

H2 Mathematics (9758) Chapter 2 Transformations of Curves Learning Experience 1 Exploration of Basic Transformations Filled-in Copy

Success Criteria:

Surface Learning		Deep Learning		Transfer Learning
	Determine the translation units in the positive / negative y-direction by observing the graph using the applet.		Identify the replacement of variable involved in translation of a graph (i.e. $y = f(x) + a$ &	
	Determine the translation units in the positive / negative <i>x</i> -direction by observing the graph using the applet.		y = f(x+a)) Identify the replacement of variable involved in	
	Identify whether the transformation involves either the <i>x</i> -value or the <i>y</i> -value.		stretching of a graph (i.e. $y = af(x) \&$	
	Determine the stretch factor parallel to <i>x</i> -axis / <i>y</i> -axis by observing the graph using the applet. Visualise a graph that undergoes a reflection in the <i>x</i> -axis / <i>y</i> -axis		$y = f\left(\frac{-}{a}\right)$ Write down the equation of the resultant curve after going through a reflection in the <i>x</i> -axis / <i>y</i> -axis.	
	using applet.		Identify the replacement of variable involved in reflecting a graph either in the <i>x</i> -axis or <i>y</i> -axis.	

Instructions to students:

1. For each applet in Section 1 and 2, **move the slider** to vary the value of *A* before writing down your observations.



2. Circle the correct answer where there is an * sign.

§1 Translation

§1.1 Translation in the direction of *y*-axis

Let $y = (x-1)^2 + 1$. Using Geogebra, observe the change in the behavior of the graph of $y = \left[(x-1)^2 + 1 \right] + A$ when the value of A changes.

Activity 1

Observation 1:

Describe the change in the graph of $y = (x-1)^2 + 1$ when the value of A increases from 0 to 3.

Translation of 3 units in the positive *y***-direction.**

Observation 2: Sketch the graph after this transformation.



Observation 3:

Let (1, 1) be the minimum turning point on the curve $y = (x-1)^2 + 1$. Observe and write down the new coordinates of this point after going through this transformation. (1,4)

Label this point on the transformed graph that you have drawn in Observation 2.





Observation 5:

What is the replacement of variable involved in transforming the graph of $y = (x-1)^2 + 1$ to

$$y = \left[\left(x - 1 \right)^2 + 1 \right] - 2?$$

Replace y by y - (-2) = y +

$$-(-2) = y + 2$$

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§1.2 Translation in the direction of *x*-axis

Let $y = (x-1)^2 + 1$. Using Geogebra, observe the change in the behavior of the graph of $y = [(x+A)-1]^2 + 1$ when the value of *A* changes.

Activity 1

Observation 1:

Describe the change in the graph of $y = [(x+A)-1]^2 + 1$ when the value of A increases from 0 to 2.

Translation of 2 units in the negative *x***-direction.**

Observation 2: Sketch the graph after this transformation.



Observation 3:



Label this point on the transformed graph that you have drawn in Observation 2.



Activity 2

Observation 1:

Describe the change in the graph of $y = [(x+A)-1]^2 + 1$ when the value of A decreases from 0 to -3.

Translation of 3 units in the positive *x***-direction.**





Observation 3:

Let (1, 1) be the minimum turning point on the curve $y = (x-1)^2 + 1$. Observe and write down the new coordinates of this point after going through this transformation. (4,1)

Label this point on the transformed graph that you have drawn in Observation 2.

Observation 4:

Which value is changed?

x-value

Observation 5:

What is the replacement of variable involved in transforming the graph of $y = (x-1)^2 + 1$ to

$$y = [(x-3)-1]^2 + 1(i.e. \ y = (x-4)^2 + 1)?$$

Replace x by $x-3$

§2 Stretch

§2.1 Stretch parallel to the *y*-axis

Let $y = (x-1)^2 + 1$. Using Geogebra, observe the change in the behavior of the graph of $y = A[(x-1)^2 + 1]$ when the value of *A* changes.

Activity 1

Observation 1:

Describe the change in the graph of $y = A[(x-1)^2 + 1]$ when the value of A increases from 1 to 3.

Stretch of factor 3 parallel to the y-axis.

Observation 2: Sketch the graph after this transformation.



Observation 3:

Let (1,1) be the minimum turning point on the curve $y = (x-1)^2 + 1$. Observe and write down the new coordinates of this point after going through this transformation. (1,3)

Label this point on the transformed graph that you have drawn in Observation 2.





§2.2 Stretch parallel to the *x*-axis

Let $y = (x-1)^2 + 1$. Using Geogebra, observe the change in the behavior of the graph of $y = \left(\frac{x}{A} - 1\right)^2 + 1$ when the value of A changes.

Activity 1

Observation 1:

Describe the change in the graph of $y = \left(\frac{x}{A} - 1\right)^2 + 1$ when the value of A decreases from 1

to $\frac{1}{4}$.

Stretch of factor $\frac{1}{4}$ parallel to the *x*-axis.

Observation 2: Sketch the graph after this transformation.



Observation 3:

Let (1,1) be the minimum turning point on the curve $y = (x-1)^2 + 1$. Observe and write down the new coordinates of this point after going through this transformation. $\left(\frac{1}{4},1\right)$ Label this point on the transformed graph that you have drawn in Observation 2^L. **Observation 4:** Which value is changed? x-value **Observation 5:** What is the replacement of variable involved in transforming the graph of $y = (x-1)^2 + 1$ to $\frac{x}{\frac{1}{4}} - 1$ + 1 = $(4x - 1)^2 + 1?$ here x by $4x = \frac{x}{\frac{1}{2}}$ Replace *x* by



§3 Reflection

§3.1 Reflection in the *x*-axis

Let $y = (x-1)^2 + 1$. Using Geogebra, write down the new equation of the graph $y = (x-1)^2 + 1$ when it is reflected in the *x*-axis.

Observation 1:

Write down the equation of the new curve after going through this transformation:

 $y = -\left[\left(x-1\right)^2 + 1\right]$

Observation 2: Sketch the graph after this transformation.



Observation 3: Let (1,1) be the minimum turning point on the curve $y = (x-1)^2 + 1$. Observe and write down the new coordinates of this point after going through this transformation. (1,-1) Label this point on the transformed graph that you have drawn in Observation 2. **Observation 4:** Which value is changed? **y-value Observation 5:** What is the replacement of variable involved in transforming the graph of $y = (x-1)^2 + 1$ to $y = -[(x-1)^2 + 1]$? Replace y by -y

§3.2 Reflection in the *y*-axis

Let $y = (x-1)^2 + 1$. Using Geogebra, write down the new equation of the graph $y = (x-1)^2 + 1$ when it is reflected in the y-axis.

Observation 1:

Write down the equation of the new curve after going through this transformation:

 $y = \left(-x - 1\right)^2 + 1$

Observation 2: Sketch the graph after this transformation.



Observation 3:

Let (1, 1) be the minimum turning point on the curve $y = \sqrt{x}$. Observe and write down the new coordinates of this point after going through this transformation. (-1,1)

Label this point on the transformed graph that you have drawn in Observation 2.

x-value

Observation 4:

Which value is changed?

Observation 5:

What is the replacement of variable involved in transforming the graph of $y = (x-1)^2 + 1$ to

$$y = (-x-1)^2 + 1?$$

Replace x by -x

End of Activity