Higher Check In - 7.03 Transformations of curves and their equations

1. The graph of $y = x^2$ has a minimum point at (0, 0). Write down the coordinates of the minimum point of $y = x^2 - 2$.

2. Find the axis of symmetry of $y = (x + 3)^2$.

3. Sketch the graph of $y = (x - 4)^2 + 2$.

4. The graph of $y = (x + 3)^2 - 1$ is translated to the right by 5 and up by 3. What is the equation of the transformed graph?

5. Which equation gives the same graph as $y = \cos x$?
   (a) $y = \cos(-x + 90°)$ (b) $y = \sin(x - 90°)$ (c) $y = -\cos(x + 90°)$ (d) $y = -\sin(x - 90°)$

6. The graphs of $y = x^3$ can be transformed to the graph of $y = -(x - 2)^3$ through a series of two transformations. Describe the two transformations.

7. Abbie draws the graph of $y = x^2$. Karl draws the graph of $y = (-x)^2$. Explain using transformations why the two graphs would look the same.

8. The graph of $y = -x^2 + 10x - 16$ is reflected about the y-axis. Show that the vertex of the resulting curve is (-5, 9).

9. The graph of $y = x^2 - 10x + 25$ is translated by the vector $\begin{pmatrix} p \\ -3 \end{pmatrix}$. If the graph intercepts the y-axis at $y = 13$, find the equation of the transformed graph.

10. Sketch the graph of the equation for the composite function formed by 'Function C followed by Function A, followed by Function B'. Clearly label the x- and y-intercepts and the vertex.

Function A	Function B	Function C
$y = -x^2 + 9$	$y = -x$	$y = x - 1$

Extension
Which of these equations are always true?
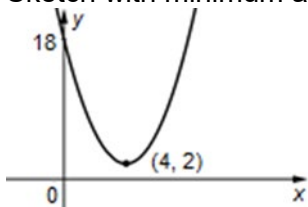   (a) $\sin x = \sin(-x)$
   (b) $\sin x = \cos(x - 90°)$
   (c) $\tan x = \tan(180° + x)$
   (d) $\sin x = \cos(x + 270°)$
   (e) $\tan(x + 180°) = -\tan(x)$
   (f) $\cos x = \cos(x - 180°)$
Create four more equations like this: two that are always true and two that are not.

Answers

1. (0, ⁻2)

2. $x = -3$

3. Sketch with minimum at (4, 2):

4. $y = (x - 2)^2 + 2$

5. (d) $y = -\sin(x - 90°)$

6. A translation right by 2; reflection in *x*-axis (in either order).

7. The graph $y = x^2$ has the *y*-axis as a line of symmetry. Since $y = (-x)^2$ is a reflection of $y = x^2$ in the *y*-axis, the two graphs are the same.

8. Completing the square of $y = -x^2 + 10x - 16$ gives $y = -(x - 5)^2 + 9$, so the vertex is (5, 9). Reflecting in the *y*-axis reverses the sign of the *x*-coordinate giving (⁻5, 9).

9. Substituting (0, 13) into $y = (x - 5 + p)^2 - 3$ gives $p = 9$ or $p = 1$ so $y = (x \pm 4)^2 - 3$.

10. Sketch of $y = (x - 1)^2 - 9$ showing these features:
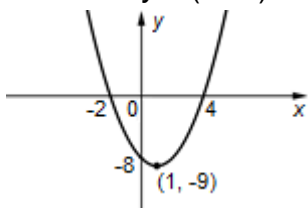
Extension
Equations (b), (c) and (d) are always true.

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Identify a vertical translation of a given graph			
AO1	2	Identify a horizontal translation of a given graph			
AO1	3	Sketch horizontal and vertical translations of a given graph			
AO1	4	Translate a given graph horizontally and vertically			
AO1	5	Identify translations and reflections of trigonometric graphs			
AO2	6	Describe translations and reflections on a given graph			
AO2	7	Explain the symmetries of the graph of $y = x^2$			
AO2	8	Reflect a given graph in the y-axis and determine its vertex			
AO3	9	Solve a problem involving a translation			
AO3	10	Sketch the graph of a composite function			