This worksheet focuses on using the discriminant to determine the nature of the roots of quadratic equations. You will practise computing the discriminant and interpreting its value to gain insight into the types of solutions that quadratic equations have.

Easy Questions

1. Compute the discriminant of x^2+5x+6 and state whether the equation has distinct real roots, a repeated real root or no real roots.
2. Calculate the discriminant of $x^2 + 4x + 4$ and describe the nature of its root(s).
3. Find the discriminant of $2x^2 - 3x + 1$ and indicate the nature of the roots.
4. Write the formula for the discriminant and then compute it for $3x^2 + 7x + 2$. What does this tell you about the quadratic's roots?
5. Determine the discriminant of $x^2 + 2x + 5$ and state the nature of its roots.

Intermediate Questions

6. For the quadratic $4x^2 + 12x + 9$, compute the discriminant and state the nature of the roots.
7. Compute the discriminant of $x^2 - 6x + 5$ and explain what it indicates about the solutions.
8. Find the discriminant of $5x^2 + 2x + 1$ and determine whether the roots are real or complex.
9. Calculate the discriminant for $2x^2 + 5x + 2$ and state the nature of its roots.
10. Determine the value of c for which the quadratic $x^2 + 8x + c$ has a discriminant of 16.
11. Explain in one sentence what can be said about the roots of a quadratic equation when its discriminant equals 0.
12. The quadratic $3x^2 + kx + 4 = 0$ has a discriminant equal to 1. Find all possible values of k.
13. For the quadratic x^2+px+9 to have real roots, what must be true about p? Provide the range of values for p that meet this condition.

14. Write down a quadratic equation with integer coefficients whose discriminant is a perfect square and ensure that it has two distinct real roots.

15. Determine the range of values for a (with $a \neq 0$) such that the quadratic equation $ax^2 + 4x + 1 = 0$ has real roots.

16. For the quadratic $2x^2 + mx + 3 = 0$, find the range of m for which the equation has non-real (complex) roots.

17. Find the value(s) of b such that the quadratic $6x^2 + bx + 4 = 0$ has a repeated root.

18. Determine the value of c which makes the quadratic $2x^2 - 3x + c = 0$ have equal roots.

19. For $x^2 + bx + 10 = 0$ to have non-real roots, find the range of values of b.

20. For the quadratic $x^2 + kx + k = 0$, determine all values of k for which the roots are real.

Hard Questions

21. For the quadratic $3x^2 + 12x + c = 0$, express the condition required on c for the equation to have real roots and state the corresponding interval for c.

22. For a general quadratic $ax^2 + bx + c = 0$, derive the inequality that must be satisfied by a, b, and c for the equation to have two distinct real roots.

23. Consider the quadratic $2x^2 + (k-3)x + (k+2) = 0$. Find the range of values of k for which the equation has no real roots.

24. Find the value of m that makes the quadratic $mx^2 + 4x + 3 = 0$ have equal roots.

25. State the condition on a, b, and c (with $a \neq 0$) that ensures the quadratic $ax^2 + bx + c = 0$ has real roots. Include a brief explanation.

26. The quadratic equation $kx^2 - (3k+2)x + (2k+5) = 0$ has a repeated root. Find all possible values of k.

27. Consider the family of quadratics $x^2 + (2p-3)x + p^2 = 0$. Find the set of values for p that will ensure the roots of the equation are real.

28. Suppose $x^2 + bx + 9 = 0$ has equal roots. Find the possible value(s) of b and explain your process briefly.

29. For the quadratic $4x^2 + 8x + k = 0$ to have real and distinct roots, determine the condition that k must satisfy.

30. The quadratic equation $ax^2 + 5x + 6 = 0$ has a discriminant equal to 1. Determine the possible value(s) of a.