



Finding a Turning Point by Completing the Square



REVISE THIS TOPIC



- 1 Find the coordinates of the turning point on the curve with equation $y = x^2 + 2x + 7$
You must show all your working.

$$\begin{aligned} & (x+1)^2 - 1 + 7 \\ &= (x+1)^2 + 6 \end{aligned}$$

(-1, 6)

(Total for Question 1 is 3 marks)

- 2 Find the coordinates of the turning point on the curve with equation $y = x^2 + 6x + 13$
You must show all your working.

$$\begin{aligned} & (x+3)^2 - 9 + 13 \\ &= (x+3)^2 + 4 \end{aligned}$$

(-3, 4)

(Total for Question 2 is 3 marks)

- 3 Find the coordinates of the turning point on the curve with equation $y = x^2 - 10x + 29$
You must show all your working.

$$\begin{aligned} & (x-5)^2 - 25 + 29 \\ &= (x-5)^2 + 4 \end{aligned}$$

(5, 4)

(Total for Question 3 is 3 marks)



- 4 Find the coordinates of the turning point on the curve with equation $y = x^2 - 2x - 7$
You must show all your working.

$$\begin{aligned}
 &(x-1)^2 - 1 - 7 \\
 &= (x-1)^2 - 8
 \end{aligned}$$

(.....1.....,-8.....)

(Total for Question 4 is 3 marks)

- 5 Find the coordinates of the turning point on the curve with equation $y = x^2 + 12x + 40$
You must show all your working.

$$\begin{aligned}
 &(x+6)^2 - 36 + 40 \\
 &= (x+6)^2 + 4
 \end{aligned}$$

(.....-6.....,4.....)

(Total for Question 5 is 3 marks)

- 6 Find the coordinates of the turning point on the curve with equation $y = x^2 - 3x + 4$
You must show all your working.

$$\begin{aligned}
 &(x - \frac{3}{2})^2 - \frac{9}{4} + 4 \\
 &= (x - \frac{3}{2})^2 - \frac{9}{4} + \frac{16}{4} \\
 &= (x - \frac{3}{2})^2 + \frac{7}{4}
 \end{aligned}$$

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

(Total for Question 6 is 3 marks)

- 7 Find the coordinates of the turning point on the curve with equation $y = x^2 - 5x - 9$
You must show all your working.

$$\begin{aligned}
 &(x - \frac{5}{2})^2 - \frac{25}{4} - 9 \\
 &= (x - \frac{5}{2})^2 - \frac{25}{4} - \frac{36}{4} \\
 &= (x - \frac{5}{2})^2 - \frac{61}{4}
 \end{aligned}$$

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

(Total for Question 7 is 3 marks)



- 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 .

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

$a = \underline{\quad -8 \quad}$

$b = \underline{\quad 14 \quad}$

(Total for Question 8 is 3 marks)

- 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 .

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

$a = \underline{\quad 8 \quad}$

$b = \underline{\quad 25 \quad}$

(Total for Question 9 is 3 marks)

- 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 .

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

$a = \underline{\quad 6 \quad}$

$b = \underline{\quad 6 \quad}$

(Total for Question 10 is 3 marks)



11 Find the coordinates of the turning point on the curve with equation $y = 2x^2 - 8x + 33$
You must show all your working.

$$\begin{aligned}
 & 2[x^2 - 4x] + 33 \\
 &= 2[(x-2)^2 - 4] + 33 \\
 &= 2(x-2)^2 - 8 + 33 \\
 &= 2(x-2)^2 + 25
 \end{aligned}$$

(.....2.....25.....)

(Total for Question 11 is 4 marks)

12 Find the coordinates of the turning point on the curve with equation $y = 3x^2 + 18x - 4$
You must show all your working.

$$\begin{aligned}
 & 3[x^2 + 6x] - 4 \\
 &= 3[(x+3)^2 - 9] - 4 \\
 &= 3(x+3)^2 - 27 - 4 \\
 &= 3(x+3)^2 - 31
 \end{aligned}$$

(.....-3.....-31.....)

(Total for Question 12 is 4 marks)

13 Find the coordinates of the turning point on the curve with equation $y = 5x^2 - 15x + 3$
You must show all your working.

$$\begin{aligned}
 & 5[x^2 - 3x] + 3 \\
 &= 5\left[\left(x - \frac{3}{2}\right)^2 - \frac{9}{4}\right] + 3 \\
 &= 5\left(x - \frac{3}{2}\right)^2 - \frac{45}{4} + 3 \\
 &= 5\left(x - \frac{3}{2}\right)^2 - \frac{45}{4} + \frac{12}{4} \\
 &= 5\left(x - \frac{3}{2}\right)^2 - \frac{33}{4}
 \end{aligned}$$

(..... $\frac{3}{2}$ $-\frac{33}{4}$)

(Total for Question 13 is 5 marks)

