

# Complete the Square

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# 1) Complete the Square: Easier

1) Write  $x^2 + 8x + 16$  in the form  $(x + a)^2$

$$(x + 4)(x + 4) = (x + 4)^2$$

$$\dots\dots\dots (x + 4)^2 \dots\dots\dots$$

**(1 mark)**

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2) Write  $x^2 - 10x - 25$  in the form  $(x - a)^2$

$$(x - 5)(x - 5) = (x - 5)^2$$

$$\dots\dots\dots (x - 5)^2 \dots\dots\dots$$

**(1 mark)**

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3) Write  $x^2 - 4x + 10$  in the form  $(x - 2)^2 + a$

$$\begin{aligned} & x^2 - 4x + 10 \\ = & (x - 2)^2 - 2^2 + 10 \\ = & (x - 2)^2 + 6 \end{aligned}$$

$$\dots\dots\dots (x - 2)^2 + 6 \dots\dots\dots$$

**(2 marks)**

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4) Write  $x^2 + 6x - 4$  in the form  $(x + a)^2 + b$

$$\begin{aligned} & x^2 + 6x - 4 \\ = & (x + 3)^2 - 3^2 - 4 \\ = & (x + 3)^2 - 13 \end{aligned}$$

$$\dots\dots\dots (x + 3)^2 - 13 \dots\dots\dots$$

**(2 marks)**

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# 1) Complete the Square: Medium

5) i) Write  $x^2 - 16x + 9$  in the form  $(x + a)^2 + b$

$$\begin{aligned}
 & x^2 - 16x + 9 \\
 = & (x - 8)^2 - 8^2 + 9 \\
 = & (x - 8)^2 - 55
 \end{aligned}$$

$$\dots\dots\dots (x - 8)^2 - 55 \dots\dots\dots$$

**(2 marks)**

ii) Hence write down the coordinates of the minimum point of  $y = x^2 - 16x + 9$

$$( 8 , - 55 )$$

**(1 mark)**

6) a) Write  $x^2 + 5x + 1$  in the form  $(x + a)^2 + b$

$$\begin{aligned}
 & x^2 + 5x + 1 \\
 = & \left(x + \frac{5}{2}\right)^2 - \left(\frac{5}{2}\right)^2 + 1 \\
 = & \left(x + \frac{5}{2}\right)^2 - \frac{25}{4} + \frac{4}{4} \\
 = & \left(x + \frac{5}{2}\right)^2 - \frac{21}{4}
 \end{aligned}$$

$$\dots\dots\dots = \left(x + \frac{5}{2}\right)^2 - \frac{21}{4} \dots\dots$$

**(3 marks)**

b) Hence write down the coordinates of the minimum point of  $f(x) = x^2 + 5x + 1$

$$\left( -\frac{5}{2} , -\frac{21}{4} \right)$$

**(1 mark)**

# 1) Complete the Square: Harder

7) i) Write  $x^2 - 4x$  in the form  $(x - b)^2 + c$

$$x^2 - 4x = (x - 2)^2 - 4$$

$$\dots\dots\dots (x - 2)^2 - 4 \dots\dots\dots$$

**(2 marks)**

ii) Hence, or otherwise, write  $2x^2 - 8x$  in the form  $a(x - b)^2 + c$

$$\begin{aligned} 2x^2 - 8x &= 2[x^2 - 4x] \\ &= 2[(x - 2)^2 - 4] \\ &= 2(x - 2)^2 - 2 \times 4 \\ &= 2(x - 2)^2 - 8 \end{aligned}$$

$$\dots\dots\dots 2(x - 2)^2 - 8 \dots\dots\dots$$

**(2 marks)**

8) a) Write  $3x^2 + 18x + 40$  in the form  $a(x + b)^2 + c$

$$\begin{aligned} 3x^2 + 18x + 40 &= 3[x^2 + 6x] + 40 \\ &= 3[(x + 3)^2 - 9] + 40 \\ &= 3(x + 3)^2 - 3 \times 9 + 40 \\ &= 3(x + 3)^2 + 13 \end{aligned}$$

$$\dots\dots\dots 3(x + 3)^2 + 13 \dots\dots\dots$$

**(3 mark)**

b) Hence, or otherwise, write down the coordinates of the turning point of the graph of  $y = 3x^2 + 15x - 10$

$$( -3 , 13 )$$