

CBSE CLASS 10 MATHEMATICS TERM EXAM - SET A

CLASS: CLASS 10

SUBJECT: MATHEMATICS

BOARD: CBSE

TIME ALLOWED: 3 HOURS

MAXIMUM MARKS: 80

SECTION A: MULTIPLE CHOICE QUESTIONS

General Instructions: Answer all 20 questions. Each question carries 1 mark. Select the most appropriate option.

- For what value of k does the quadratic equation $3x^2 - 6x + k = 0$ have equal roots? (1)
 - 3
 - 6
 - 9
 - 12
- The roots of the quadratic equation $x^2 - 5x + 6 = 0$ are: (1)
 - 2, 3
 - 2, -3
 - 1, 5
 - 1, -5
- What is the discriminant of the quadratic equation $2x^2 - 4x + 3 = 0$? (1)
 - 8
 - 8
 - 4
 - 16
- If one root of the quadratic equation $ax^2 + bx + c = 0$ is the reciprocal of the other, then which of the following is true? (1)
 - $a = c$
 - $b = c$
 - $a = b$
 - $a + c = 0$
- The number of real roots of the equation $(x^2 + 1)^2 - x^2 = 0$ is: (1)
 - 0
 - 1
 - 2
 - 4
- Which of the following is a quadratic equation? (1)
 - $x^2 + 2x + 1 = (4 - x)^2 + 3$
 - $x^3 - x^2 = (x - 1)^3$
 - $2x^2 + 3 = 2x - 3$
 - $x + \frac{1}{x} = 5$
- The value of p for which the quadratic equation $px^2 + 4x + 1 = 0$ has real roots is: (1)
 - $p \leq 4$
 - $p \geq 4$
 - $p < 4$
 - $p > 4$

8. The roots of the equation $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$ are: (1)
 (a) $-\sqrt{2}, -\frac{5}{\sqrt{2}}$ (b) $\sqrt{2}, \frac{5}{\sqrt{2}}$
 (c) $-\sqrt{2}, \frac{5}{\sqrt{2}}$ (d) $\sqrt{2}, -\frac{5}{\sqrt{2}}$
9. If $x = 3$ is a root of the equation $x^2 - kx - 15 = 0$, then the value of k is: (1)
 (a) -2 (b) 2
 (c) -5 (d) 5
10. The sum of the roots of the quadratic equation $3x^2 - 9x + 5 = 0$ is: (1)
 (a) 3 (b) $-\frac{3}{5}$
 (c) 5 (d) $\frac{5}{3}$
11. The product of the roots of the equation $4x^2 - 8x - 12 = 0$ is: (1)
 (a) -3 (b) 3
 (c) 2 (d) -2
12. If the equation $x^2 - bx + c = 0$ has consecutive integer roots, then the value of $b^2 - 4c$ is: (1)
 (a) 1 (b) 2
 (c) 3 (d) 4
13. If α and β are the roots of the equation $x^2 + x + 1 = 0$, then the value of $\alpha^2 + \beta^2$ is: (1)
 (a) -1 (b) 1
 (c) 2 (d) -2
14. The mathematical condition for the quadratic equation $ax^2 + bx + c = 0$ to have non-real roots is: (1)
 (a) $b^2 - 4ac < 0$ (b) $b^2 - 4ac = 0$
 (c) $b^2 - 4ac > 0$ (d) $b^2 - 4ac \geq 0$
15. The roots of the equation $2x^2 - x - 6 = 0$ are: (1)
 (a) $2, -\frac{3}{2}$ (b) $-2, \frac{3}{2}$
 (c) $2, \frac{3}{2}$ (d) $-2, -\frac{3}{2}$
16. What is the discriminant of the quadratic equation $x^2 - \frac{1}{2}x + \frac{1}{16} = 0$? (1)
 (a) 0 (b) $\frac{1}{4}$
 (c) $-\frac{1}{2}$ (d) $\frac{1}{4}$
17. The roots of the equation $x^2 - 0.04 = 0$ are: (1)
 (a) ± 0.2 (b) ± 0.02
 (c) ± 2.0 (d) ± 0.4

18. If one root of the quadratic equation $2x^2 + kx - 6 = 0$ is 2, what is the value of k ? (1)
 (a) -1 (b) 1
 (c) -2 (d) 2
19. The real roots of the equation $x + \frac{1}{x} = 2.5$ are: (1)
 (a) 2, 0.5 (b) 1, 1.5
 (c) 3, $\frac{1}{3}$ (d) 4, 0.25
20. The roots of the equation $x^2 - 9 = 0$ are: (1)
 (a) ± 3 (b) ± 9
 (c) 3, 0 (d) 0, 9

SECTION B: FILL IN THE BLANKS

General Instructions: Answer all 10 questions. Each question carries 1 mark.

- If the discriminant of a quadratic equation is zero, then its roots are real and _____. (1)
- The general mathematical standard form of a quadratic equation is _____. (1)
- The quadratic equation $x^2 + 5x + 6 = 0$ has exactly _____ real roots. (1)
- If α and β are roots of $ax^2 + bx + c = 0$, then their sum $\alpha + \beta$ is equal to _____. (1)
- The maximum algebraic degree of a quadratic equation is always _____. (1)
- If the equation $x^2 - kx + 9 = 0$ has real and equal roots, then the value of k is _____. (1)
- The numerical values of the roots of the quadratic equation $x^2 - 4 = 0$ are _____. (1)
- The discriminant of the polynomial quadratic equation $x^2 + x + 1 = 0$ is _____. (1)
- If one root of the quadratic equation $x^2 - 3x + k = 0$ is 1, then the value of k must be _____. (1)
- The legendary quadratic formula to solve $ax^2 + bx + c = 0$ is written as $x =$ _____. (1)

SECTION C: ASSERTION & REASONING

General Instructions: Each question consists of an Assertion (A) and a Reason (R). Choose the appropriate option from below: a) Both (A) and (R) are true and (R) is the correct explanation of (A). b) Both (A) and (R) are true but (R) is not the correct explanation of (A). c) (A) is true but (R) is false. d) (A) is false but (R) is true.

1. Assertion (A): The equation $x^2 + 3x + 1 = (x - 2)^2$ is a quadratic equation. Reason (R): Any equation of the mathematical degree 2 is known as a quadratic equation. (1)
 (a) a (b) b
 (c) c (d) d
2. Assertion (A): The quadratic equation $x^2 - 4x + 13 = 0$ has no real roots. Reason (R): The discriminant of the equation $x^2 - 4x + 13 = 0$ is strictly negative ($D < 0$). (1)
 (a) a (b) b
 (c) c (d) d
3. Assertion (A): If the product of the roots of the quadratic equation $x^2 - 3x + k = 0$ is 2, then $k = 2$. Reason (R): For any quadratic equation $ax^2 + bx + c = 0$, the product of the roots is given by the formula $\frac{c}{a}$. (1)
 (a) a (b) b
 (c) c (d) d
4. Assertion (A): The equation $x^2 + 2x + 1 = 0$ has identical real roots. Reason (R): The discriminant $D = b^2 - 4ac$ must be equal to zero for a quadratic equation to have equal roots. (1)
 (a) a (b) b
 (c) c (d) d
5. Assertion (A): $x = 2$ is a solution root of the quadratic equation $x^2 - 5x + 6 = 0$. Reason (R): Any real number α is a root of the quadratic equation $p(x) = 0$ if and only if $p(\alpha) = 0$. (1)
 (a) a (b) b
 (c) c (d) d

SECTION D: SHORT ANSWER QUESTIONS

General Instructions: Answer all 8 questions. Each question carries 3 marks. Show clear mathematical steps.

1. Solve the quadratic equation $x^2 - 7x + 12 = 0$ using the method of prime factorization. (3)
2. Determine the mathematical nature of the roots of the quadratic equation $2x^2 - 6x + 3 = 0$. (3)
3. Solve the equation for x : $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}$ where $x \neq -4, 7$. (3)
4. Find the positive value of p for which the quadratic equation $2x^2 + px + 8 = 0$ possesses real and equal roots. (3)
5. Solve the algebraic equation for x : $x^2 - 2ax + (a^2 - b^2) = 0$. (3)

6. If one root of the quadratic equation $3x^2 - kx - 2 = 0$ is 2, find the numerical value of k and compute the second root. (3)
7. The sum of a positive real number and its reciprocal is $\frac{10}{3}$. Formulate the quadratic equation and determine the number. (3)
8. Find the discriminant of the quadratic equation $3x^2 - 2x + \frac{1}{3} = 0$ and describe the nature of its roots. (3)

SECTION E: LONG ANSWER QUESTIONS

General Instructions: Answer all 5 questions. Questions 44-47 carry 4 marks each; Question 48 carries 5 marks. Provide detailed algebraic calculations.

1. A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream than to return downstream to the same start point. Determine the speed of the stream. (4)
2. Solve the complex equation for x : $\frac{1}{x+1} + \frac{2}{x+2} = \frac{4}{x+4}$ where $x \neq -1, -2, -4$. (4)
3. Two water taps together can fill a reservoir 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. Find the time in which each tap can separately fill the tank. (4)
4. Find the values of k for which the quadratic equation $(k+1)x^2 - 2(k-1)x + 1 = 0$ has real and equal roots. (4)
5. A commercial plane left 30 minutes later than its scheduled departure time. In order to reach its destination 1500 km away in time, it had to increase its speed by 250 km/h from its usual speed. Determine its usual cruise speed. (5)

--- END OF EXAMINATION ---