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WJEC Level 2 Additional Mathematics – Question Pack

Writing x^2+bx+c in completed-square form to find the least (or greatest) value of an expression and where it occurs.

REVISE
.wales

Completing the square & minimum values

Algebra · Level 2 Certificate (9550) · calculator allowed

Writing x^2+bx+c in completed-square form to find the least (or greatest) value of an expression and where it occurs.

LEVEL 2 · 9550

Estimated time for entire question pack: ~37 minutes

At the Additional Maths pace of ~1.2 min/mark (31 marks across 7 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. It gathers every question on this topic from the 2011–2024 papers.

Questions are ordered by year, newest first.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – method marks are awarded for clear setup.

A calculator is allowed throughout this qualification.

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Completing the square & minimum values – what's examined

WJEC Level 2 Additional Mathematics (9550) · single written paper, calculator allowed.

Completed-square form Algebra

- Write x^2+bx+c as $(x+p)^2+q$.
- p is half the coefficient of x .
- q adjusts for the square term added.

Turning point Algebra

- Least value of $(x+p)^2+q$ is q , at $x = -p$.
- Square brackets are never negative.
- State both the value and the x where it happens.

Reading the question Method

- 'Minimum value' means the q in $(x+p)^2+q$.
- Give the value AND its x -coordinate if asked.
- Watch a leading coefficient $a \neq 1$.

Completing the square & minimum values in one page

Quick-reference notes – revisit before each question. Don't use during the questions.

The method

$$x^2 + bx + c = (x + b/2)^2 - (b/2)^2 + c$$

Least value

$(x + p)^2 + q$ has a **minimum of q** when $x = -p$ (the bracket is 0).

Greatest value

If the x^2 term is negative, the turning point is a **maximum** instead.

Check

Expand $(x+p)^2+q$ to confirm you recover the original expression.

16. The expression $x^2 + 28x + 100$ has a minimum value.
By **completing the square**, complete the statements below.

You must show all your working.

[3]

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The minimum value of $x^2 + 28x + 100$ occurs when $x =$

The minimum value of $x^2 + 28x + 100$ is





A horizontal line with a small vertical tick at the left end, defining the top boundary of the answer area.

2. Do not use a calculator to answer this question.

Solve, by completing the square, $x^2 = 20x - 28$.

Give your answers in the form $a + b\sqrt{c}$, where a , b and c are integers, and c is as small as possible.

You must show all your working.

[4]

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3. Simplify **each** of the following.

(a) $3x^{\frac{1}{5}} \times 4x^{\frac{1}{2}}$ [1]

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(b) $\left(x^{\frac{1}{4}} \times x^{\frac{3}{4}}\right)^5$ [1]

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(c) $x^{-\frac{1}{4}}\left(2x^{\frac{1}{4}} + 5x^{\frac{3}{4}}\right)$ [2]

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8. The expression $x^2 + 40x + 100$ has a minimum value.

By **completing the square**, complete the statements below.

You must show all your working.

[3]

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The minimum value of $x^2 + 40x + 100$ occurs when $x =$

The minimum value of $x^2 + 40x + 100$ is





1. (a) (i) Factorise $27x^2 + 6x - 5$. [2]

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- (ii) Hence solve the equation $27x^2 + 6x - 5 = 0$. [2]

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- (b) (i) Express $x^2 + 10x + 35$ in the form $(x + a)^2 + b$, where a and b are integers to be found. [2]

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- (ii) Hence, find the least value of $x^2 + 10x + 35$. [1]

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Least value of $x^2 + 10x + 35$ is

- (iii) What is the value of x when $x^2 + 10x + 35$ has its least value? [1]

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2. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 10x^4 + 3x^2 - 5.$

[3]

(b) $y = \frac{2}{x^{11}}.$

[1]

(c) $y = x^{\frac{7}{8}}.$

[1]

3. Prove that $\frac{x}{2} - \frac{x+3}{5} + \frac{x+5}{11} \equiv \frac{43x-16}{110}.$

[4]

7. The expression $x^2 + 18x + 92$ has a minimum value.

By **completing the square**, complete the statements below.
You must show your working.

[3]

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'The minimum value of $x^2 + 18x + 92$ occurs when $x =$

'The minimum value of $x^2 + 18x + 92$ is

3. The expression $x^2 + 22x + 123$ has a minimum value.
By **completing the square**, complete the statements below.
You must show your working.

[3]

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'The minimum value of $x^2 + 22x + 123$ occurs when $x =$

'The minimum value of $x^2 + 22x + 123$ is

2. The expression $x^2 + 14x + 9$ has a minimum value.

- (a) By **completing the square**, find the value of x when $x^2 + 14x + 9$ has its minimum value.
You must show your working. [2]

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- (b) Write down the minimum value of $x^2 + 14x + 9$. [1]

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3. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 5x^8 - 6x - 9$

[3]

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(b) $y = x^{-8}$

[1]

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(c) $y = x^{\frac{2}{5}}$

[1]

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