

Day 8: 1.4-Transformations

Remember from Grade 11:

$|a| > 1$: vertically stretched
by a factor of $|a|$.

$0 < |a| < 1$: vertically compressed
by a factor of $|a|$.

$a < 0$: reflection in x -axis

$c > 0$:
Vertical translation
' c ' units upwards.

$c < 0$: vertical translation
' c ' units downwards.

$$y = af[k(x - d)] + c$$

$|k| > 1$: horizontally compressed
by a factor of $\frac{1}{|k|}$

$0 < |k| < 1$: horizontally stretched
by a factor of $\frac{1}{|k|}$

$k < 0$: reflection in
 y -axis.

$d > 0$: horizontal
translation ' d ' units
to the right

$d < 0$: horizontal
translation ' d ' units
to the left.

Example One: Describe the transformations applied to $f(x) = x^4$ to obtain $y = -f(3x + 6) + 4$. Write the full equation of the transformed function.

$$y = -f(3(x+2)) + 4$$

$$f(x) = -[3(x+2)]^4 + 4$$

- Reflection in x-axis
- horizontally compressed by a factor of $\frac{1}{3}$
- horizontal translation 2 units to the left and vertical translation up.

Example Two: Write an equation, domain, and range for a cubic function that is reflected on the y-axis, 4 units stretched vertically by a factor of 2, stretched horizontally by factor 4, translated right 3 and down 6.

$$y = 2\left[-\frac{1}{4}(x-3)\right]^3 - 6$$

$$D = \{x \in \mathbb{R}\} \text{ or } x \in (-\infty, \infty)$$

$$R = \{y \in \mathbb{R}\} \text{ or } y \in (-\infty, \infty)$$

In grade 10 and 11 we graphed transformed functions by applying transformation to the parent function in the order: **Stretch, Reflect, Translate**. or **RST**

Another way to sketch transformed functions is to apply **mapping notation**:

$$(x, y) \rightarrow \left(\frac{x}{k} + d, ay + c\right)$$

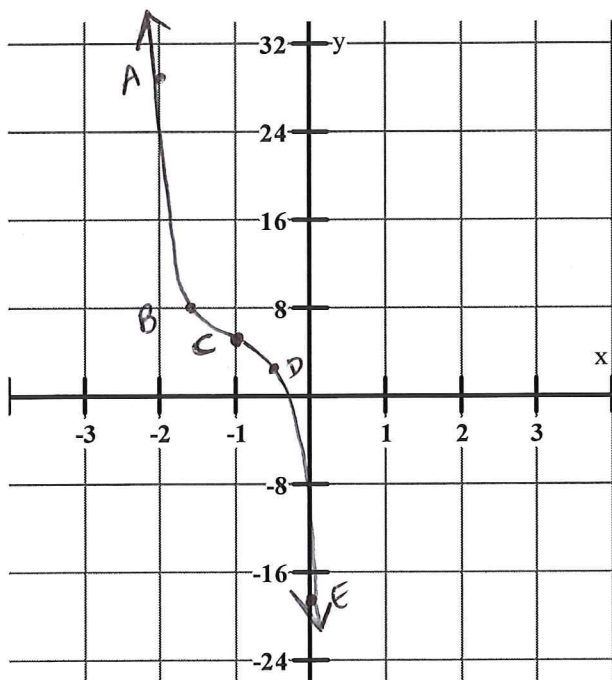
Note: Mapping coordinates maintains proper order of transformations because of order of operations.

Example Three: Sketch a graph of the following function by completing the table provided using the mapping rule.

$$y = -3[2(x+1)]^3 + 5$$

$$a = -3 \quad d = -1$$

$$k = 2 \quad c = 5$$



(x, y)	$\left(\frac{x}{2} - 1, -3y + 5\right)$
$(-2, -8)$	$(-2, 29)$ A
$(-1, 1)$	$(-1.5, 8)$ B
$(0, 0)$	$(-1, 5)$ C
$(1, 1)$	$(-0.5, 2)$ D
$(2, 8)$	$(0, -19)$ E

↓
Points
on
 $y = x^3$