

Name: _____

GCSE (1 – 9)

Completing the Square

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- The marks for each question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end

- 1 (a) Write $x^2 - 6x + 1$ in the form $(x + a)^2 + b$ where a and b are integers.

$$(x - 3)^2 - 9 + 1$$

$$(x - 3)^2 - 8$$

$$\frac{(x - 3)^2 - 8}{(2)}$$

- (b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = x^2 - 6x + 1$

$$\frac{(3, -8)}{(1)}$$

(Total for question 1 is 3 marks)

- 2 (a) Write $x^2 + 8x + 5$ in the form $(x + a)^2 + b$ where a and b are integers.

$$(x + 4)^2 - 16 + 5$$

$$(x + 4)^2 - 11$$

$$\frac{(x + 4)^2 - 11}{(2)}$$

- (b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = x^2 + 8x + 5$

$$\frac{(-4, -11)}{(1)}$$

(Total for question 2 is 3 marks)

- 3 (a) Write $x^2 + 10x + 2$ in the form $(x + a)^2 + b$ where a and b are integers.

$$(x + 5)^2 - 25 + 2$$

$$(x + 5)^2 - 23$$

$$\frac{(x + 5)^2 - 23}{(2)}$$

- (b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = x^2 + 10x + 2$

$$\frac{(-5, -23)}{(1)}$$

(Total for question 3 is 3 marks)

- 4 (a) Write $x^2 - 2x - 1$ in the form $(x + a)^2 + b$ where a and b are integers.

$$(x - 1)^2 - 1 - 1$$

$$(x - 1)^2 - 2$$

$$\frac{(x - 1)^2 - 2}{(2)}$$

- (b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = x^2 - 2x - 1$

$$\frac{(1, -2)}{(1)}$$

(Total for question 4 is 3 marks)

- 5 By completing the square, find the coordinates of the turning point of the curve with the equation $y = x^2 + 8x + 3$
You must show all your working.

$$(x + 4)^2 - 16 + 3$$

$$(x + 4)^2 - 13$$

$$(-4, -13)$$

(Total for question 5 is 3 marks)

- 6 By completing the square, find the coordinates of the turning point of the curve with the equation $y = x^2 + 10x - 8$
You must show all your working.

$$(x + 5)^2 - 25 - 8$$

$$(x + 5)^2 - 33$$

$$(-5, -33)$$

(Total for question 6 is 3 marks)

- 7 By completing the square, find the coordinates of the turning point of the curve with the equation $y = x^2 + 3x - 7$
You must show all your working.

$$\left(x + \frac{3}{2}\right)^2 - \frac{9}{4} - 7$$

$$\left(x + \frac{3}{2}\right)^2 - \frac{9}{4} - \frac{28}{4}$$

$$\left(x + \frac{3}{2}\right)^2 - \frac{37}{4}$$

$$\left(-\frac{3}{2}, -\frac{37}{4}\right)$$

(Total for question 7 is 3 marks)

- 8 By completing the square, find the coordinates of the turning point of the curve with the equation $y = x^2 - x + 8$
You must show all your working.

$$\left(x - \frac{1}{2}\right)^2 - \frac{1}{4} + 8$$

$$\left(x - \frac{1}{2}\right)^2 - \frac{1}{4} + \frac{32}{4}$$

$$\left(x - \frac{1}{2}\right)^2 + \frac{31}{4}$$

$$\left(\frac{1}{2}, \frac{31}{4}\right)$$

(Total for question 8 is 3 marks)

- 9 (a) Write $2x^2 - 12x + 23$ in the form $a(x + b)^2 + c$ where a , b , and c are integers.

$$2(x^2 - 6x + 11.5)$$

$$2((x - 3)^2 - 9 + 11.5)$$

$$2((x - 3)^2 + 2.5)$$

$$\underline{\underline{2(x - 3)^2 + 5}}$$

$$\underline{\underline{2(x - 3)^2 + 5}} \quad (3)$$

- (b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 2x^2 - 12x + 23$

$$\underline{\underline{(3, 5)}} \quad (1)$$

(Total for question 9 is 4 marks)

- 10 (a) Write $2x^2 + 16x + 26$ in the form $a(x + b)^2 + c$ where a , b , and c are integers.

$$2(x^2 + 8x + 13)$$

$$2((x + 4)^2 - 16 + 13)$$

$$2((x + 4)^2 - 3)$$

$$2(x + 4)^2 - 6$$

$$\underline{\underline{2(x + 4)^2 - 6}} \quad (3)$$

- (b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 2x^2 + 16x + 26$

$$\underline{\underline{(-4, -6)}} \quad (1)$$

(Total for question 10 is 4 marks)

11 (a) Write $3x^2 - 6x + 6$ in the form $a(x + b)^2 + c$ where a , b , and c are integers.

$$3(x^2 - 2x + 2)$$

$$3((x - 1)^2 - 1 + 2)$$

$$3((x - 1)^2 + 1)$$

$$3(x - 1)^2 + 3$$

$$\underline{3(x - 1)^2 + 3}$$

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 3x^2 - 6x + 6$

$$\underline{(1, 3)}$$

(1)

(Total for question 11 is 4 marks)

12 (a) Write $3x^2 - 30x + 63$ in the form $a(x + b)^2 + c$ where a , b , and c are integers.

$$3(x^2 - 10x + 21)$$

$$3((x - 5)^2 - 25 + 21)$$

$$3((x - 5)^2 - 4)$$

$$3(x - 5)^2 - 12$$

$$\underline{3(x - 5)^2 - 12}$$

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 3x^2 - 30x + 63$

$$\underline{(5, -12)}$$

(1)

(Total for question 12 is 4 marks)

- 13 By completing the square, solve $x^2 + 10x - 3 = 0$
Give your answers in surd form.

$$(x+5)^2 - 25 - 3 = 0$$

$$(x+5)^2 - 28 = 0$$

$$(x+5)^2 = 28$$

$$(x+5) = \pm\sqrt{28}$$

$$x = -5 \pm \sqrt{28}$$

or

$$= -5 \pm 2\sqrt{7}$$

$$x = -5 + 2\sqrt{7} \text{ or } x = -5 - 2\sqrt{7}$$

(Total for question 13 is 5 marks)

- 14 By completing the square solve $x^2 + 5x + 4.25 = 0$
Give your answers in surd form.

$$\left(x + \frac{5}{2}\right)^2 - \frac{25}{4} + 4.25 = 0$$

$$\left(x + \frac{5}{2}\right)^2 - 2 = 0$$

$$\left(x + \frac{5}{2}\right)^2 = 2$$

$$x + \frac{5}{2} = \pm\sqrt{2}$$

$$x = -\frac{5}{2} \pm \sqrt{2}$$

$$x = -\frac{5}{2} + \sqrt{2} \text{ or } x = -\frac{5}{2} - \sqrt{2}$$

(Total for question 14 is 5 marks)