

Core 1 Basic Algebra Questions

1 (a) Simplify $(\sqrt{5} + 2)(\sqrt{5} - 2)$. (2 marks)

(b) Express $\sqrt{8} + \sqrt{18}$ in the form $n\sqrt{2}$, where n is an integer. (2 marks)

3 (a) (i) Express $x^2 - 4x + 9$ in the form $(x - p)^2 + q$, where p and q are integers. (2 marks)

(ii) Hence, or otherwise, state the coordinates of the minimum point of the curve with equation $y = x^2 - 4x + 9$. (2 marks)

4 The quadratic equation $x^2 + (m + 4)x + (4m + 1) = 0$, where m is a constant, has equal roots.

(a) Show that $m^2 - 8m + 12 = 0$. (3 marks)

(b) Hence find the possible values of m . (2 marks)

2 (a) Express $x^2 + 8x + 19$ in the form $(x + p)^2 + q$, where p and q are integers. (2 marks)

(b) Hence, or otherwise, show that the equation $x^2 + 8x + 19 = 0$ has no real solutions. (2 marks)

(c) Sketch the graph of $y = x^2 + 8x + 19$, stating the coordinates of the minimum point and the point where the graph crosses the y -axis. (3 marks)

(d) Describe geometrically the transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 + 8x + 19$. (3 marks)

4 (a) Express $(4\sqrt{5} - 1)(\sqrt{5} + 3)$ in the form $p + q\sqrt{5}$, where p and q are integers. (3 marks)

(b) Show that $\frac{\sqrt{75} - \sqrt{27}}{\sqrt{3}}$ is an integer and find its value. (3 marks)

(ii) Find the values of k for which the equation

$$x^2 - 2(k + 1)x + 2k^2 - 7 = 0$$

has equal roots. (4 marks)

3 (a) Express $\frac{\sqrt{5} + 3}{\sqrt{5} - 2}$ in the form $p\sqrt{5} + q$, where p and q are integers. (4 marks)

(b) (i) Express $\sqrt{45}$ in the form $n\sqrt{5}$, where n is an integer. (1 mark)

(ii) Solve the equation

$$x\sqrt{20} = 7\sqrt{5} - \sqrt{45}$$

giving your answer in its simplest form. (3 marks)

7 The quadratic equation $(k + 1)x^2 + 12x + (k - 4) = 0$ has real roots.

(a) Show that $k^2 - 3k - 40 \leq 0$. (3 marks)

(b) Hence find the possible values of k . (4 marks)

2 (a) Express $\frac{\sqrt{63}}{3} + \frac{14}{\sqrt{7}}$ in the form $n\sqrt{7}$, where n is an integer. (3 marks)

(b) Express $\frac{\sqrt{7} + 1}{\sqrt{7} - 2}$ in the form $p\sqrt{7} + q$, where p and q are integers. (4 marks)

3 (a) (i) Express $x^2 + 10x + 19$ in the form $(x + p)^2 + q$, where p and q are integers. (2 marks)

(ii) Write down the coordinates of the vertex (minimum point) of the curve with equation $y = x^2 + 10x + 19$. (2 marks)

(iii) Write down the equation of the line of symmetry of the curve $y = x^2 + 10x + 19$. (1 mark)

(iv) Describe geometrically the transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 + 10x + 19$. (3 marks)

(b) Determine the coordinates of the points of intersection of the line $y = x + 11$ and the curve $y = x^2 + 10x + 19$. (4 marks)

7 The quadratic equation

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

where k is a constant, has real roots.

(a) Show that $2k^2 - 5k + 2 \leq 0$. (3 marks)

(b) (i) Factorise $2k^2 - 5k + 2$. (1 mark)

(ii) Hence, or otherwise, solve the quadratic inequality

$$2k^2 - 5k + 2 \leq 0$$
 (3 marks)