

Exercise 2.4

1. Determine the nature of the roots of each of the following quadratic equations.
 - (a) $x^2 - 6x + 9 = 0$
 - (b) $x^2 - 6x + 10 = 0$
 - (c) $3x^2 + 4x + 2 = 0$
 - (d) $2x^2 - 5x + 3 = 0$
 - (e) $4x^2 - 12x + 9 = 0$
2. Find the real roots, if any, of each of the following quadratic equations. Give your answer in surd form.
 - (a) $x^2 - 3x + 1 = 0$
 - (b) $2x^2 + 3x - 1 = 0$
 - (c) $1 + 2x + x^2 = 0$
 - (d) $3x^2 - 4x + 2 = 0$
 - (e) $4x^2 - 12x - 27 = 0$
3. Solve each of the following quadratic equations. Give your answers correct to two decimal places.
 - (a) $x^2 - 7x + 5 = 0$
 - (b) $2x^2 - 6x - 3 = 0$
 - (c) $3x^2 + 5x - 2 = 0$
 - (d) $5x^2 + 9x + 4 = 0$
 - (e) $4x^2 - 8x + 3 = 0$
4. Find the value of k if each of the following quadratic equations has equal roots.
 - (a) $x^2 + 2kx + k + 6 = 0$
 - (b) $(x + 1)(x + 3) = k$
5. Find the range of values of p if $x^2 + 2px + (p + 2) = 0$ has real and distinct roots.
6. Find the range of values of q if $x^2 + (q + 1)x + q + 1 = 0$ has complex roots.
7. Find the range of values of m if $x^2 + x + 1 = m(x + 2)$ has real and distinct roots.
8. Find the range of values of k if $x^2 + (k - 3)x + k = 0$ has
 - (a) real and distinct roots,
 - (b) roots with the same sign.

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1. (a) Real and equal (b) Not real
(c) Not real (d) Real and distinct
(e) Real and equal
2. (a) $\frac{1}{2}(3 \pm \sqrt{5})$ (b) $\frac{1}{2}(-3 \pm \sqrt{17})$
(c) $-1, 1$ (d) No real root
(e) $-\frac{3}{2}, \frac{9}{2}$
3. (a) 0.81, 6.19 (b) -0.44, 3.44
(c) -2, 0.33 (d) -1, -0.80
(e) 0.50, 1.50
4. (a) $-2, 3$ (b) -1
5. $p < -1, p > 2$
6. $-1 < q < 3$
7. $m < -3 - 2\sqrt{3}, m > -3 + 2\sqrt{3}$
8. (a) $k < 1, k > 9$ (b) $k > 0$