

## Quadratic Graphs - Worksheet

### Skill

#### Group A - Graphs of simple quadratic functions

Plot the graphs of these functions, using the x values given.

**1)**  $y = x^2 + 1, -3 \leq x \leq 3$

**2)**  $y = x^2 + 3, -3 \leq x \leq 3$

**3)**  $y = x^2 - 3, -3 \leq x \leq 3$

**4)**  $y = x^2 + 3x, -5 \leq x \leq 2$

**5)**  $y = x^2 + 4x, -6 \leq x \leq 2$

**6)**  $y = x^2 - 2x, -2 \leq x \leq 4$

**7)**  $y = x^2 + 3x + 1, -5 \leq x \leq 3$

**8)**  $y = x^2 + 2x + 1, -5 \leq x \leq 3$

**9)**  $y = x^2 - 3x + 1, -2 \leq x \leq 5$

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#### Group B - Graphs of more tricky quadratic functions

Plot the graphs of these functions, using the x values given.

**1)**  $y = x^2 - 2x, -3 \leq x \leq 5$

**2)**  $y = x^2 + 2x + 5, -4 \leq x \leq 2$

**3)**  $y = x^2 - 2x + 5, -2 \leq x \leq 4$

**4)**  $y = 3 - x^2, -3 \leq x \leq 3$

**5)**  $y = 3x - x^2, -3 \leq x \leq 5$

**6)**  $y = 3 + 2x - x^2, -2 \leq x \leq 4$

**7)**  $y = 2x^2 + 4x, -4 \leq x \leq 2$

**8)**  $y = 4x + 2x^2 + 3, -4 \leq x \leq 2$

**9)**  $y = 4x - 2x^2, -1 \leq x \leq 3$

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#### Group C - Finding key points and sketching quadratic graphs

Find the turning points and y-intercepts of these quadratic functions, then sketch their graphs.

**1)**  $y = x^2 + 6x + 8$

**2)**  $y = x^2 + 8x + 12$

**3)**  $y = x^2 - 2x - 8$

**4)**  $y = x^2 + 3x$

**5)**  $y = x^2 - 3x$

**6)**  $y = 2x^2 + 3x$

**7)**  $y = 4x - 2x^2$

**8)**  $y = 4x + 2x^2 + 3$

**9)**  $y = 4x + 2x^2$

# Quadratic Graphs - Worksheet

## Applied

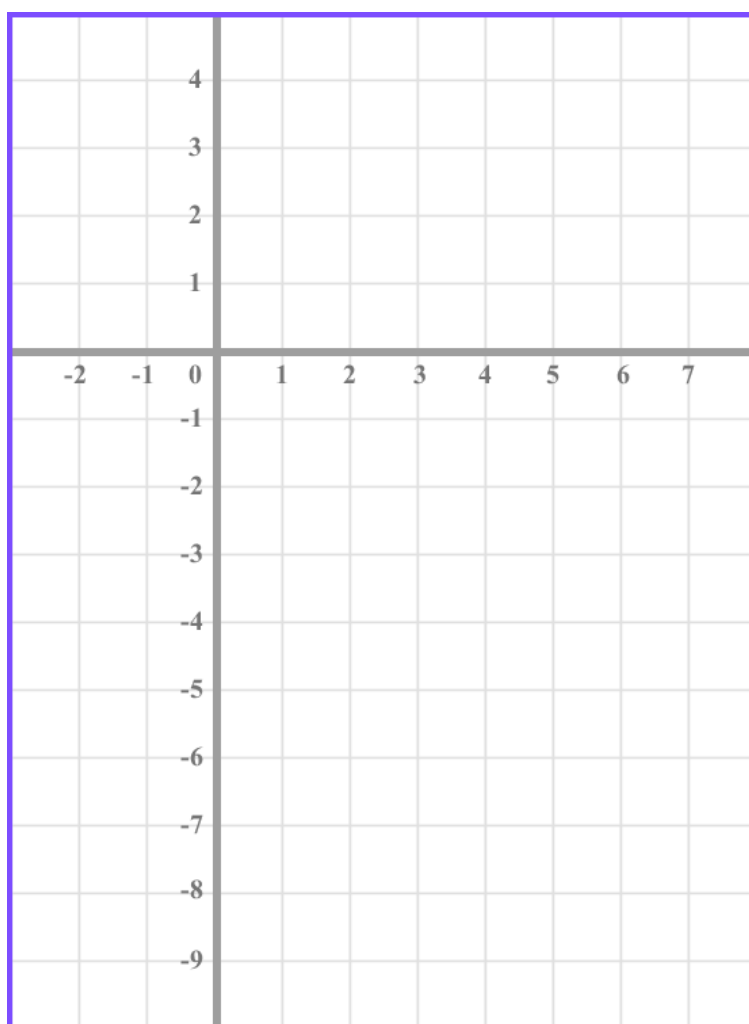
- 1) a) Draw the graph of the function  $y = x^2 + 2x + 4$ ,  $-4 \leq x \leq 2$
- b) Use your graph to write down the coordinates of the turning point. Is it a maximum or a minimum?
- c) What happens when you try to solve the equation  $x^2 + 2x + 4 = 0$ ? Use your graph to explain why this happens.
- 2) a) Draw the graph of the function  $y = x^2 - 5x + 6$ ,  $-1 \leq x \leq 6$
- b) Solve the equation  $x^2 - 5x + 6 = 0$ . Where can you see these solutions on the graph?
- c) Use your graph to estimate the coordinates of the turning point. Check your answer algebraically by completing the square on the expression  $x^2 - 5x + 6$ .
- 3) a) Draw the graph of the function  $y = 2x + 8 - x^2$ ,  $-3 \leq x \leq 5$ .
- b) Write down the coordinates of the vertex and roots.
- c) Using the graph, estimate the solutions to the equation  $2x + 8 - x^2 = 4$ .
- d) Using the graph, find the solutions to the equation  $2x + 8 = x^2$ .
- e) Using the graph, find the solutions to the equation  $2x + 8 - x^2 = 2x + 4$ . Check your answer algebraically.

## Quadratic Graphs - Exam Questions

- 1) (a) Complete the table of values for  $y = x^2 - 5x - 2$  (2)

$x$	-1	0	1	2	3	4	5	6
$y$			-6				-2	

- (b) On the grid draw the graph of  $y = x^2 - 5x - 2$  for values of  $x$  from -1 to 6 (2)

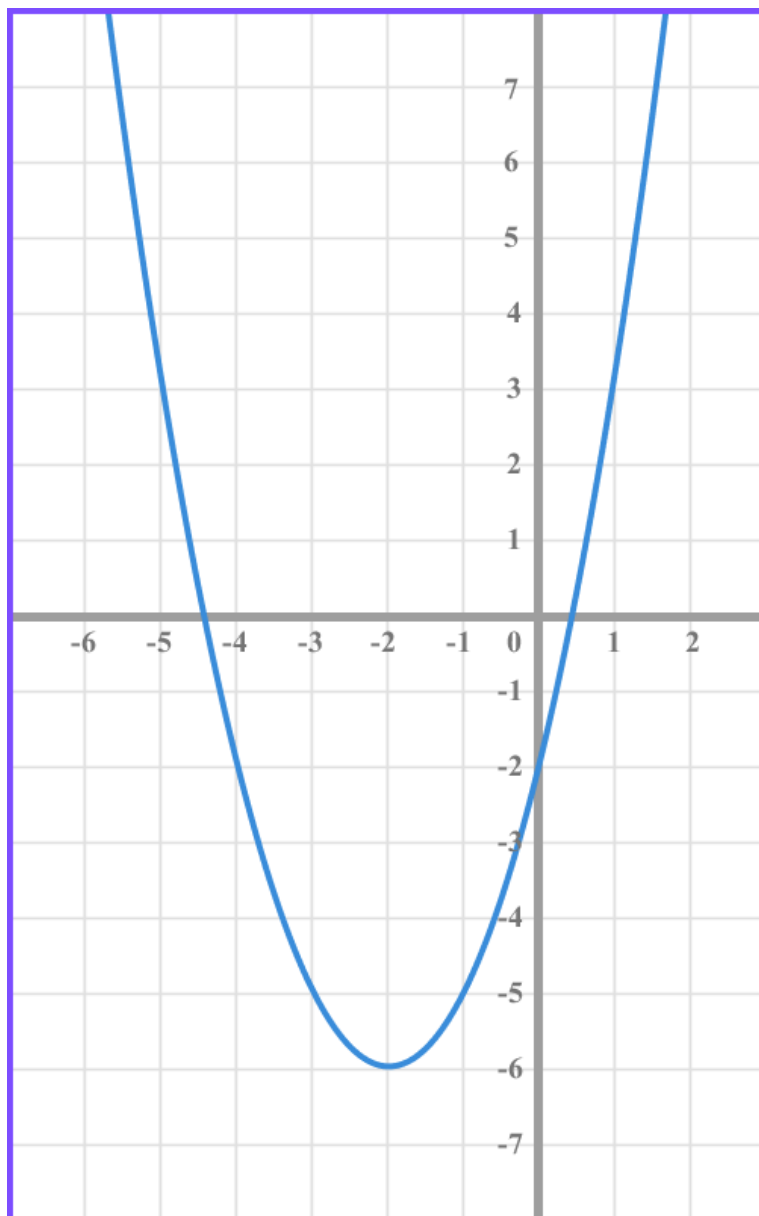


- (c) Use the graph to find estimates of the solutions to the equation  $-4 = x^2 - 5x - 2$  .....  
(2)  
(6 marks)

2) (a) Here is the graph of  $y = x^2 + 4x - 2$

.....

(1)



Write down the turning point of the graph  $y = x^2 + 4x - 2$

(b) Use the graph to find approximate roots of the equation  
 $x^2 + 4x + 3 = 5$

.....

(2)

(c) Use the graph to find approximate solutions of the equation  
 $5 = x^2 + 4x - 2$

.....

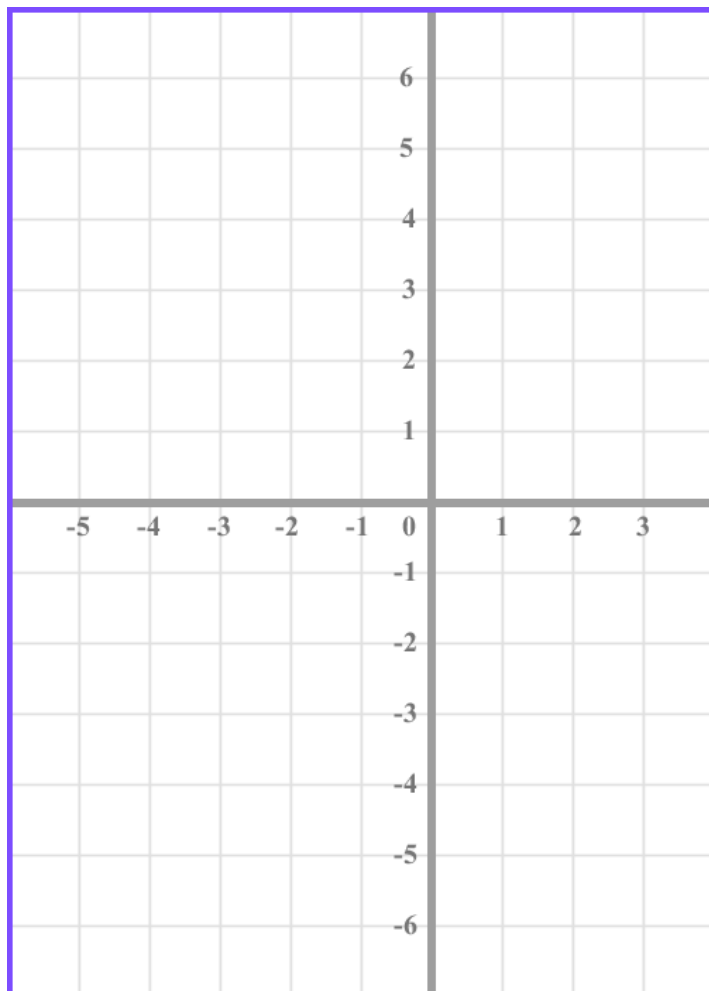
(2)

(5 marks)

3) (a) Complete the table of values for  $y = 3 - 2x - x^2$  ..... (2)

$x$	-4	-3	-2	-1	0	1	2
$y$			3			0	

(b) Draw the graph of  $y = 3 - 2x - x^2$  for values of  $x$  from -4 to 2. .... (2)



(c) Use the graph to find estimates of the solutions to the equation  $3 - 2x = x^2$  ..... (2)

(d) Use the graph to find the coordinates of the turning point of the graph  $y = 3 - 2x - x^2$ . ..... (1)  
(7 marks)



7)  $y = x^2 + 3x + 1, -5 \leq x \leq 3$

8)  $y = x^2 + 2x + 1, -5 \leq x \leq 3$

9)  $y = x^2 - 3x + 1, -2 \leq x \leq 5$

7-9)



$y = x^2 + 3x + 1$

$y = x^2 + 2x + 1$

$y = x^2 - 3x + 1$

Group B

Plot the graphs of these functions, using the x values given.

You can plot each set of three graphs on one set of axes to speed things up.

1)  $y = x^2 - 2x, -3 \leq x \leq 5$

2)  $y = x^2 + 2x + 5, -4 \leq x \leq 2$

3)  $y = x^2 - 2x + 5, -2 \leq x \leq 4$

4)  $y = 3 - x^2, -3 \leq x \leq 3$

5)  $y = 3x - x^2, -3 \leq x \leq 5$

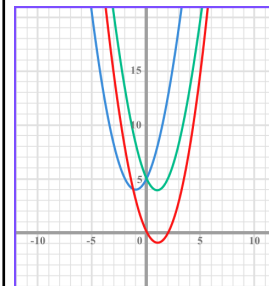
6)  $y = 3 + 2x - x^2, -2 \leq x \leq 4$

7)  $y = 2x^2 + 4x, -4 \leq x \leq 2$

8)  $y = 4x + 2x^2 + 3, -4 \leq x \leq 2$

9)  $y = 4x - 2x^2, -1 \leq x \leq 3$

1-3)

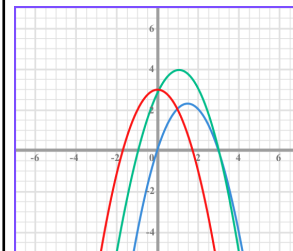


$y = x^2 - 2x$

$y = x^2 + 2x + 5$

$y = x^2 - 2x + 5$

4-6)



$y = 3 - x^2$

$y = 3x - x^2$

$y = 3 + 2x - x^2$

7-9)

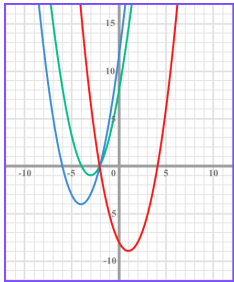
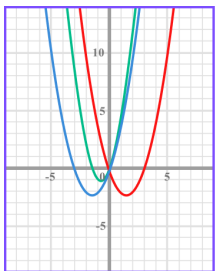


$y = 4x - 2x^2$

$y = 4x + 2x^2 + 3$

$y = 4x + 2x^2$

# Quadratic Graphs - Answers

	Question	Answer
Group C	Skill Questions	
	<p>Find the key points of these quadratic functions algebraically, then sketch their graphs.</p> <p>You can sketch each set of three graphs on one set of axes to speed things up.</p> <p>1) <math>y = x^2 + 6x + 8</math></p> <p>2) <math>y = x^2 + 8x + 12</math></p> <p>3) <math>y = x^2 - 2x - 8</math></p> <p>4) <math>y = x^2 + 6x + 8</math></p> <p>5) <math>y = x^2 + 8x + 12</math></p> <p>6) <math>y = x^2 - 2x - 8</math></p>	<p><b>1-3)</b></p>  <ul style="list-style-type: none"> <li><span style="color: blue;">↕</span> <math>y = x^2 + 6x + 8</math></li> <li><span style="color: green;">↕</span> <math>y = x^2 + 8x + 12</math></li> <li><span style="color: red;">↕</span> <math>y = x^2 - 2x - 8</math></li> </ul> <p><math>y = x^2 + 6x + 8</math>                      Roots (-4,0) and (-2,0)                      Vertex (-3,-1)                      y-intercept (0,8)</p> <p><math>y = x^2 + 8x + 12</math>                      Roots (-6,0) and (-2,0)                      Vertex (-4,-4)                      y-intercept (0,-8)</p> <p><math>y = x^2 - 2x - 8</math>                      Roots (-2,0) and (4,0)                      Vertex (1,-9)                      y-intercept (0,12)</p> <p><b>4-6)</b></p>  <ul style="list-style-type: none"> <li><span style="color: blue;">↕</span> <math>y = x^2 + 3x</math></li> <li><span style="color: red;">↕</span> <math>y = x^2 - 3x</math></li> <li><span style="color: green;">↕</span> <math>y = 2x^2 + 3</math></li> </ul> <p><math>y = x^2 + 3x</math>                      Roots (0,0) and (-3,0)</p>



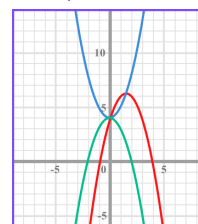
Vertex  $(-\frac{3}{2}, \frac{9}{4})$   
y-intercept (0,0)




$y = x^2 - 3x$   
Roots (0,0) and (3,0)  
Vertex  $(\frac{3}{2}, -\frac{9}{4})$   
y-intercept (0,0)

$y = 2x^2 + 3x$   
Roots (0,0) and  $(-\frac{3}{2}, 0)$   
Vertex  $(-\frac{3}{4}, -\frac{9}{8})$   
y-intercept (0,0)

- 7)  $y = 4 - x^2$   
8)  $y = 4 + 3x - x^2$   
9)  $y = x^2 + 4$

7-9)



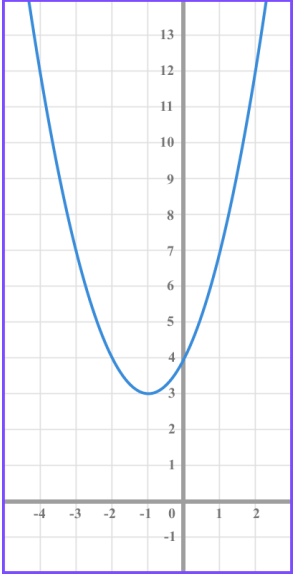
-   $y = 4 - x^2$
-   $y = 4 + 3x - x^2$
-   $y = x^2 + 4$

$y = 4 - x^2$   
Roots (2,0) and (-2,0)  
Vertex (0,4)  
y-intercept (0,4)

$y = 4 + 3x - x^2$   
Roots (-1,0) and (4,0)  
Vertex  $(\frac{3}{2}, \frac{25}{4})$   
y-intercept (0,4)

$y = x^2 + 4$   
No real roots  
Vertex (0,4)  
y-intercept (0,4)

## Quadratic Graphs - Answers

	Question	Answer
	Applied Questions	
1)	<p>a) Draw the graph of the function  <math>y = x^2 + 2x + 4, -4 \leq x \leq 2</math></p> <p>b) Use your graph to write down the coordinates of the turning point. Is it a maximum or a minimum?</p> <p>c) What happens when you try to solve the equation <math>x^2 + 2x + 4 = 0</math>? Use your graph to explain why this happens.</p>	<p>a) </p> <p>b) <math>(-1, 3)</math> Minimum.</p> <p>c) There are no (real) solutions - the quadratic formula doesn't work because you have to square root a negative number. The graph has no x-intercepts so we can tell there are no real roots.</p>

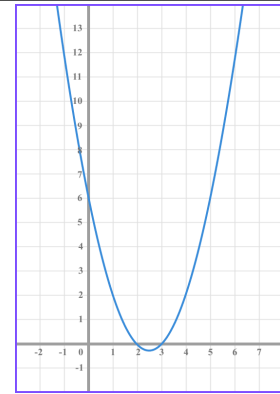
2)

a) Draw the graph of the function

$$y = x^2 - 5x + 6, -1 \leq x \leq 6$$

b) Solve the equation  $x^2 - 5x + 6 = 0$ .  
Where can you see these solutions on the graph?

c)  
Use your graph to estimate the coordinates of the turning point. If you know how to, check your answer algebraically by completing the square on the expression  $x^2 - 5x + 6$ .



a)

$$(x - 3)(x - 2) = 0$$

b) gives solutions  $x = 3, x = 2$ .  
These solutions are the roots/x-intercepts.

c)  $\left(\frac{5}{2}, \frac{-1}{4}\right)$   
 $\left(x - \frac{5}{2}\right)^2 - \frac{1}{4}$

3)

a) Draw the graph of the function

$$y = 2x + 8 - x^2, \quad -3 \leq x \leq 5$$

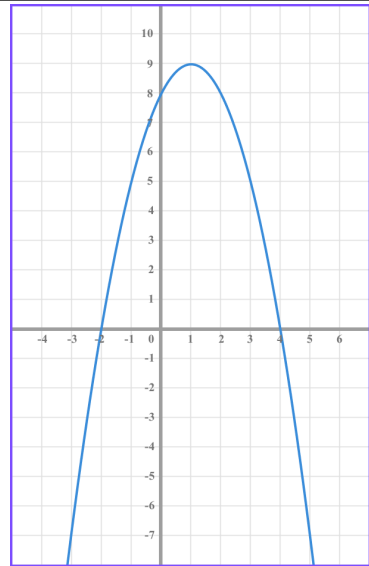
b) Write down the coordinates of the vertex and roots.

c) Using the graph, estimate the solutions to the equation  $2x + 8 - x^2 = 4$ .

d) Using the graph, find the solutions to the equation  $2x + 8 = x^2$ .

e) Using the graph, find the solutions to the equation  $2x + 8 - x^2 = 2x + 4$ . Check your answer algebraically.

a)



b)

Vertex (1, 9)

Roots  $x = 4, x = -2$

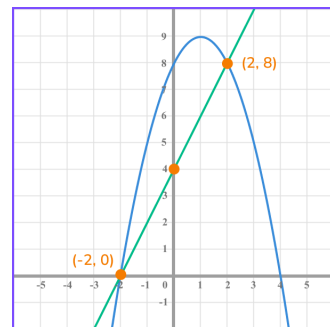
c)

$x = -1.2, x = 3.2$

d)

$x = 4, x = -2$

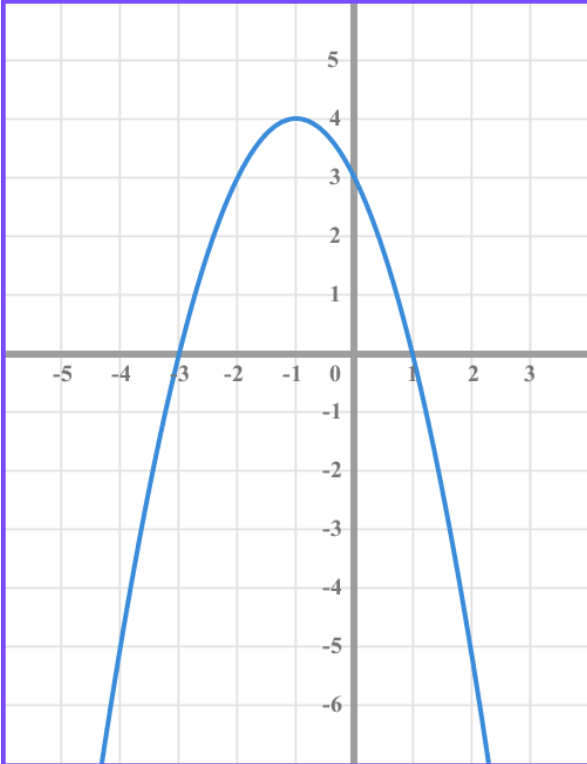
e)



$x = -2, x = 2$

## Quadratic Graphs - Mark Scheme

	Question	Answer																																					
	<b>Exam Questions</b>																																						
<b>1) (a)</b>	Complete the table of values for $y = x^2 - 5x - 2$  <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td><math>x</math></td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td><math>y</math></td><td></td><td></td><td>-6</td><td></td><td></td><td></td><td>-2</td><td></td></tr> </table>	$x$	-1	0	1	2	3	4	5	6	$y$			-6				-2		(a) <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td><math>x</math></td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td><math>y</math></td><td>4</td><td>-2</td><td>-6</td><td>-8</td><td>-8</td><td>-6</td><td>-2</td><td>4</td></tr> </table> (1) 4-5 correct values (1) All correct values	$x$	-1	0	1	2	3	4	5	6	$y$	4	-2	-6	-8	-8	-6	-2	4	<b>(2)</b>
$x$	-1	0	1	2	3	4	5	6																															
$y$			-6				-2																																
$x$	-1	0	1	2	3	4	5	6																															
$y$	4	-2	-6	-8	-8	-6	-2	4																															
<b>(b)</b>	On the grid draw the graph of $y = x^2 - 5x - 2$ for values of $x$ from -1 to 6	(b) <div style="text-align: center;"> </div> (1) Points plotted correctly ft. pt (a) (1) Points joined with a smooth curve	<b>(2)</b>																																				
<b>(c)</b>	Use the graph to find estimates of the solutions to the equation $-4 = x^2 - 5x - 2$	$x = 0.4, x = 4.6$  (1) Line $y = -4$ drawn on graph (1) Solutions $\pm 0.1$	<b>(2)</b>																																				

2) (a)	Write down the turning point of the graph $y = x^2 + 4x - 2$	(a) $(-2, -6)$  (1) Correct coordinates	(1)																																
	(b) Use the graph to find approximate roots of the equation $x^2 + 4x + 3 = 5$	(b) $x = 0.4, x = -4.4$  (1) Rearrangement to $x^2 + 4x + 3 = 5$ and indication of reading x-intercept values (1) Correct answers	(2)																																
	(c) Use the graph to find approximate solutions of the equation $5 = x^2 + 4x - 2$	(c) $x = 1.3, x = -5.3$ (1) Line $y = 5$ drawn on graph (1) Solutions $\pm 0.1$	(2)																																
3) (a)	Complete the table of values for $y = 3 - 2x - x^2$  <table border="1" data-bbox="256 792 743 902"> <tbody> <tr> <td><math>x</math></td> <td>-4</td> <td>-3</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> </tr> <tr> <td><math>y</math></td> <td></td> <td></td> <td>3</td> <td></td> <td></td> <td>0</td> <td></td> </tr> </tbody> </table>	$x$	-4	-3	-2	-1	0	1	2	$y$			3			0		(a) <table border="1" data-bbox="820 696 1409 824"> <tbody> <tr> <td><math>x</math></td> <td>-4</td> <td>-3</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> </tr> <tr> <td><math>y</math></td> <td>-5</td> <td>0</td> <td>3</td> <td>4</td> <td>3</td> <td>0</td> <td>-5</td> </tr> </tbody> </table> (1) 4-5 correct values (1) All correct values	$x$	-4	-3	-2	-1	0	1	2	$y$	-5	0	3	4	3	0	-5	(2)
$x$	-4	-3	-2	-1	0	1	2																												
$y$			3			0																													
$x$	-4	-3	-2	-1	0	1	2																												
$y$	-5	0	3	4	3	0	-5																												
	(b) Draw the graph of $y = 3 - 2x - x^2$ for values of $x$ from -4 to 2.	(b)  (1) Points plotted correctly ft. pt (a) (1) Points joined with a smooth curve	(2)																																
	Use the graph to find estimates of the solutions to the equation $3 - 2x = x^2$	(c) $x = -3, x = 1$  (1) Rearrangement to $3 - 2x - x = 0$ and indication of reading x-intercept values (1) Correct answers	(2)																																

	Use the graph to find the coordinates of the turning point of the graph $y = 3 - 2x - x^2$	$(-1, 4)$ <b>(1)</b> Correct coordinates	<b>(1)</b>
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