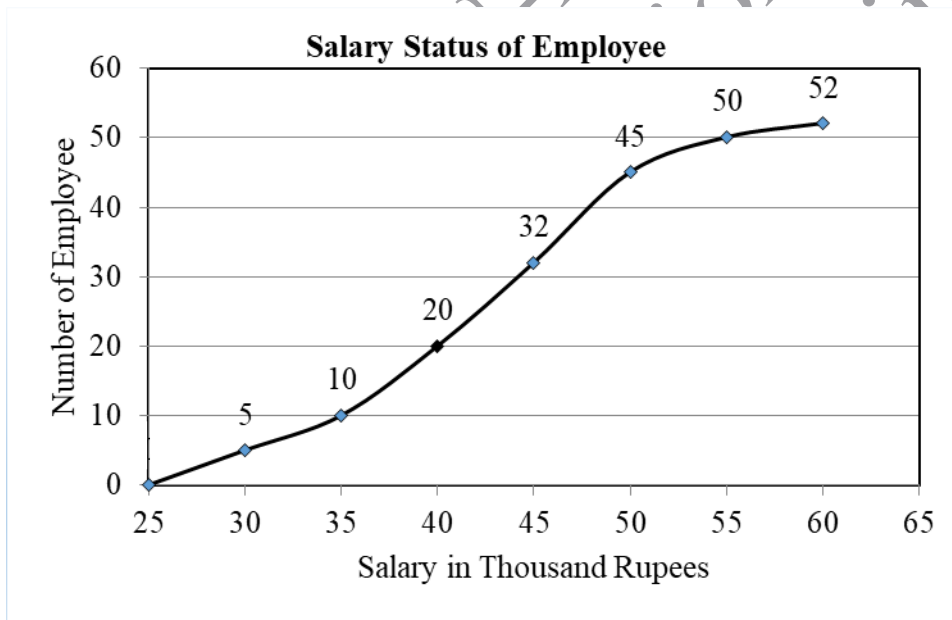
$$\frac{\text{number of employees earning less than or equal to Rs 35,000}}{\text{number of employees earning less than or equal to Rs 50,000}}$$

The given ratio for this curve will be equal to

   A. 1:9
   B. 5:32
   C. 7:10
   D. 2:9

6.   If the arithmetic mean of 10, 20, 30, 40, 50, …, 180, 190 and 200 is 105, then the arithmetic mean of 20, 40, 60, 80, 100 …, 360, 380 and 400

   A.   is 105
   B.   is 115
   C.   is 210
   D.   cannot be determined

7.   The simplest form of $\dfrac{ab+b^2}{(a+b)^2}$ is equal to

   A. b.
   B. $\dfrac{b}{a}$.
   C. $\dfrac{b}{(a+b)}$.
   D. $\dfrac{a}{(a+b)}$.

8.   The least common multiple (LCM) of the expressions $\dfrac{(x-3)^2}{x^2-y^2}$ and $\dfrac{x-y}{(x+3)(x-3)}$ is

   A. $\dfrac{x-3}{x-y}$.
   B. $\dfrac{1}{(x-3)(x-y)}$.
   C. $\dfrac{x-3}{(x+y)(x+3)}$.
   D. $\dfrac{1}{(x^2-y^2)(x^2-9)}$.

9.   The product of two polynomials is $(x^3+1)(x^2-1)$. If their highest common factor (HCF) is $x+1$, then their least common multiple (LCM) will be

   A. $(x^3+1)(x^2+1)$.
   B. $(x^3+1)(x+1)$.
   C. $(x^3+1)(x-1)$.
   D. $(x^3+1)(x^2-1)$.

10. The positive square root of $(x+2)^2 \times (x^2 - 2x + 1)$ is

    A. $(x+2)(x-1)$.
    B. $(x+2)(x-2)$.
    C. $(x+1)(x-2)$.
    D. $(x+2)(x-\sqrt{2x}+1)$.

11. The highest common factor (HCF) of $2x-2$, $(2x-2)^2$ and $(2x-2)(2x+2)$ is

    A. $x-1$
    B. $2x-2$
    C. $(2x-2)^2$
    D. $(2x-2)^2(2x+2)$

12. The positive square root of the expression $a^n \times a^{2n} \times a^{3n}$, where a is a real number and n is a positive integer, is

    A. a^n.
    B. a^{2n}.
    C. a^{3n}.
    D. $a^{\sqrt{6n}}$.

13. Which of the following fractions is a proper fraction?

    A. $\dfrac{ax^2 + bx + c}{ax^3 + bx^2 + c}$

    B. $\dfrac{ax^2 + bx + c}{ax^2 + cx + d}$

    C. $\dfrac{ax^4 + bx + c}{x^3}$

    D. $\dfrac{ax^5 + bx + c}{ax^4 + cx + d}$

14. The solution set of the equation $\dfrac{x}{3} - b = 0$ is

    A. $\{\,0\,\}$.
    B. $\{\,b\,\}$.
    C. $\{3b\}$.
    D. $\{\,b-3\,\}$.

15. The solution set of the equation $\sqrt{4-t} = \sqrt{4}$ is

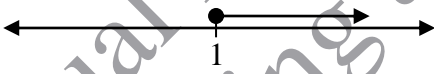   A. $\{\ \}$.
    B. $\{0\}$.
    C. $\{2\}$.
    D. $\{8\}$.

16. The solution set of the equation $\dfrac{|2x-1|}{4} + 4 = 3$ is

    A. $\left\{\dfrac{5}{2}, -\dfrac{3}{2}\right\}$.
    B. $\left\{-\dfrac{5}{2}, \dfrac{3}{2}\right\}$.
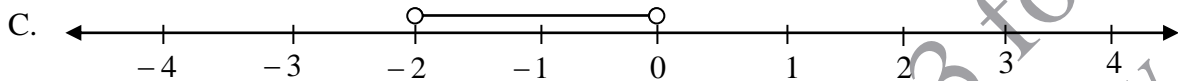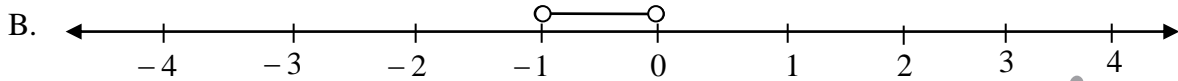   C. $\{5, -3\}$.
    D. $\{\ \}$.

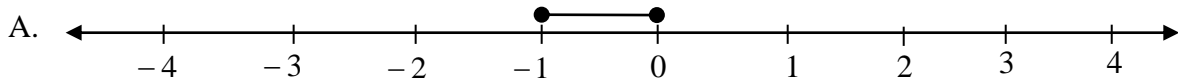17. The solution of $\dfrac{|x|}{2} > 0$ is equal to

    A. $x < -2$ or $x > 2$
    B. $x < 2$ or $x > 0$
    C. $x < 0$ or $x > 0$
    D. $x < 0$ or $x > 2$

18. On number line, the solution set of $2 - x \leq 1$ is

    A.
    B.
    C.
    D.

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19. The solution of $-1 < \dfrac{x}{2} < 0$, where $x \in R$, is represented on a number line as

A.

B.

C.

D.

20. If the line on the given graph represents the equation $y = mx + c$, then the values of m and c are
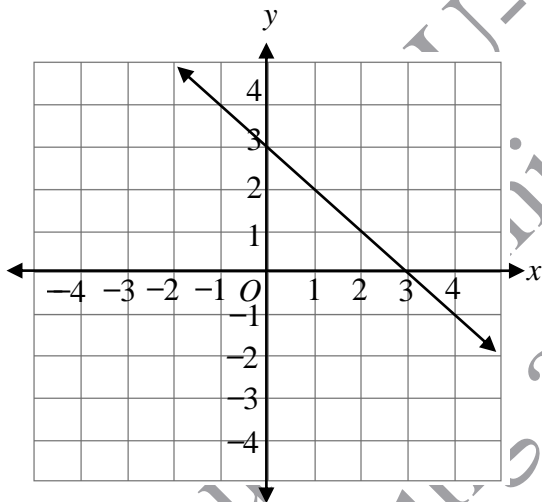
	m	c
A	0	3
B	-1	0
C	-1	3
D	3	-1

21. The given graph represents relationship between distance measured in kilometers and miles.
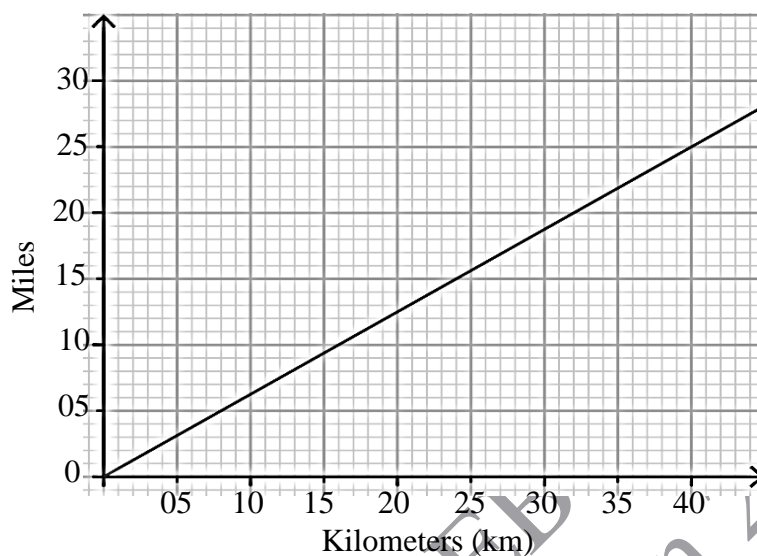
Referring to the graph, 25 miles is approximately equal to

A. 16 km.
B. 28 km.
C. 40 km.
D. 45 km.

22. On solving $x = 2y$ and $2x - y = 6$, the value of y will be

A. -3
B. -2
C. 2
D. 3

23. The solution set of the quadratic equation $2x^2 + 4x + 2 = 0$ is

A. $\{1\}$.
B. $\{-1\}$.
C. $\{0,1\}$.
D. $\{0,-1\}$.

24. In standard form, the quadratic equation $-\dfrac{2}{3}x + \dfrac{5}{3}x^2 + 2 = 0$ can be written as

A. $5x^2 - 2x + 6 = 0$
B. $5x^2 - 2x + 2 = 0$
C. $5x^2 - 2x - 6 = 0$
D. $5x^2 - 2x - 2 = 0$

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25. The nature of the roots of the quadratic equation $5x^2 - 6x + 1 = 0$ are

   A.   rational and equal.
   B.   rational and unequal.
   C.   irrational and equal.
   D.   irrational and unequal.

26. The roots of the equation $x^2 - x + 1 = 0$ are
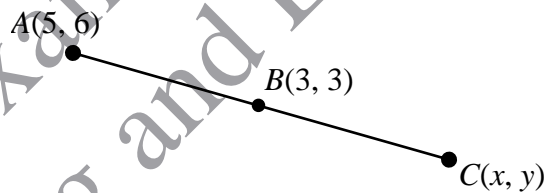
   A.   1 and 1
   B. -1 and -1
   C. $\dfrac{-1 + \sqrt{3}i}{2}$ and $\dfrac{-1 - \sqrt{3}i}{2}$
   D. $\dfrac{1 + \sqrt{3}i}{2}$ and $\dfrac{1 - \sqrt{3}i}{2}$

27. The length of the line segment whose end points are (5, 7) and (3, 9) is

   A.   4 units.
   B. $\sqrt{8}$ units.
   C. $\sqrt{24}$ units.
   D. $\sqrt{320}$ units.

28. In the given line segment AC, B is the midpoint. The y-coordinate of C is

   A.   0
   B.   1
   C.   4
   D. $\dfrac{9}{2}$

   $A(5, 6)$

   $B(3, 3)$

   $C(x, y)$

29. When the angle of measurement 240° is converted into radians, it becomes

   A. $\dfrac{3\pi}{2}$ radians.
   B. $\dfrac{4\pi}{3}$ radians.
   C. $\dfrac{5\pi}{2}$ radians.
   D. $\dfrac{5\pi}{3}$ radians.

30. The terminal ray of the angle 200° lies in quadrant

   A.   I.
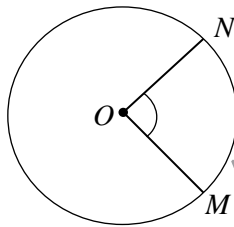   B.   II.
   C.   III.
   D.   IV.

31. The value of $\sin 30^{\circ} + \cos 60^{\circ}$ is

   A.   1
   B. $\sqrt{3}$
   C.   3
   D. $2\sqrt{3}$

32. On simplification of $\dfrac{1}{\sqrt{1-\sin\theta} \times \sqrt{1+\sin\theta}}$, we get

   A. $\sec\theta$.
   B. $\sec^2\theta$.
   C. $\operatorname{cosec}\theta$.
   D. $\operatorname{cosec}^2\theta$.

33. The given diagram shows a circle with centre *O*. The arc *MN* subtends an angle *NOM* at the centre.
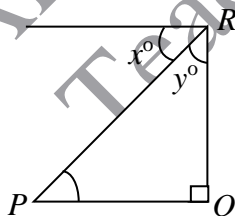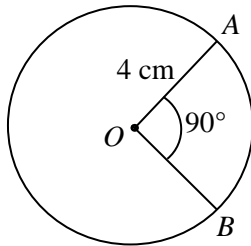

NOT TO SCALE

   If $\angle NOM$ is 1 radian, then the

   A.   radius of the circle is 1 unit.
   B.   two radii are at right angle.
   C.   arc length and radius are equal.
   D.   arc length is twice the length of radius.

34. In the given diagram, the angle of elevation of *R* from *P* is

   A. x°
   B. y°
   C. $(x+y)^{\circ}$
   D. $(x-y)^{\circ}$

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35. As shown in the diagram, a disc is made of a circular card sheet of 4 cm radius. A student cut a small piece *AOB* of the sheet away.

NOT TO SCALE

The area of the card sheet cut away is

A. π cm^2
B. 4π cm^2
C. 72 cm^2
D. 180 cm^2

36. In the third quadrant, the signs of $\cos\theta$ and $\tan\theta$ are respectively

A. positive and negative.
B. positive and positive.
C. negative and positive.
D. negative and negative.

37. In the given $\Delta\,XYZ$, the length *XY* is equal to
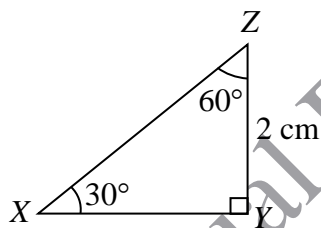
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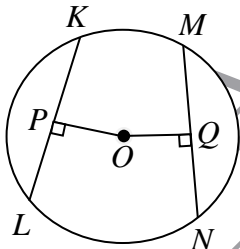A. 2 cm.
B. $2\sqrt{3}$ cm.
C. 3 cm.
D. 4 cm.

38. A ladder is placed against a wall as shown in the given figure.

NOT TO SCALE

12 m

5 m
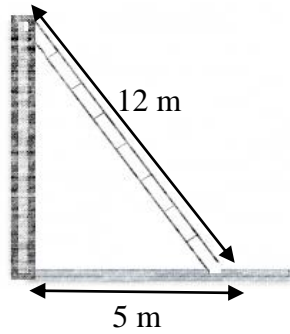
If the distance of the ladder from the base of the wall is 5 m and the length of the ladder is 12 m, then the height of the wall will be

A. 13 m.
B. $\sqrt{17}$ m.
C. $\sqrt{119}$ m.
D. 119 m.

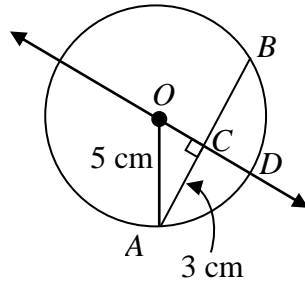39. In the given diagram, O is the centre of the circle and the two chords KL and MN are congruent.

NOT TO SCALE

If $\angle OPL = \angle OQM = 90^o$ and $PK = (x + 1)$ units, then the value of MN is equal to

A. $(x + 2)$ units.
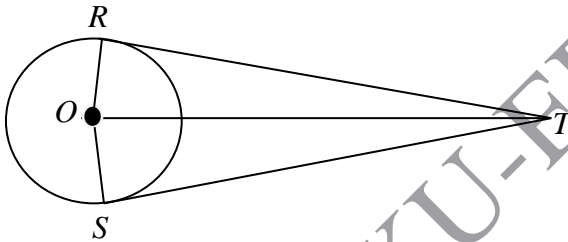B. $(2x + 1)$ units.
C. $2(x + 1)$ units.
D. $2(x + 2)$ units.

40. In the given diagram, if *OA* is 5 cm and *AC* is 3 cm, then the length of *BC* will be

NOT TO SCALE

A. 3 cm.
B. 4 cm.
C. 5 cm.
D. 8 cm.

41. In the given diagram, *O* is the centre of the circle and *RT* and *ST* are the two tangents drawn to the circle.

NOT TO SCALE

If *OR = x* units and *OT = (2x + 1)* units, then the expression for $(RT)^2$ is

A. $[(2x + 1)^2 - x]$ square units.
B. $[(2x + 1)^2 + x]$ square units.
C. $[(2x + 1)^2 - x^2]$ square units.
D. $[(2x + 1)^2 + x^2]$ square units.

42. The given diagram shows three circles having centres C_1, C_2 and C_3. The radius of circle having centre
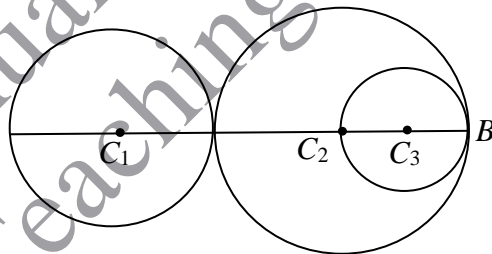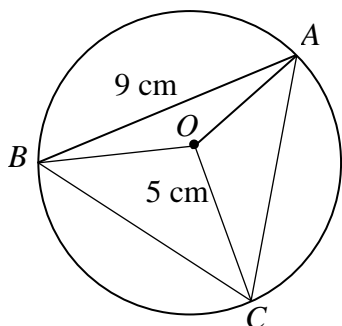
NOT TO SCALE

- C_1 is 3 cm.
- C_2 is 4 cm.
- C_3 is 2 cm.

The distance between C_1 and C_2 is
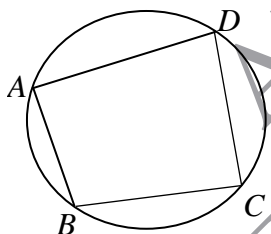
A. 5 cm.
B. 7 cm.
C. 10 cm.
D. 11 cm.

43. In the given diagram, a circle with centre *O* is shown that has a radius of 5 cm.

NOT TO SCALE

If chord *AB* is 9 cm and the arc *AB*, arc *BC* and arc *AC* are of equal lengths, then the perimeter of the triangle *ABC* will be
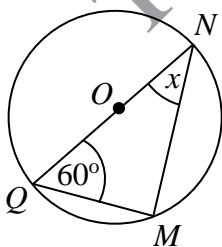
A. 14 cm.
B. 15 cm.
C. 18 cm.
D. 27 cm.

44. A quadrilateral *ABCD* is inscribed in a circle as shown in the given diagram.

NOT TO SCALE

For the given diagram, the TRUE condition will be

A. $\angle A = \angle C$
B. $\angle A = \angle D$
C. $\angle A + \angle B = 180^\circ$
D. $\angle A + \angle C = 180^\circ$

45. The value of *x* in the given inscribed triangle *QMN* is

NOT TO SCALE

A. 15°
B. 30°
C. 60°
D. 90°

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