

**AGA KHAN UNIVERSITY EXAMINATION BOARD**

**HIGHER SECONDARY SCHOOL CERTIFICATE**

**CLASS XI**

**ANNUAL EXAMINATIONS (THEORY) 2025**

**Mathematics Paper II**

**Time: 1 hour and 30 minutes    Marks: 50**

**INSTRUCTIONS**

**Please read the following instructions carefully.**

1. Check your name and school information. Sign if it is accurate.

**I agree that this is my name and school.  
Candidate's Signature**

**RUBRIC**

2. There are EIGHT questions. Answer ALL questions. Choices are specified inside the paper.
3. When answering the questions:  
  
Read each question carefully.  
Use a black pointer to write your answers. DO NOT write your answers in pencil.  
Use a black pencil for diagrams. DO NOT use coloured pencils.  
DO NOT use staples, paper clips, glue, correcting fluid or ink erasers.  
Complete your answer in the allocated space only. DO NOT write outside the answer box.
4. The marks for the questions are shown in brackets ( ).
5. A formulae list is provided on page 2 and 3. You may refer to it during the paper, if you wish.
6. You may use a scientific calculator if you wish.

### List of Formulae

#### Note:

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

#### Complex Numbers

$$|z| = \sqrt{a^2 + b^2}$$

#### Matrices and Determinants

$$A_{ij} = (-1)^{i+j} M_{ij}$$

$$\text{Adj}A = (A_{ij})^t$$

$$A^{-1} = \frac{1}{|A|} \text{Adj}A$$

#### Sequence & Series and Miscellaneous Series

$$a_n = a + (n-1)d$$

$$A = \frac{a+b}{2}$$

$$S_n = \frac{n}{2}(2a + (n-1)d)$$

$$a_n = ar^{n-1}$$

$$G = \pm\sqrt{ab}$$

$$H = \frac{2ab}{a+b}$$

$$S_n = \frac{a(1-r^n)}{1-r}, \text{ if } |r| < 1$$

$$S_n = \frac{a(r^n - 1)}{r-1}, \text{ if } |r| > 1$$

$$S_\infty = \frac{a}{1-r}$$

$$\sum_{k=1}^n k = \frac{n(n+1)}{2}$$

$$\sum_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\sum_{k=1}^n k^3 = \left(\frac{n(n+1)}{2}\right)^2$$

#### Permutations, Combinations and Probability

$${}^n P_r = \frac{n!}{(n-r)!}$$

$${}^n C_r = \frac{n!}{(n-r)!r!}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A/B) = \frac{P(A \cap B)}{P(B)}$$

$$P(A \cap B) = P(A) \times P(B)$$

#### Binomial Theorem and Mathematical Induction

$$(a+x)^n = \binom{n}{0}a^n + \binom{n}{1}a^{n-1}x + \binom{n}{2}a^{n-2}x^2 + \binom{n}{3}a^{n-3}x^3 + \dots + \binom{n}{n-1}a^1x^{n-1} + x^n$$

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 + \dots + \frac{n(n-1)(n-2)\dots(n-r+1)}{r!}x^r + \dots$$

$$T_{r+1} = \binom{n}{r}a^{n-r}x^r$$

#### Quadratic Equation

$$x^2 - Sx + P = 0$$

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

$$D = b^2 - 4ac$$

**Introduction to Trigonometry and Trigonometric Identities**

$$l = r\theta \qquad \sin^2 \theta + \cos^2 \theta = 1 \qquad 1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta \qquad \cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$$

$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta \qquad \tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$$

$$\cos \frac{\theta}{2} = \pm \sqrt{\frac{1 + \cos \theta}{2}} \qquad \sin \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{2}} \qquad \tan \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}$$

$$\frac{a}{\sin \alpha} = \frac{b}{\sin \beta} = \frac{c}{\sin \gamma} \qquad a^2 = b^2 + c^2 - 2bc \cos \alpha \qquad \frac{a-b}{a+b} = \frac{\tan \frac{\alpha-\beta}{2}}{\tan \frac{\alpha+\beta}{2}}$$

$$\cos P - \cos Q = -2 \sin \frac{P+Q}{2} \sin \frac{P-Q}{2} \qquad \sin P - \sin Q = 2 \cos \frac{P+Q}{2} \sin \frac{P-Q}{2}$$

$$\cos P + \cos Q = 2 \cos \frac{P+Q}{2} \cos \frac{P-Q}{2} \qquad \sin P + \sin Q = 2 \sin \frac{P+Q}{2} \cos \frac{P-Q}{2}$$

$$\sin \frac{\alpha}{2} = \sqrt{\frac{(s-b)(s-c)}{bc}} \qquad \tan \frac{\alpha}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$$

$$\cos \frac{\alpha}{2} = \sqrt{\frac{s(s-a)}{bc}}$$

**Application of Trigonometry**

$$\Delta = \frac{1}{2} bc \sin \alpha = \frac{1}{2} ac \sin \beta = \frac{1}{2} ab \sin \gamma \qquad \Delta = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\Delta = \frac{c^2 \sin \alpha \sin \beta}{2 \sin \gamma} = \frac{b^2 \sin \alpha \sin \gamma}{2 \sin \beta} = \frac{a^2 \sin \beta \sin \gamma}{2 \sin \alpha} \qquad R = \frac{a}{2 \sin \alpha} = \frac{b}{2 \sin \beta} = \frac{c}{2 \sin \gamma}$$

$$r_1 = \frac{\Delta}{s-a}, r_2 = \frac{\Delta}{s-b} \text{ and } r_3 = \frac{\Delta}{s-c} \qquad r = \frac{\Delta}{s} \qquad R = \frac{abc}{4\Delta}$$

**Inverse Trigonometric Functions and Trigonometric Equations**

$$\sin^{-1} A \pm \sin^{-1} B = \sin^{-1} \left( A\sqrt{1-B^2} \pm B\sqrt{1-A^2} \right) \qquad \cos^{-1} A \pm \cos^{-1} B = \cos^{-1} \left( AB \mp \sqrt{(1-A^2)(1-B^2)} \right)$$

$$\tan^{-1} A \pm \tan^{-1} B = \tan^{-1} \left( \frac{A \pm B}{1 \mp AB} \right)$$

Q.1. (Total 4 Marks)

Factorise the expression  $m^2 + 4im$  by using completing square method.

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(ATTEMPT EITHER PART a OR PART b OF Q.6.)

Q.6.

(Total 6 Marks)

a.

- i. Prove that  $(1 + \omega^8 + \omega^5 - \omega^3)^2 = 4\omega$  (3 Marks)

(Note: Where  $\omega$  is one of the cube root of unity.)

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- ii. For a quadratic equation  $ax^2 + bx + c = 0$ , the sum of roots is  $\frac{13}{6}$ , the product of roots is 1 and  $c = 6$ .

Find the values of  $a$  and  $b$ . Also, calculate discriminant of the equation. (3 Marks)

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**(ATTEMPT EITHER PART a OR PART b OF Q.6.)**

b. The polynomial  $Q(x)$  is given as  $px^3 - 2x^2 + 7x + q$ , and it is divisible by  $x - 2$ .

i. Show that the equation connecting  $p$  and  $q$  is  $8p + q = -6$ . (2 Marks)

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ii. Further, the polynomial  $Q(x)$  is divided by  $x + 1$  and leaves a remainder of  $-10$ .

Find the relationship between  $p$  and  $q$ . (2 Marks)

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iii. Use the answer of (i) and (ii), find the value of  $p$  and  $q$ . (2 Marks)

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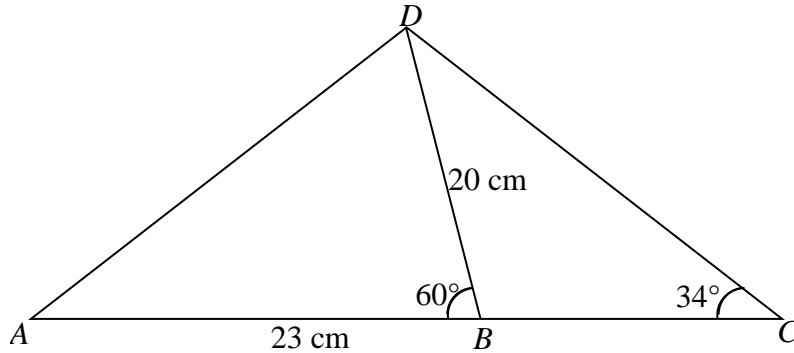
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(ATTEMPT ANY TWO PARTS a, b OR c OF Q.7.)

c. In the given diagram,  $AB = 23\text{ cm}$ ,  $BD = 20\text{ cm}$ ,  $\angle ABD = 60^\circ$  and  $\angle BCD = 34^\circ$ .



**NOT TO SCALE**

Calculate

i. the length of  $CD$ .

(3 Marks)

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ii. the length of  $AD$ .

(2 Marks)

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