Completing the Square

1. Express each of the following in the form $(x + a)^2 + b$

(a)
$$x^{2} + 6x - 1$$
 (b) $x^{2} + 10x - 5$ (c) $x^{2} - 2x + 7$ (d) $x^{2} - 12x + 3$
(e) $x^{2} - 10x + 6$ (f) $x^{2} - 3x - 4$ (g) $x^{2} - 7x - 3$

- 2. Express each of the following in the form $a(x + b)^2 + c$
 - (a) $2x^2 + 8x + 7$ (b) $3x^2 18x + 1$ (c) $4x^2 + 8x 5$ (d) $3x^2 24x 2$ (e) $2x^2 - 12x - 1$ (f) $5 - 4x - x^2$ (g) $10 - 6x - x^2$ (h) $3x^2 - 9x + 2$ (i) $2x^2 - 5x - 1$
- 3. (a) $f(x) = x^2 6x + 11$. Express f(x) in the form $f(x) = (x + a)^2 + b$.
 - (b) Hence sketch the graph of f(x) showing clearly where it cuts the y-axis and its turning point.
- 4. (a) Express $y = x^2 10x + 1$ in the form $y = (x + a)^2 + b$.
 - (b) Hence sketch the graph of y showing clearly where it cuts the y-axis and its turning point.
- 5. (a) $f(x) = 3x^2 18x 2$. Express f(x) in the form $f(x) = a(x + b)^2 + c$.
 - (b) Hence sketch the graph of f(x) showing clearly where it cuts the y-axis and its turning point, stating whether it is a maximum or minimum.
- 6. (a) Express $y = 10 2x x^2$ in the form $y = a(x + b)^2 + c$.
 - (b) Hence sketch the graph of y showing clearly where it cuts the y-axis and its turning point, , stating whether it is a maximum or minimum.
- 7. (a) Express $5 8x 2x^2$ in the form $a(x + b)^2 + c$.
 - (b) Hence sketch the graph of $y = 5 8x 2x^2$ showing clearly where it cuts the y-axis and its turning point.
- 8. (a) Express f(x) = (2x 1)(2x + 5) in the form $f(x) = a(x + b)^2 + c$.
 - (b) Hence sketch the graph of f(x) showing clearly where it cuts the y-axis and its turning point.
- 9. (a) Express $f(x) = x^2 4x + 5$ in the form $f(x) = (x a)^2 + b$.

(b) On the same diagram sketch (i) y = f(x) (ii) y = 10 - f(x)

- 10. (a) Express f(x) = 1 6x x² in the form f(x) = a(x + b)² + c
 (b) Sketch on separate diagrams (i) y = f(x) (ii) y = f(-x) 1
- 11. (a) Express $x^2 + 2x + 9$ in the form $(x + a)^2 + b$.

(b) Hence state the maximum value of $\frac{16}{x^2 + 2x + 9}$.

- 12. (a) Express $x^2 + 6x + 10$ in the form $(x + a)^2 + b$.
 - (b) Hence state the maximum value of $\frac{24}{x^2 + 6x + 10}$.
- 13. (a) Express $x^2 + 8x + 20$ in the form $(x + a)^2 + b$.

(b) Hence state the maximum value of $\frac{2}{x^2 + 8x + 20}$.