Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

STEM | Exam Builder

Completing the square

Time allowed: 40 minutes

Subject code **0580**

Mathematics

Questions from Paper 2 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
You may use a calculator.

Total marks

/ 30

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 8 questions worth 30 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

STEM | Exam Builder

Print at 100% (Actual size) so diagrams keep their real measurements.

1 $x^2 - 16x + a$ can be written in the form $(x+b)^2$.

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [2]

Completing the square Click for more variations

1	[a =] 64 [b =] −8	**2**	**B1** for each or for both $(x-8)^2$ and $x^2 - 16x + 64$

2 Write $x^2 + 8x - 7$ in the form $(x+a)^2 + b$.

..... [2]

Completing the square Click for more variations

2	$(x+4)^2 - 23$ final answer	**2**	**B1** for $(x+4)^2$

STEM | Exam Builder

3 $(x-5)^2+k=x^2-px-21$

Find the value of p and the value of k.

$p =$ .....

$k =$ .....
[2]

Completing the square Click for more variations

3	[p =] 10 [k =] –46	**2**	**B1** for each

4 $y = x^2 + 7x - 5$ can be written in the form $y = (x + a)^2 + b$.

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [3]

Completing the square Click for more variations

4	$a = 3.5$ or $\frac{7}{2}$ **and** $b = -17.25$ or $-\frac{69}{4}$	**3**	**B2** for one correct or **M2** for $(x+\frac{7}{2})^2-5-\left(\frac{7}{2}\right)^2$ or **M1** for $(x+\frac{7}{2})^2$ oe or $2a = 7$ or $a^2 + b = -5$ after $x^2 + 2ax + a^2$

STEM | Exam Builder

5 $2x^2 + 12x - 2$ can be written in the form $a(x+b)^2 - c$.

Find the values of a, b and c.

$a =$ ..... , $b =$ ..... , $c =$ ..... [3]

Completing the square Click for more variations

5	$a = 2$ $b = 3$ $c = 20$	**3**	**B2** for any two correct For c, FT 2 + *their* $a \times$ *their* $(b)^2$ or **B1** for $b = 3$ nfww OR **B2** for $2(x+3)^2 - 20$ or **M1** for $(x + 3)^2$ seen or for $ax^2 + 2abx + ab^2 - c$ or for $a = 2$ and one of $2ab = 12$ and $ab^2 - c = -2$

STEM | Exam Builder

6 $x^2 + 8x + 10 = (x+p)^2 + q$

(a) Find the value of p and the value of q.

$p =$ .....

$q =$ ..... [2]

(b) Solve.

$x^2 + 8x + 10 = 30$

$x =$ ..... or $x =$ ..... [2]

(a) Completing the square (b) Solving by completing the square Click for more variations

6(a)	[p =] 4 [q =] –6	**2**	**B1** for one correct or $(x+4)^2 - 6$ or $x^2 + px + px + p^2$ [+ q]
6(b)	–10 and 2	**2**	**M1** for $(x+4)^2 = 36$ or $(x + their4)^2 = 30 - their(-6)$ or for correct method to solve quadratic e.g. $(x+10)(x-2)$

STEM | Exam Builder

7 **(a)** Write $x^2 - 18x - 27$ in the form $(x+k)^2 + h$.

..... [2]

(b) Use your answer to **part (a)** to solve the equation $x^2 - 18x - 27 = 0$.

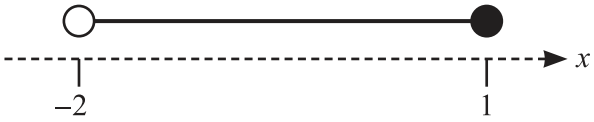
$x =$ ..... or $x =$ ..... [2]

(a) Completing the square (b) Solving by completing the square Click for more variations

7(a)	$(x-9)^2 - 108$	**2**	**B1** for $(x+h)^2 - 108$ or $(x-9)^2 + h$ or $k = -9$
7(b)	19.4 or 19.39… -1.39 or $-1.392\ldots$	**2**	**M1FT** $x - their 9 = \pm\sqrt{their 108}$ **A1** for $9 \pm \sqrt{108}$ or $9 \pm 6\sqrt{3}$

STEM | Exam Builder

8 (a)



Write down the inequality in x shown by the number line.

..... [2]

(b) (i) Write x^2+4x+1 in the form $(x+p)^2+q$.

..... [2]

(ii) Use your answer to **part (b)(i)** to solve the equation $x^2+4x+1=0$.

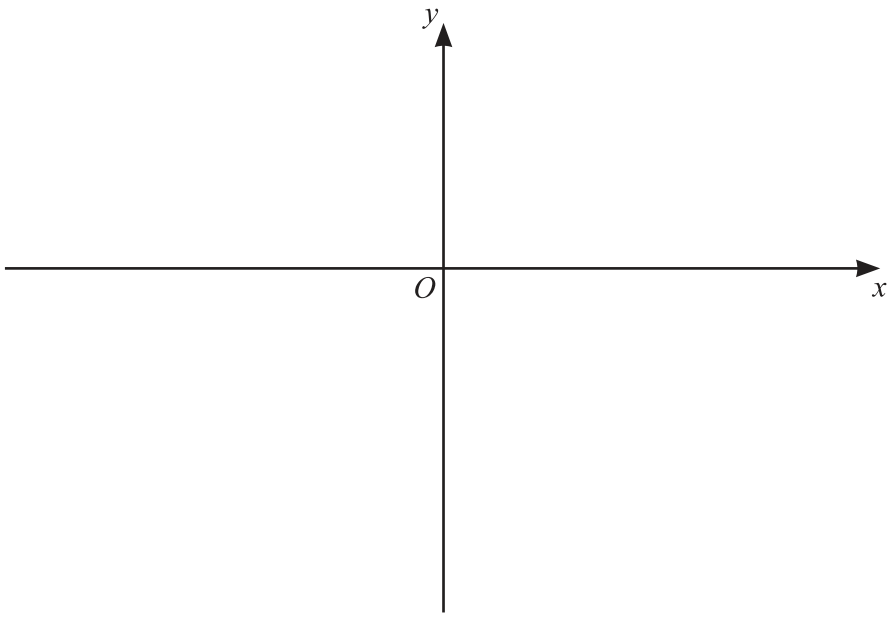
$x =$ ..... or $x =$ ..... [2]

STEM | Exam Builder

(iii) Use your answer to **part (b)(i)** to write down the coordinates of the minimum point on the graph of $y = x^2 + 4x + 1$.

(..... , ...) [2]

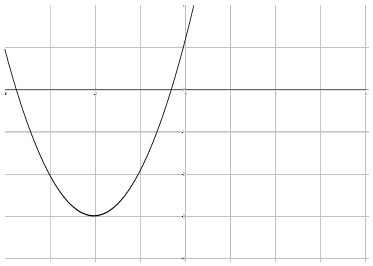
(iv) On the diagram, sketch the graph of $y = x^2 + 4x + 1$.



[2]

(a) Solving linear inequalities (b)(i) Completing the square (b)(ii) Solving by completing the square (b)(iii) Completing the square (b)(iv) Sketching graphs Click for more variations

STEM | Exam Builder

8(a)	$-2 < x \leqslant 1$	**2**	**B1** for $-2 < x$ or $x \leqslant 1$
8(b)(i)	$(x+2)^2 - 3$	**2**	**M1** for $(x+2)^2 + k$
8(b)(ii)	$(x+2)^2 = 3$	**M1**	**FTdep** *their* **(b)(i)** for $k < 0$
	–3.73 or –3.732... and –0.268 or –0.2679...	**B1**	
8(b)(iii)	(–2, –3)	**2**	**FT** *their* $(x+2)^2 - 3$ **B1** for each coordinate
8(b)(iv)	Correct sketch 	**2**	Parabola with minimum point in correct quadrant and both x-intercepts negative and positive y-intercept **B1** for parabola with minimum point.

STEM | Exam Builder