

**SIKSHAM**

Mathematics | Computer | Coding &amp; Programming

**ADVANCED MOCK ASSESSMENT - X****Mathematics****Time Allowed: 1 Hour 30 Minutes****Maximum Marks: 50 (Written: 45 + Viva: 5)****General Instructions:**

- All questions are compulsory.
- Questions are modeled directly from high-frequency and standard board examination matrices.
- Section A contains 10 Multiple Choice Questions (1 mark each).
- Section B contains 5 Short Answer Type-I questions (2 marks each).
- Section C contains 5 Long Answer Type-I questions (3 marks each).
- Section D contains 2 Long Answer Type-II questions (5 marks each).
- Section E contains a 5-mark Viva-Voce oral evaluation sequence.

**SECTION A (10 MARKS)****1. Choose the correct answer from the given four options: [1×10=10]**

a. If two positive integers  $a$  and  $b$  are expressible in the form  $a = p^3q^4$  and  $b = p^2q^3$ , where  $p, q$  are prime numbers, then  $LCM(a, b)$  is:

- (i)  $p^2q^3$  (ii)  $p^3q^4$   
(iii)  $pq$  (iv)  $p^5q^7$

b. The decimal expansion of the rational number  $\frac{14587}{1250}$  will terminate after how many decimal places?

- (i) one decimal place (ii) two decimal places  
(iii) three decimal places (iv) four decimal places

c. If the sum of the zeroes of the quadratic polynomial  $kx^2 + 2x + 3k$  is equal to their product, then  $k$  equals:

- (i)  $\frac{1}{3}$  (ii)  $-\frac{1}{3}$   
(iii)  $\frac{2}{3}$  (iv)  $-\frac{2}{3}$

d. The number of real zeroes that a linear polynomial can have at most is:

- (i) 0 (ii) 1  
(iii) 2 (iv) infinitely many

e. The pair of linear equations  $x = a$  and  $y = b$  graphically represents two lines which are:

- (i) parallel (ii) intersecting at  $(b, a)$

(iii) coincident

(iv) intersecting at (a, b)

f. If the system of linear equations  $x + y = 3$  and  $2x + 2y = k$  has infinitely many solutions, then the value of  $k$  is:

(i) 3

(ii) 6

(iii) 9

(iv) 0

g. Which of the following mathematical equations possesses real and distinct roots?

(i)  $x^2 - 4x + 4 = 0$

(ii)  $2x^2 - 3x + 4 = 0$

(iii)  $3x^2 - 5x + 1 = 0$

(iv)  $x^2 + x + 1 = 0$

h. The quadratic equation whose roots are reciprocal to the roots of  $ax^2 + bx + c = 0$  is:

(i)  $cx^2 + bx + a = 0$

(ii)  $ax^2 - bx + c = 0$

(iii)  $cx^2 - bx + a = 0$

(iv)  $bx^2 + ax + c = 0$

i. The product of a non-zero rational number and an irrational number is always:

(i) rational

(ii) irrational

(iii) an integer

(iv) zero

j. If a line intersects the x-axis at exactly three distinct physical coordinates, the polynomial is:

(i) linear

(ii) quadratic

(iii) cubic

(iv) constant

**SECTION B (10 MARKS)**

2. Calculate the HCF and LCM of 12, 15, and 21 simultaneously by using the Prime Factorization Method. [2]

3. Find the zeroes of the quadratic polynomial  $4x^2 - 4x + 1$ , and verify the relationship between its zeroes and coefficients. [2]

4. Solve the following system of linear equations by using the substitution method: [2]

$$\frac{x}{a} + \frac{y}{b} = 2 \quad \text{and} \quad ax - by = a^2 - b^2$$

5. Determine the exact values of  $k$  for which the quadratic equation  $(k + 4)x^2 + (k + 1)x + 1 = 0$  possesses real and equal roots. [2]

6. Investigate whether the mathematical parameter statement holds true: Can the number  $4^n$  end with the digit zero for any arbitrary natural number value of  $n$ ? Justify your logic. [2]

**SECTION C (15 MARKS)**

7. Prove explicitly that the number  $7 + 3\sqrt{2}$  is an irrational number, given that  $\sqrt{2}$  is already known to be irrational. [3]

8. Find a quadratic polynomial whose zeroes are given as the conjugate elements  $2 + \sqrt{3}$  and  $2 - \sqrt{3}$  respectively. [3]

9. Solve the following system of linear equations using the elimination method: [3]

$$\begin{aligned} 152x - 378y &= -74 \\ -378x + 152y &= -604 \end{aligned}$$

10. Solve the following algebraic quadratic expression for the value of  $x$  via standard factorization method: [3]

$$4x^2 - 4a^2x + (a^4 - b^4) = 0$$

11. If the zeroes of the cubic polynomial  $x^3 - 3x^2 + x + 1$  are expressible as  $a - b$ ,  $a$ , and  $a + b$ , determine the values of  $a$  and  $b$ . [3]

**SECTION D (10 MARKS)**

12. Places A and B are 100 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 5 hours. If they travel towards each other, they meet in 1 hour. Formulate the relevant pair of linear equations and determine the speeds of both cars. [5]

13. Two water taps together can fill a tank in  $9\frac{3}{8}$  hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Formulate the quadratic equation and find the time in which each tap can separately fill the tank. [5]

**SECTION E (5 MARKS — VIVA VOCE ASSESSMENT LOOP)**

14. Answer the following conceptual questions during oral evaluation: [1×5=5]

1. What can you state about the prime factorization of the denominator of a rational number whose decimal expansion is non-terminating repeating?
2. If  $\alpha, \beta, \gamma$  are the roots of a cubic polynomial  $ax^3 + bx^2 + cx + d = 0$ , what is the algebraic evaluation value of  $\alpha\beta + \beta\gamma + \gamma\alpha$ ?
3. What is the geometric condition called when two linear graphs overlap perfectly over each other, and what is its consistency profile?
4. How can you deduce if a quadratic equation has real roots or imaginary roots simply by evaluating the discriminant expression value?
5. State the Sridharacharya Formula and mention the algebraic constraint required for its real root evaluation window.

--- END OF EXAM PAPER ---