



# Finding a Turning Point by Completing the Square



← **REVISE THIS TOPIC**

1 The equation of a curve is  $y = x^2 + 2x + 7$   
By completing the square, working out the coordinates of the turning point.  
You **must** show your working. [3 marks]

$$(x+1)^2 - 1 + 7$$
$$= (x+1)^2 + 6$$

Answer ( -1 , 6 )

2 The equation of a curve is  $y = x^2 + 6x + 13$   
By completing the square, working out the coordinates of the turning point.  
You **must** show your working. [3 marks]

$$(x+3)^2 - 9 + 13$$
$$= (x+3)^2 + 4$$

Answer ( -3 , 4 )

3 The equation of a curve is  $y = x^2 - 10x + 29$   
By completing the square, working out the coordinates of the turning point.  
You **must** show your working. [3 marks]

$$(x-5)^2 - 25 + 29$$
$$= (x-5)^2 + 4$$

Answer ( 5 , 4 )





4 The equation of a curve is  $y = x^2 - 2x - 7$   
 By completing the square, working out the coordinates of the turning point.  
 You **must** show your working. [3 marks]

$$(x-1)^2 - 1 - 7$$

$$= (x-1)^2 - 8$$

Answer ( 1 , -8 )

5 The equation of a curve is  $y = x^2 + 12x + 40$   
 By completing the square, working out the coordinates of the turning point.  
 You **must** show your working. [3 marks]

$$(x+6)^2 - 36 + 40$$

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

Answer ( -6 , 4 )

6 The equation of a curve is  $y = x^2 - 3x + 4$   
 By completing the square, working out the coordinates of the turning point.  
 You **must** show your working. [3 marks]

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

$$= (x - \frac{3}{2})^2 - \frac{9}{4} + \frac{16}{4}$$

$$= (x - \frac{3}{2})^2 + \frac{7}{4}$$

Answer (  $\frac{3}{2}$  ,  $\frac{7}{4}$  )

7 The equation of a curve is  $y = x^2 - 5x - 9$   
 By completing the square, working out the coordinates of the turning point.  
 You **must** show your working. [3 marks]

$$(x - \frac{5}{2})^2 - \frac{25}{4} - 9$$

$$= (x - \frac{5}{2})^2 - \frac{25}{4} - \frac{36}{4}$$

$$= (x - \frac{5}{2})^2 - \frac{61}{4}$$

Answer (  $\frac{5}{2}$  ,  $-\frac{61}{4}$  )





8 A curve with equation  $y = x^2 + bx + c$  has a turning point at the point (4, -2)  
Work out the value of  $b$  and  $c$ . [3 marks]

$$\begin{aligned} & (x-4)^2 - 2 \\ &= (x-4)(x-4) - 2 \\ &= x^2 - 4x - 4x + 16 - 2 \\ &= x^2 - 8x + 14 \\ b &= \underline{\quad -8 \quad} \quad c = \underline{\quad 14 \quad} \end{aligned}$$

9 A curve with equation  $y = x^2 + bx + c$  has a turning point at the point (-4, 9)  
Work out the value of  $b$  and  $c$ . [3 marks]

$$\begin{aligned} & (x+4)^2 + 9 \\ &= (x+4)(x+4) + 9 \\ &= x^2 + 4x + 4x + 16 + 9 \\ &= x^2 + 8x + 25 \\ b &= \underline{\quad 8 \quad} \quad c = \underline{\quad 25 \quad} \end{aligned}$$

10 A curve with equation  $y = x^2 + bx + c$  has a turning point at the point (-3, -3)  
Work out the value of  $b$  and  $c$ . [3 marks]

$$\begin{aligned} & (x+3)^2 - 3 \\ &= (x+3)(x+3) - 3 \\ &= x^2 + 3x + 3x + 9 - 3 \\ &= x^2 + 6x + 6 \\ b &= \underline{\quad 6 \quad} \quad c = \underline{\quad 6 \quad} \end{aligned}$$

