

1. Sketch the following parabolas, showing where the curve crosses the axes where possible.
(a) $y = x^2 + 1$ (b) $y = -4x - x^2$ (c) $(x - 2)^2$ (d) $y = x^2 - 4x + 3$
(e) $y = x(x - 1)$ (f) $y = (1 + x)(5 - x)$ (g) $y = 2x^2 - 3x$ (h) $y = 1 - 5x - 6x^2$
2. For what values of x is:
(a) $x^2 - 9x + 14 < 0$ (b) $x^2 + 7x > 0$ (c) $4x - x^2 \leq 0$ (d) $12 + 4x - x^2 \geq 0$
3. Find the quadratic equation whose roots are:
(a) 2 and 3 (b) -2 and $\frac{1}{3}$ (c) $2 - \sqrt{3}$ and $2 + \sqrt{3}$
4. Assuming α and β are the roots of the quadratic equation $x^2 - 4x - 3 = 0$, find the value of:
(a) $\alpha + \beta$ (b) $\alpha\beta$ (c) $(\alpha + 4)(\beta + 4)$ (d) $\alpha^2\beta + \alpha\beta^2$
(e) $\alpha^2 + \beta^2$ (f) $\frac{1}{\alpha} + \frac{1}{\beta}$ (g) $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ (h) $(\alpha - \beta)^2$
5. The roots of the quadratic equation $ax^2 - bx - 10 = 0$ are -1 and 5 . Find the values of a and b .
6. One root of the equation $x^2 + qx + r = 0$ is three times the other. Prove that $3q^2 = 16r$.
7. Find the value of k if for the equation $x^2 - (k + 2)x + 4k = 0$:
(a) the sum of the roots is 5
(b) the product of the roots is 12
(c) one root is two more than the other
8. Prove that $2x^2 = 4x + 5$ is positive for all values of x .
9. For what values of m does the quadratic equation $(5m - 3)^2 - 4mx + (m + 1) = 0$ have one root?
10. Show that the roots of the equation $ax^2 - (a + b)x + b = 0$ are rational, for all rational values of a and b .
11. Express $x^2 + 10x + 10$ in the form $a(x + 2)^2 + b(x + 1)$.
12. Find the maximum value of $6 - 5(x + 2)^2$ and the value of x for which this occurs.
13. For the parabola $y = 5 + 6x - x^2$, find the:
(a) equation of the axis of symmetry (b) the coordinates of the vertex
14. Solve the following equations by first reducing them to quadratic equations:
(a) $x^4 - 10x^2 + 9 = 0$ (b) $(x^2 - 2x^2) - 11(x^2 - 2x) + 24 = 0$ (c) $4^x - 3 \cdot 2^x + 2 = 0$
15. For what values of m does the line $y = mx - 6$ touch the parabola $y = x^2 - 2x + 3$?