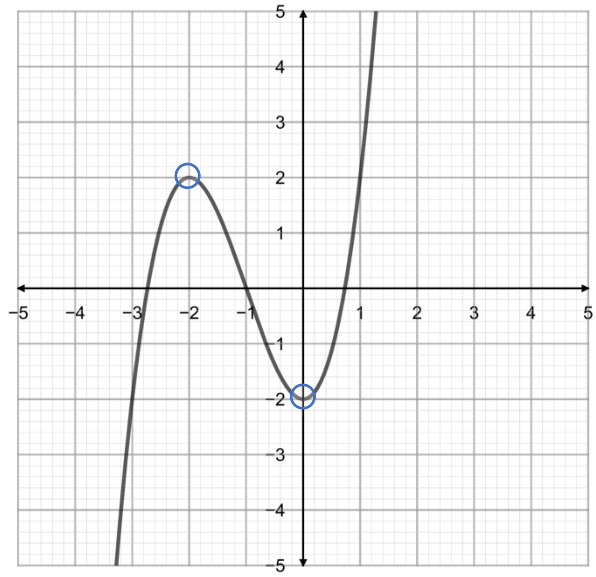
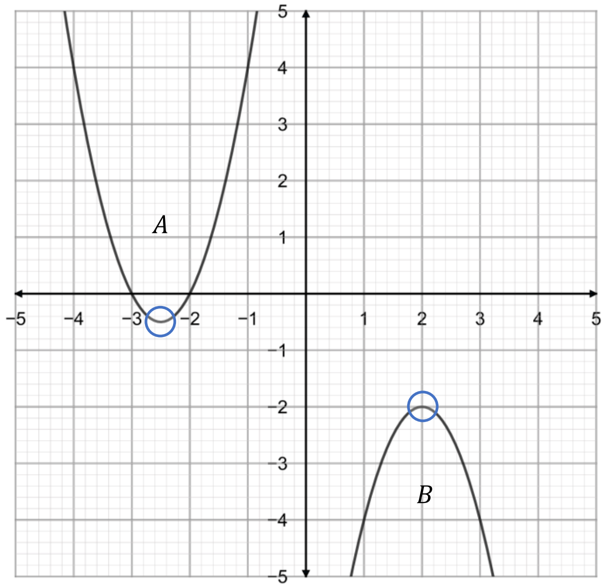
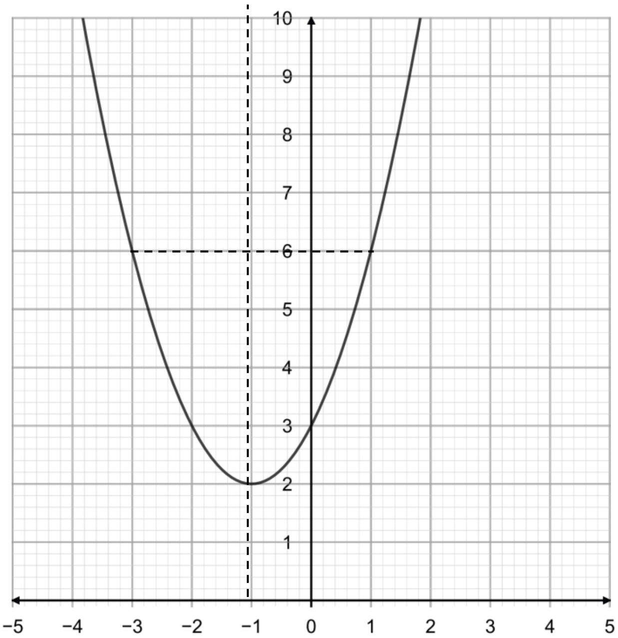
	Turning Points of Graphs Mark Scheme	
1	The turning point of a quadratic graph is where the gradient is equal to 0.	**[1]**
2		**[1]** 1 mark per correctly identified turning point **[1]** 1 mark per correctly identified turning point
3(a)		**[1]** 1 mark per correctly identified turning point **[1]** 1 mark per correctly identified turning point
	The minimum point of a quadratic graph is the smallest value it can be. Looking at graph B, we can see that the turning point is the highest point on the graph hence can also be the maximum value.	**[1]**

4(a)	$y = (x+2)^2 + 3$	**[1]**
	$x = -2\,, y = 3$	**[1]**
4(b)	$y = 3(x^2 + 12x + 33)$	**[1]**
	$= 3[(x+6)^2 - 3] = 3(x+6)^2 - 9$	**[1]**
	$x = -6\,, y = -9$	**[1]**
4(c)	$y = 2\left(x^2 + \frac{7}{2} - 5\right)$	**[1]**
	$= 2\left[\left(x + \frac{7}{4}\right)^2 - \frac{129}{16}\right] = 2\left(x + \frac{7}{4}\right)^2 - \frac{129}{8}$	**[1]**
	$x = -\frac{7}{4}\,, y = -\frac{129}{8}$	**[1]**

Turn over ►

5(a)		**[1]** Smooth connecting curve using line of symmetry
5(b)	$x = -1 , y = 2 \pm 0.25$	**[1]**
6(a)	$fg(x) = x^2 - 4$	**[1]** Correct function given
	Graph of x^2 *has turning point* $(0,0)$ $fg(x) = x^2 - 4$ *is the graph of* x^2 *but moved down* 4, *so that is how the turning point has moved too.* *The* x *stays the same, but the* y *goes down by* 4. $x = 0 , y = -4$	**[1]**
6(b)	$gf(x) = (x - 4)^2$	**[1]** Correct function given
	Graph of x^2 *has turning point* $(0,0)$ $gf(x) = (x - 4)^2$ *is the graph of* x^2 *but moved right* 4, *so that is how the turning point has moved too.* *The* x *increased by* 4, *but the* y *stays the same.* $x = 4 , y = 0$	**[1]**
6(c)	The turning point of $fg(x)$ is where $f(x)$ intercepts the y-axis. The turning point of $gf(x)$ is where $f(x)$ intercepts the x-axis.	**[1]** For either or both correct comments

END