



Completing the square

About 45 minutes Calculator allowed 40 marks

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

A1 Needed today [2 marks] **A2** From chapter 12 [2 marks]Expand and simplify
 $(2x - 7)(3x - 2)$.Two similar cylinders have
volumes 64 cm^3 and 125 cm^3 .
The smaller cylinder is 4 cm tall.
How tall is the larger cylinder?

Answer

Answer

A3 Last lesson [2 marks] **A4** From chapter 13 [2 marks]Solve $x^2 + 8x - 8 = 0$. Give your
answers in surd form.A drawing pin is dropped 40
times and the relative frequency
of point up is 0.25. It is dropped
160 more times and lands point
up 5 times. Find the relative
frequency of point up after all
200.

Answer

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1Write $x^2 + 20x + 7$ in the form $(x + a)^2 + b$.**Hint** Halve the 20 to get the number inside the
bracket. Then take off 10^2 .**B1** Write $x^2 - 16x + 55$ in the form $(x + a)^2 + b$. [2 marks]Answer $(x + \dots)^2 + \dots$

EXAMPLE 2

Solve $x^2 + 14x + 11 = 0$ by completing the square. Give your answers in the form $a \pm \sqrt{b}$.

Hint Write the left side as $(x + 7)^2 - 38$, then make the bracket the subject.

B2 Solve $x^2 - 18x + 4 = 0$ by completing the square. Give your answers in the form $a \pm \sqrt{b}$. [3 marks]

Answer $x = \dots \pm \sqrt{\dots}$

c Practice

C1 Show that $x^2 - 4x + 11 > 0$ for every value of x . [2 marks]

C2 Write $x^2 - 7x + 3$ in the form $(x + a)^2 + b$. [2 marks]

Answer $(x + \dots)^2 + \dots$

C3 Write $3x^2 + 24x + 5$ in the form $a(x + b)^2 + c$. [3 marks]

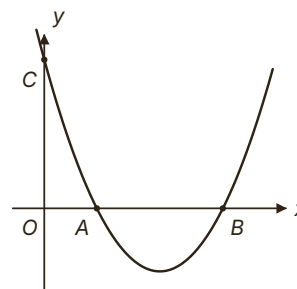
C4 Work out the turning point of $y = x^2 - 22x + 130$. [2 marks]

Answer $(\dots, \dots)$

C5 Given that $2x^2 + 20x + q \equiv a(x + b)^2 - 3$, find the values of a , b and q . [3 marks]

Answer $a = \dots$ $b = \dots$ $q = \dots$

C6 The sketch shows the curve $y = (x - 7)^2 - 16$. It crosses the x -axis at A and B , and the y -axis at C . Work out the coordinates of A , B and C . [3 marks]



Not drawn accurately

Answer $A = (\dots, \dots)$ $B = (\dots, \dots)$ $C = (\dots, \dots)$

D Exam-style questions

D1 Dev writes $x^2 - 10x + 3 = (x - 5)^2 + 3$. [2 marks]

Explain Dev's mistake, and write $x^2 - 10x + 3$ correctly in the form $(x + a)^2 + b$.

Answer $(x + \dots)^2 + \dots$

D2 A rectangle has a perimeter of 26 cm. One side is x cm long. Its area is A cm².



x cm

Not drawn accurately

(a) Show that $A = 13x - x^2$. [2 marks]

(b) Write $13x - x^2$ in the form $a - (x - b)^2$. [2 marks]

Answer $\dots - (x - \dots)^2$

(c) Hence write down the greatest possible area, and the value of x that gives it. [2 marks]

Answer $A = \dots$ cm² $x = \dots$

Total for D2: 6 marks

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 The curve $y = 2x^2 + px + 7$ has its turning point at $x = 3$. Find the value of p , and the minimum value of y . [4 marks]

Answer $p = \dots$ minimum $y = \dots$

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Take the 2 out as a factor first, then complete the square inside the bracket.
- Hint 2** $2x^2 + px + 7 = 2\left(x + \frac{p}{4}\right)^2 + \dots$, and the turning point is at $x = -\frac{p}{4}$.
- Hint 3** $-\frac{p}{4} = 3$ gives $p = -12$. Then
 $2x^2 - 12x + 7 = 2(x - 3)^2 - 18 + 7 = 2(x - 3)^2 - 11$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can write a quadratic in the form $(x + a)^2 + b$. ☐ ☐ ☐

I can solve a quadratic exactly by completing the square. ☐ ☐ ☐

I can read the turning point from the completed-square form. ☐ ☐ ☐