AGA KHAN UNIVERSITY EXAMINATION BOARD

SECONDARY SCHOOL CERTIFICATE

CLASS IX

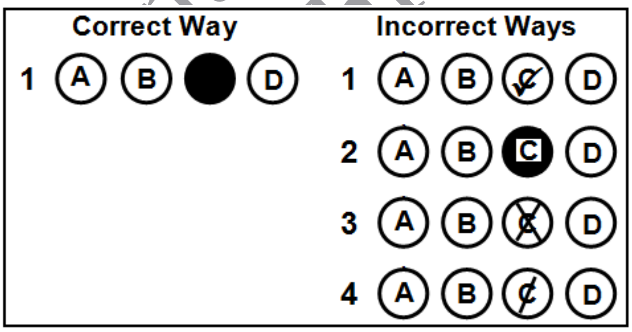
ANNUAL EXAMINATIONS (THEORY) 2023

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.



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.

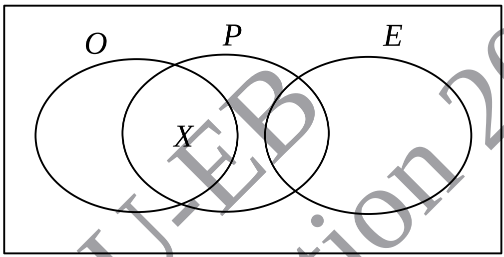
Sets and Functions		
$A\Delta B=(A\cup B)-(A\cap B)$	$(A\cap B)^c=A^c\cup B^c$	$(A\cup B)^c=A^c\cap B^c$
Real and Complex Numbers		
$x^m\times x^n=x^{m+n}$	$(x\times y)^n=x^n\times y^n$	$(x^m)^n=x^{mn}$
$\left(\dfrac{x}{y}\right)^n=\dfrac{x^n}{y^n}$	$\dfrac{x^m}{x^n}=x^{m-n}$	$a^{-m}=\dfrac{1}{a^m}$
Exponents and Logarithms		
$\log_a(m\times n)=\log_a m+\log_a n$	$\log_a\left(\dfrac{m}{n}\right)=\log_a m-\log_a n$	$\log_a b=n\Leftrightarrow a^n=b$
$\log_a(m)^n=n\log_a m$	$\log_a n=\log_b n\times\log_a b$	$\log_a n=\dfrac{\log_b n}{\log_b a}$
Algebraic Formulae & Applications and Factorisation		
$(a-b)^2=a^2-2ab+b^2$	$(a+b)^2=a^2+2ab+b^2$	
$(a-b)^3=a^3-3a^2b+3ab^2-b^3$	$a^2-b^2=(a+b)(a-b)$	
$a^3-b^3=(a-b)(a^2+ab+b^2)$	$(a+b)^2+(a-b)^2=2(a^2+b^2)$	
$(a+b+c)^2=a^2+b^2+c^2+2ab+2bc+2ca$	$(a+b)^3=a^3+3a^2b+3ab^2+b^3$	
$a^3+b^3=(a+b)(a^2-ab+b^2)$	$(a+b)^2-(a-b)^2=4ab$	
Matrices and Determinants		
$A^{-1}=\dfrac{1}{\lvert A\rvert}AdjA$		

1. If $A = \{1, 2, 3\}$ and $A \cup B = \{1, 2, 3, 4, 5\}$, then the possible set(s) represented by B could be

   I. $\{3, 4, 5\}$
   II. $\{1, 3, 5\}$
   III. $\{4, 5\}$

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

2. There are 10 balls in a bag. The balls are numbered as 1 to 10. Aman wants to separate the balls in three sets of even (E), odd (O) and prime (P) numbers as shown in the given Venn diagram.



   The overlapping region between O and P, represented as X, will contain the balls numbered as

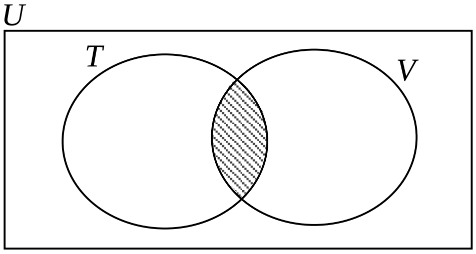
   A. $\{1, 2, 3, 5, 7, 9\}$.
   B. $\{3, 5, 7, 9\}$.
   C. $\{2, 3, 5, 7\}$.
   D. $\{3, 5, 7\}$.

3. If M, N and Q are any non-empty sets, then $M \cup (N \cap Q)$ is equal to

   A. $(M \cap N) \cap (M \cap Q)$.
   B. $(M \cup N) \cup (M \cup Q)$.
   C. $(M \cap N) \cup (M \cap Q)$.
   D. $(M \cup N) \cap (M \cup Q)$.

4. The shaded region in the given Venn diagram shows

   A. $T \cup V$.
   B. $T \cap V$.
   C. $T^c \cup V^c$.
   D. $T^c \cap V^c$.



5. If $A \times B = \{(1, a), (1, b), (1, c), (4, a), (4, b), (4, c)\}$, then the number of elements in set A must be

A. 2
B. 3
C. 5
D. 6

6. If $A = \{0, 1, 2, 3\}$ and $B = \{(0, 4)\}$, then one of the binary relations from A to B will be

A. $\{((0, 4), 0)\}$.
B. $\{(0, (0, 4))\}$.
C. $\{(0,0), (0, 4)\}$.
D. $\{(0,0), (0, 1), (0, 2)\}$.

7. Which of the given numbers is/ are rational number(s)?

I. 5.38356125
II. 5.234523452345…
III. 5.32112345145143652…

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

8. The radical form of $\left(2^3 \times 3\right)^{\frac{1}{3}}$ will be

A. $\sqrt[3]{18}$
B. $8 \times \sqrt[3]{3}$
C. $2 \times \sqrt[3]{3}$
D. $3 \times \sqrt[3]{8}$

9. The simplest form of $\dfrac{a^n \times a^{-3n}}{a^{2n}}$ will be

A. a^{-4n}
B. $a^{-\frac{3n}{2}}$
C. -1
D. a^{4n}

10. If $z_1 = -2i$ and $z_2 = 5i$ are two complex numbers, then their product will be

A. -10
B. $-3i$
C. $10i$
D. 10

11. The number $1{,}000{,}000$ can be expressed in scientific notation as

A. 1×10^6
B. 1×10^5
C. 10×10^6
D. 10×10^7

12. The value of a in the logarithmic equation $\log_2\sqrt{a} = 3$ will be

A. $2\sqrt{2}$
B. $3\sqrt{2}$
C. 8
D. 64

13. The expression $\log\dfrac{x-y}{z}$ can be expressed in the form

A. $\log x - \log y - \log z.$
B. $\log x + \log y - \log z.$
C. $\log(x-y) - \log z.$
D. $\log(x-y) + \log z.$

14. The value of the logarithmic expression $1+\log_2 32 - \log_2\dfrac{1}{8}$ will be

A. 9
B. 8
C. 3
D. 2

15. The expression $\log\sqrt[3]{9}$ is equal to

A. $\frac{1}{6}\log 9$
B. $\frac{2}{3}\log 9$
C. $\frac{2}{3}\log 3$
D. $\frac{3}{2}\log 3$

16. An algebraic expression $2x^n + 3y^m - z^p$ is a polynomial if the values of *m*, *n* and *p* belong to the set of

A. integers.
B. rational numbers.
C. non-negative integers.
D. positive real numbers.

17. The value of $(x-y)\times(x^2-xy+y^2)$ at $x=1$ and $y=-1$ will be

A. 2
B. 4
C. 5
D. 6

18. If the value of $(a+b)^2=144$ and $ab=35$, then the value of $a-b$ will be

A. ± 2
B. ± 12
C. $\pm\sqrt{74}$
D. $\pm\sqrt{109}$

19. If $a+\frac{1}{a}=2$, then $a^3+\frac{1}{a^3}$ will be equal to

A. -8
B. -2
C. 2
D. 8

20. On simplification of $2\sqrt{27}+2\sqrt{12}$, we get

A. $8\sqrt{3}$

B. $10\sqrt{3}$

C. $2\sqrt{39}$

D. $4\sqrt{39}$

21. The product of $a-1$, a^3-1 and a^2+a+1 will be

A. $(a^3+1)^2$

B. $(a^3-1)^2$

C. a^6-1

D. a^6+1

22. The complete factorised form of the expression $x+y-(x-y)(x+y)$ will be

A. $-(x+y)(x-y)$.

B. $(x+y)(x-y)$.

C. $(x+y)(1-x-y)$.

D. $(x+y)(1-x+y)$.

23. The expression $\frac{1}{p^4}+\frac{2}{p^2}+1$ can be expressed as

A. $\left(1+\frac{1}{p^2}\right)^2$.

B. $\left(1-\frac{1}{p^2}\right)^2$.

C. $\left(1+\frac{1}{p}+\frac{1}{p^2}\right)\times\left(1-\frac{1}{p}+\frac{1}{p^2}\right)$.

D. $\left(1+\frac{1}{p}+\frac{1}{p^2}\right)\times\left(1+\frac{1}{p}-\frac{1}{p^2}\right)$.

24. On factorisation of $x^2-(2x-1)$, we get

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

25. The expression t^3-3t^2+3t-1 is equal to

A. $(t-1)^3$
B. $(1-t)^3$
C. $1-t^3$
D. t^3-1

26. All of the given options are the zeros of the polynomial $p(y)=y(y-1)(y-2)(y+4)$ EXCEPT

A. 0
B. 1
C. 2
D. 4

27. The polynomial $p(a)=a^2-3a+1$ divided by a linear divisor leaves -1 as remainder. One of the linear divisor in this case is

A. $a-3$
B. $a-1$
C. $a+1$
D. $a+2$

28. Applying the factor theorem, one of the factors of the polynomial $p(t)=t^3-t^2-t+1$ is

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

29. The value of x for 7 : 6 :: 21 : x is

A. 2
B. 3
C. 18
D. 20

30. The mean proportions between 3 and 12 are

A. ± 6
B. ± 9
C. ± 12
D. ± 36

31. If *s* is inversely proportional to *t*, then the missing value of *s* in the given table will be

s	5	?
t	12	24

A. 2.5
B. 7.5
C. 10
D. 17

32. If $a:b::c:d$, then $\frac{a+b}{a-b}=\frac{c+d}{c-d}$. This is the statement of

A. dividendo theorem.
B. alternendo theorem.
C. componendo theorem.
D. componendo dividendo theorem.

33. The order of the matrix $\begin{bmatrix} 5 & 6 & 1 & 0 \end{bmatrix}$ is

A. 1 × 3
B. 1 × 4
C. 3 × 1
D. 4 × 1

34. The matrix $\begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ is a

I. null matrix
II. square matrix
III. symmetric matrix

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

35. The matrix $\begin{bmatrix} 0 & -b \\ 0 & -4 \end{bmatrix}$ is the additive inverse of the matrix

A. $\begin{bmatrix} b & 0 \\ 4 & 0 \end{bmatrix}$.

B. $\begin{bmatrix} 0 & b \\ 0 & 4 \end{bmatrix}$.

C. $\begin{bmatrix} -b & 0 \\ 4 & 0 \end{bmatrix}$.

D. $\begin{bmatrix} 0 & b \\ 0 & -4 \end{bmatrix}$.

36. The product of $A = \begin{bmatrix} a & -b \\ 1 & 1 \end{bmatrix}$ and an unknown matrix B is $AB = I$, where I is the identity matrix of order 2×2. The matrix B would be

A. $\frac{1}{a+b}\begin{bmatrix} 1 & b \\ -1 & a \end{bmatrix}$.

B. $\frac{1}{a-b}\begin{bmatrix} 1 & b \\ -1 & a \end{bmatrix}$.

C. $\frac{1}{a-b}\begin{bmatrix} -a & 1 \\ -b & -1 \end{bmatrix}$.

D. $\frac{1}{a+b}\begin{bmatrix} -a & 1 \\ -b & -1 \end{bmatrix}$.

37. If the matrix $\begin{bmatrix} a & -a \\ b & b \end{bmatrix}$ is a singular matrix, then a and b are related as

A. $ab = \frac{1}{2}$.

B. $ab = 0$.

C. $a = -b$.

D. $ab = -\frac{1}{2}$.

38. On solving the matrix equation $\begin{bmatrix} 1 & 2 \\ 1 & -1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$ by Crammer's rule, the value of x can be represented as

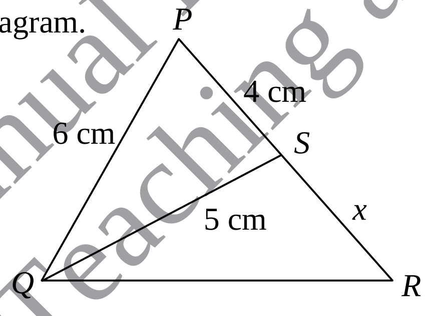
A. $\dfrac{\begin{vmatrix} 3 & 2 \\ -1 & -1 \end{vmatrix}}{\begin{vmatrix} 1 & 2 \\ 1 & -1 \end{vmatrix}}$.

B. $\dfrac{\begin{vmatrix} 1 & 2 \\ 1 & -1 \end{vmatrix}}{\begin{vmatrix} 3 & 2 \\ -1 & -1 \end{vmatrix}}$.

C. $\dfrac{\begin{vmatrix} 2 & 3 \\ -1 & -1 \end{vmatrix}}{\begin{vmatrix} 1 & 2 \\ 1 & -1 \end{vmatrix}}$.

D. $\dfrac{\begin{vmatrix} 1 & 2 \\ 1 & -1 \end{vmatrix}}{\begin{vmatrix} 2 & 3 \\ -1 & -1 \end{vmatrix}}$.

39. In the correspondence of $\Delta PQS \leftrightarrow \Delta RQS$, $PQ = QR$ and $\angle PQS = \angle SQR$, as shown in the given diagram.

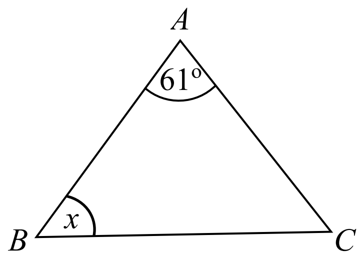


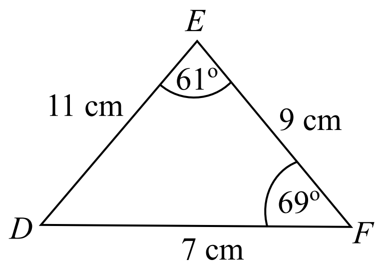
NOT TO SCALE

The value of x will be

A. 4 cm.
B. 5 cm.
C. 6 cm.
D. 11 cm.

40. In the correspondence $\Delta ABC \leftrightarrow \Delta EFD$, if $\Delta ABC \cong \Delta EFD$, then the value of x will be

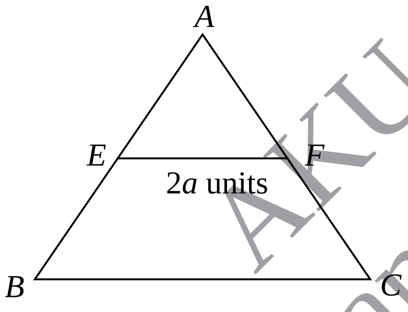




NOT TO SCALE

A. 50°
B. 61°
C. 69°
D. 119°

41. Consider the triangle *ABC* such that *E* and *F* are the midpoints of the sides *AB* and *AC* respectively.

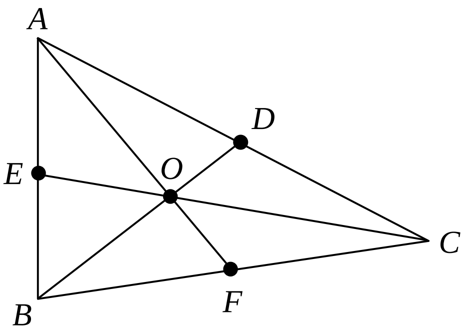


NOT TO SCALE

The length of *BC* would be

A. $\frac{1}{2}a$ units .
B. a unit.
C. $2a$ units.
D. $4a$ units.

42. In the given triangle ABC, the points D, E and F are the midpoints of the sides AC, AB and BC respectively.

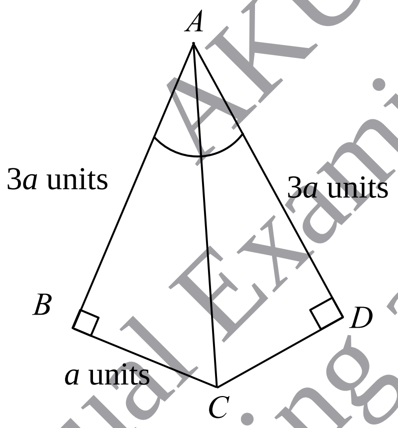


NOT TO SCALE

The line segments AF, BD and CE are the

A. altitudes.
B. medians.
C. right bisectors.
D. angle bisectors.

43. In the given figure, AC is the angle bisector of angle $\angle BAD$.

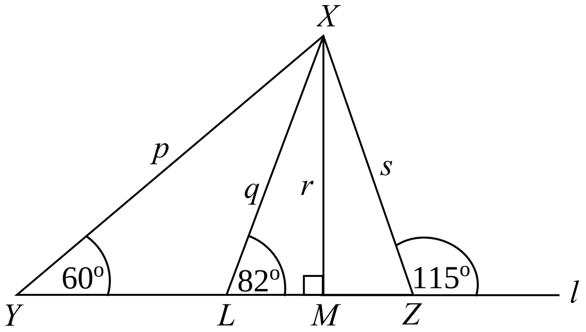


NOT TO SCALE

If $BC = a$ units, then the length of CD will be

A. $\frac{1}{2}a$ units.
B. a units.
C. $2a$ units.
D. $3a$ units.

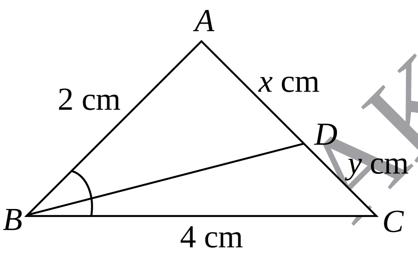
44. In the given diagram, if *p*, *q*, *r* and *s* are distances of point *X* from the line *l*, then the shortest distance is



NOT TO SCALE

A. *p*.
B. *q*.
C. *r*.
D. *s*.

45. If BD is the bisector of $\angle ABC$, then the ratio $x : y$ is



NOT TO SCALE

A. 1:1
B. 1:2
C. 1:4
D. 2:1

END OF PAPER

Please use this page for rough work

Please use this page for rough work