



Quadratic graphs and key points

About 50 minutes Calculator allowed 43 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]

Find the value of $-p^2 - 5pq$ when $p = -4$ and $q = -4$.

Answer

A2 From chapter 12 [2 marks]

A post 200 cm tall casts a shadow 2 m long. At the same time, a tree casts a shadow 9 m long. How tall is the tree, in metres?

Answer

- A3** From chapter 15 [2 marks]

$x^3 + 5x = 31$ has a solution between 2.6 and 2.7. When $x = 2.6$, $x^3 + 5x = 30.58$; when $x = 2.7$, it is 33.18; when $x = 2.65$, it is 31.86. Give the solution to 1 decimal place.

Answer

A4 From chapter 8 [2 marks]

Factorise fully $2x(x - 5) + 9(x - 5)$.

Answer

B Example, then your turn

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

EXAMPLE 1

Find where the curve $y = x^2 - 2x - 35$ crosses the x -axis, and find the coordinates of its turning point.

Hint Factorise and set $y = 0$. The turning point is halfway between the two roots.

- B1** Find where the curve $y = x^2 - 12x + 20$ crosses the x -axis, and find the coordinates of its turning point. [4 marks]

Answer $x = \dots\dots$ and $\dots\dots$ ($\dots\dots, \dots\dots$)

EXAMPLE 2

Find the turning point of $y = 21 - 4x - x^2$. Is it a maximum or a minimum?

Hint Write it as $-(x^2 + 4x - 21)$ and factorise to find the roots.

B2 Find the turning point of $y = 32 + 4x - x^2$. Is it a maximum or a minimum? Give a reason. [3 marks]

Answer (.....,)

C Practice

C1 Write down the coordinates of the point where $y = 3x^2 + 5x - 8$ crosses the y -axis. [1 mark]

Answer (.....,)

C2 For $y = x^2 - 5x - 7$, work out the value of y when $x = -3$. [2 marks]

Answer

C3 A curve crosses the x -axis at -11 and 3 . Write down its line of symmetry. [1 mark]

Answer

C4 Find where $y = x^2 - 15x + 54$ crosses the x -axis. [2 marks]

Answer

C5 Complete the table of values for $y = x^2 - x - 3$. [2 marks]

x	-1	0	1	2	3
y		-3		-1	

C6 A curve $y = a(x + 2)(x - 6)$ crosses the y -axis at $(0, 36)$. Work out the value of a . [2 marks]

Answer

Answer $x = -1 : \dots$ $x = 1 : \dots$ $x = 3 : \dots$

D Exam-style questions

D1 Ravi says, "The turning point of $y = x^2 - 10x + 16$ is $(0, 16)$, because that is where the curve crosses the y -axis." [3 marks]

Explain why Ravi is wrong, and find the turning point.

Answer (.....,)

D2 A theatre charges $\pounds x$ for a ticket. Its profit, $\pounds P$ thousand, is given by

$$P = -x^2 + 22x - 40$$

(a) Find the two ticket prices for which the profit is zero. [2 marks]

Answer

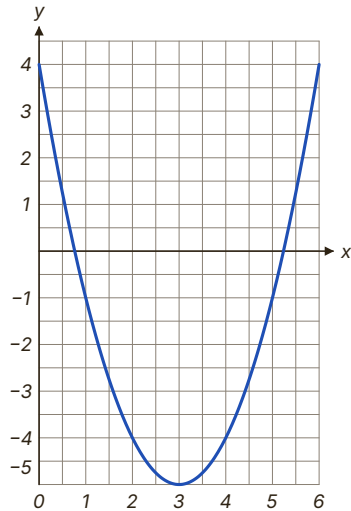
- (b) Find the ticket price that gives the greatest profit, and work out that profit.

[3 marks]

Answer price £ profit £ thousand

Total for D2: 5 marks

D3 The graph of $y = x^2 - 6x + 4$ is drawn on the grid.



- (a) By drawing a suitable straight line, use the graph to find estimates of the solutions of $x^2 - 6x + 6 = 0$.

[3 marks]

Answer $x = \dots\dots$ and $x = \dots\dots$

- (b) Explain how the graph shows that $x^2 - 6x + 12 = 0$ has no solutions.

[2 marks]

- (c) The equation $x^2 - 6x + 4 = k$ has two solutions. Write down the values that k can take.

[1 mark]

Answer

Total for D3: 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 $y = (x - p)(x - q)$, where p and q are whole numbers, crosses the y -axis at $(0, 28)$. Its line of symmetry is $x = 5.5$. Find p and q , and the least value of y .

[4 marks]

Answer $p = \dots\dots$ $q = \dots\dots$ least value

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Put $x = 0$ into $(x - p)(x - q)$. The line of symmetry is halfway between p and q .
- Hint 2** $pq = 28$ and $p + q = 11$.
- Hint 3** The whole numbers with product 28 and sum 11 are 4 and 7. The least value is at $x = 5.5$:
 $(1.5)(-1.5) = -2.25$.

How did it go?

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

I can find where a quadratic curve crosses the axes. ☐ ☐ ☐

I can find a turning point and say if it is a maximum or a minimum. ☐ ☐ ☐

I can use a drawn curve to solve a different equation. ☐ ☐ ☐