AGA KHAN UNIVERSITY EXAMINATION BOARD

SECONDARY SCHOOL CERTIFICATE

CLASS IX

ANNUAL EXAMINATIONS (THEORY) 2024

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.

Candidate's Signature

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.

Sets and Functions

$A \Delta B = (A \cup B) - (A \cap B)$ $\qquad$ $(A \cap B)^c = A^c \cup B^c$ $\qquad$ $(A \cup B)^c = A^c \cap B^c$

Real and Complex Numbers

$x^m \times x^n = x^{m+n}$ $\qquad$ $(x \times y)^n = x^n \times y^n$ $\qquad$ $(x^m)^n = x^{mn}$

$\left(\dfrac{x}{y}\right)^n = \dfrac{x^n}{y^n}$ $\qquad$ $\dfrac{x^m}{x^n} = x^{m-n}$ $\qquad$ $a^{-m} = \dfrac{1}{a^m}$

Exponents and Logarithms

$\log_a(m \times n) = \log_a m + \log_a n$ $\qquad$ $\log_a\left(\dfrac{m}{n}\right) = \log_a m - \log_a n$ $\qquad$ $\log_a b = n \Leftrightarrow a^n = b$

$\log_a(m)^n = n\log_a m$ $\qquad$ $\log_a n = \log_b n \times \log_a b$ $\qquad$ $\log_a n = \dfrac{\log_b n}{\log_b a}$

Algebraic Formulae & Applications and Factorisation

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

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

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

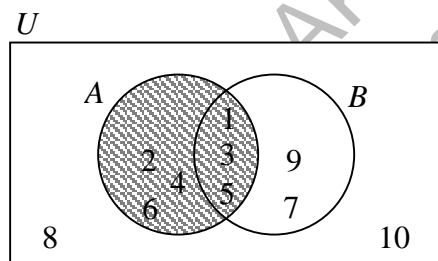$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$ $\qquad$ $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$ $\qquad$ $(a+b)^2 - (a-b)^2 = 4ab$

Matrices and Determinants

$A^{-1} = \dfrac{1}{|A|} \, AdjA$

1. If *A* and *B* are two non-empty sets, then $A \cap B$ will contain

    A. the common elements of set *A* and set *B*.
    B. all of the elements in set *A* and set *B*.
    C. the elements in set *A* but not in set *B*.
    D. the elements in set *B* but not in set *A*.

2. It is given that $M = \{0, 1, 2, 3\}$ and $N = \{1, 3, 4, 5\}$. The set $M - N$ is equal to

    A. {0}.
    B. {0, 2}.
    C. {4, 5}.
    D. {1, 3}.

3. If *M*, *N* and *P* are three non-empty sets, then the associative property of intersection will be

    A. $(M \cap N) \cap (M \cap P) = (M \cap P) \cap (M \cap N)$.
    B. $M \cap (N \cap P) = (M \cap N) \cap P$.
    C. $M \cap (N \cap P) = (N \cap P) \cap M$.
    D. $M \cap N \cap P = P \cap N \cap M$.

4. Given is a Venn diagram.

    The shaded region in the Venn diagram represents

    I. $A \cap B$
    II. $A \cup (A \cap B)$
    III. $A \cap (A \cup B)$

    A. I only.
    B. II only.
    C. I and III.
    D. II and III.

5. If $(2, k) = (c, 3)$, then the values of *k* and *c* respectively are

    A. 2 and 3
    B. 3 and 2
    C. −2 and 3
    D. −3 and 2

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6. If $M = \{a, b, c, d\}$ and $N = \{x, y\}$, then $f = \{(a, x), (b, y), (c, x), (d, y)\}$ is a/ an

A. into function.
B. onto function.
C. one-one function.
D. bijective function.

7. Which of the following is a rational number?

A. $\sqrt{2}$
B. π
C. 3.2137814115…
D. 3.33333…

8. The multiplicative inverse of 2 is

A. -2
B. $-\dfrac{1}{2}$
C. $\dfrac{1}{2}$
D. 2

9. If $2i + 3 = b + ai - 3i,$ then the value of a will be

A. -2
B. -1
C. 1
D. 5

10. The complex number $2i^2 + 3 - 5i$ is equal to

A. $1 - 5i.$
B. $5 - 5i.$
C. $3 - 3i.$
D. $2 - 2i.$

11. If $a \times 10^{-2} = 0.050,$ then a is equal to

A. -2
B. 0.05
C. 1
D. 5

12. The value of $\log_3 9$ is equal to

    A. 2
    B. 3
    C. 6
    D. 9

13. The logarithmic form of $a^{-3} = x$ is

    A. $\log_{-3} a = x$
    B. $\log_x a = -3$
    C. $\log_a x = -3$
    D. $-\log_3 a = x$

14. The $\log \sqrt{\dfrac{x+y}{2}}$ can be expressed in expanded form as

    A. $\dfrac{1}{2}\log(x+y) - \log 2$

    B. $\dfrac{1}{2}\log(x+y) - \dfrac{1}{2}\log 2$

    C. $\dfrac{1}{2}\log x + \log y - \log 2$

    D. $\dfrac{1}{2}\log x + \dfrac{1}{2}\log y - \dfrac{1}{2}\log 2$

15. If $\log_m n = \dfrac{\log_a n}{\log_a m}$, then $\dfrac{\log_k 3}{\log_k 5}$ is equal to

    A. $\log_3 5$
    B. $\log_5 3$
    C. $\log_k 3 + \log_k 5$
    D. $\log_k 3 - \log_k 5$

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16. The expression $\frac{x^2 - 1}{x - 1}$, for $x \neq 1$, is

    I.   algebraic
    II.   rational
    III. polynomial

    A.   I only.
    B.   II only.
    C.   I and III.
    D.   II and III.

17. If $a = 1$ and $b = -1$, then the value of $\frac{a^2 - b^2}{a^2 + b^2}$ is equal to

    A. -1
    B. 0
    C. 1
    D. 2

18. The simplest form of the expression $\frac{m^2 - 4mn}{4m}$ will be

    A. $\frac{m^2 - 4n}{4}$.
    B. $\frac{m - 4n}{4}$.
    C. $m^2 - n$.
    D. $m - n$.

19. If $(a + b)^2 = 16$ and $4ab = 12$, then $(a - b)^2$ is equal to

    A. 2
    B. 4
    C. ± 2
    D. ± 4

20. The expression $t^3 + 8 + p$ is a perfect cube, if p is equal to
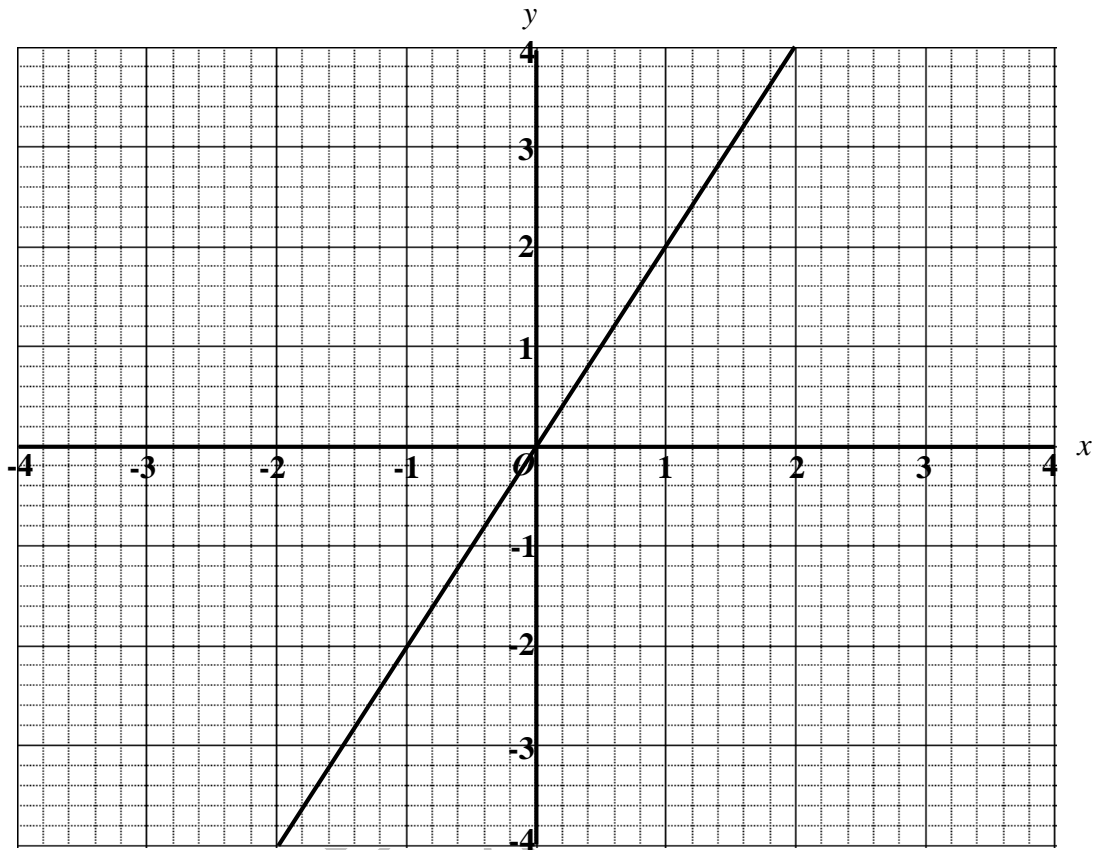
    A. $6t(t - 2)$.
    B. $3t(t - 2)$.
    C. $3t(t + 2)$.
    D. $6t(t + 2)$.

21. The expression $3\sqrt{3} - 6\sqrt{3}$ will be equal to

   A. $3\sqrt{3}$
   B. $-3\sqrt{3}$
   C. $9\sqrt{3}$
   D. $-9\sqrt{3}$

22. The factors of an expression $a(b-c) - b(c-b)$ are

   A. $b - c$ and $a - b.$
   B. $b - c$ and $a + b.$
   C. $b + c$ and $a - b.$
   D. $b + c$ and $a + b.$

23. The expression $xy - 5y + 4x - 20$ is equal to

   A. $(x-5)(y-4).$
   B. $(x-5)(y+4).$
   C. $(x+5)(y-4).$
   D. $(x+5)(y+4).$

24. One of the factors of $2 - 16x^3$ is

   A. $1 - 4x.$
   B. $1 - 2x.$
   C. $2 + 2x.$
   D. $2 + 4x.$

25. The factorised form of the polynomial $1 - 3x - 10x^2$ will be

   A. $(1 - 5x)(1 + 2x).$
   B. $(1 + 5x)(1 - 2x).$
   C. $(1 - 5x)(1 - 2x).$
   D. $(1 + 5x)(1 + 2x).$

26. If $(x - b)$ is a factor of a polynomial $P(x)$, then $P(b)$ is equal to

   A. $-b$
   B. b
   C. 0
   D. 1

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27. If $2x^3 - 1$ is divided by $x + 1$, then the remainder will be

    A.   1
    B.   0
    C. -1
    D. -3

28. One of the factors of the polynomial $P(x) = (x - 1)^2 - 4$ is

    A. $x + 2$
    B. $x - 2$
    C. $x - 1$
    D. $x + 1$

29. In a local cafe, the ratio of an apple juice to orange juice in their signature blend is 2:3.

    The cafe currently has a total of 120 cups of juice, then the quantity of orange is

    A.   80 cups.
    B.   72 cups.
    C.   48 cups.
    D.   40 cups.

30. If $a : b :: c : d$, then according to alternendo theorem

    A. $a : b :: d : c$
    B. $a : c :: b : d$
    C. $a + b : b :: c + d : c$
    D. $a : a - b :: c : c - d$

Use the given graph to answer Q.31 and Q.32.

The given graph represents the variation in quantity '*y*' with the variation in quantity '*x*'.

31.   The constant of proportionality will be

   A. -2
   B. -1
   C. 1
   D. 2

32.   The equation form of the given relation will be

   A. $y = \dfrac{x}{2}$.
   B. $y = x$.
   C. $y = 2x$.
   D. $y = x^2$.

33. If the matrix $P = \begin{bmatrix} q & p \\ p & q \end{bmatrix}$ is a symmetric matrix, then P^t will be equal to

A. $\begin{bmatrix} p & q \\ p & q \end{bmatrix}$.

B. $\begin{bmatrix} q & p \\ q & p \end{bmatrix}$.

C. $\begin{bmatrix} p & q \\ q & p \end{bmatrix}$.

D. $\begin{bmatrix} q & p \\ p & q \end{bmatrix}$.

34. The additive identity of a matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ will be

A. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.

B. $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$.

C. $\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$.

D. $\begin{bmatrix} -a & -b \\ -c & -d \end{bmatrix}$.

35. If $X = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}, Y = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $Z = \begin{bmatrix} 1 & 2 \end{bmatrix}$ are matrices, then which of the following is/ are possible for matrix multiplication?

I. XY
II. XZ
III. ZY

A. I only
B. II only
C. I and III
D. II and III

36. If $A = \begin{bmatrix} a & 18 \\ 2 & a \end{bmatrix}$ is a singular matrix, then the possible value(s) of a will be
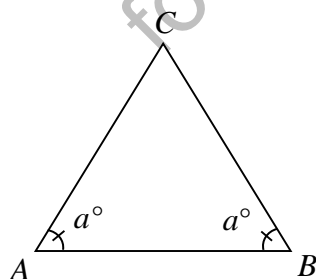
A. ± 18
B. ± 6
C. 0
D. 9

37. If the equation of a matrix is $X - \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, then the matrix X will be

A. $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$.

B. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.

C. $\begin{bmatrix} -1 \\ -1 \end{bmatrix}$.

D. $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$.

38. If $|A| = 5$ and $A = \begin{bmatrix} 1 & 5 \\ 3 & x \end{bmatrix}$, then the value of x in matrix A will be

A. -20
B. -10
C. 10
D. 20

39. If the sum of all the three sides of a triangle ABC is 14 cm and $m\overline{AB} = 4\,\text{cm}$, then $m\overline{AC}$ is equal to

NOT TO SCALE
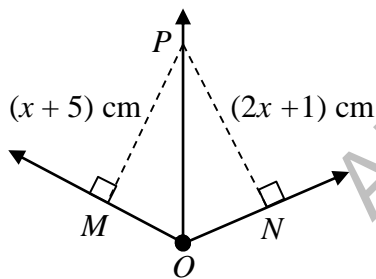

A.   5 cm.
B.   6 cm.
C.   10 cm.
D.   18 cm.

40. If $\triangle ABC \cong \triangle DFE$, then the value of a is equal to

NOT TO SCALE

A. 20°
B. 25°
C. 35°
D. 50°

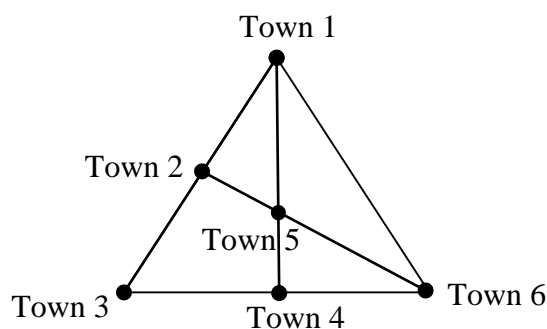41. In the given diagram, OP is the angle bisector of $\angle MON$.

NOT TO SCALE

Based on the given information, the value of x will be

A. 2
B. 3
C. 4
D. 6

42. The given diagram shows the various paths connecting towns.

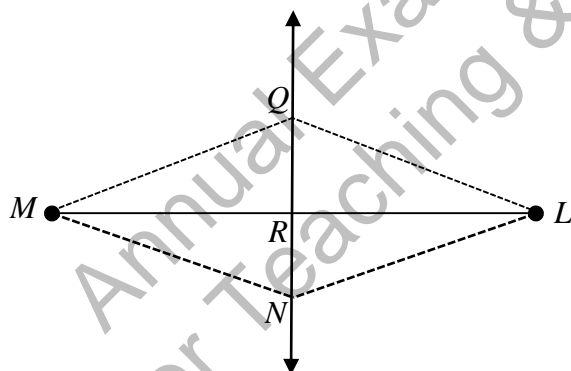- The paths connecting Town 1, Town 3 and Town 6 form a triangle.
- Town 2 is halfway between Town 1 and Town 3.
- Town 4 lies half way between Town 3 and Town 6.

NOT TO SCALE

If direct paths from Town 2 to Town 6 lies through Town 5, then the distance between Town 2 to Town 5 would be

A.   half of the distance from Town 3 to Town 4.
B.   half of the distance from Town 2 to Town 6.
C.   one third of the distance from Town 2 to Town 6.
D.   one third of the distance from Town 4 to Town 6.
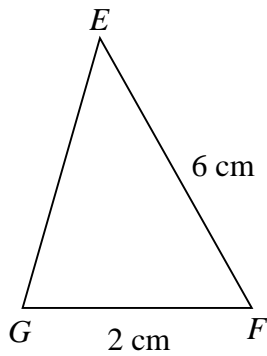
43. Consider the given diagram.
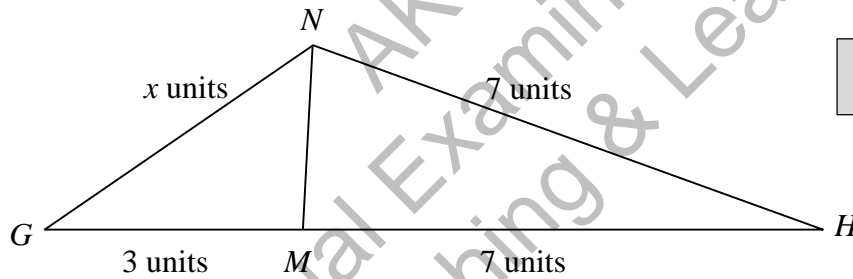
NOT TO SCALE

If $QM = QL$ and $NM = NL$, then

I. $QR = NR$
II. $MR = LR$
III. $\angle MRQ = 90°$

A.   I only.
B.   III only.
C.   I and II.
D.   II and III.

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44. Which of the following is TRUE for the given triangle *EFG*?

NOT TO SCALE

E

6 cm

G   2 cm   F

A. $\angle F > \angle G$
B. $\angle G > \angle E$
C. $\angle E > \angle F$
D. $\angle G = \angle E + \angle F$

45. In the given triangle *NGH*, if *NM* bisects $\angle GNH$, then *x* will be equal to

N

x units   7 units

NOT TO SCALE

G   H
   3 units   M   7 units

A.   3 units.
B.   7 units.
C.   10 units.
D.   11 units.

END OF PAPER

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