

Name _____ Date _____ Period _____

Transformations of $f(x) = |x|$, Part I

TEACHER KEY | Algebra II Honors | Unit 2 | Day 2 | TEK A2.6.C

Objective: I can name the transformation a given form of $a|x|$ or $|bx|$ describes, and use a table of values to decide whether two different transformations produce the same graph.

Vocabulary

Vertical stretch/compression: $a|x|$; $|a| > 1$ **stretches**, $0 < |a| < 1$ **compresses**.

Horizontal stretch/compression: $|bx|$; $|b| > 1$ **compresses**, $0 < |b| < 1$ **stretches**.

Reflection: $a < 0$ flips over the **x-axis**; $b < 0$ flips over the **y-axis**.

Invariant point: a point that does not move - here, the **vertex (0, 0)**.

KEY IDEA

The a in $a|x|$ - vertical: $3|x|$ STRETCHES by 3 (steeper). $(1/2)|x|$ COMPRESSES by $1/2$ (flatter).

The b in $|bx|$ - horizontal: $|4x|$ COMPRESSES by $1/4$ (steeper). $|(1/4)x|$ STRETCHES by 4 (flatter).

The vertex (0, 0) never moves. Two DIFFERENT transformations can land on the SAME graph - test it with a table, not a guess.

Let's Work Through It

Example 1 — $f(x) = 2|x|$. Name the transformation. Steeper or flatter?

vertical stretch by 2 Steeper or flatter: **steeper** Vertex: **(0, 0)**

Example 2 — $f(x) = |3x|$. Name the transformation. Steeper or flatter?

horizontal compression by $1/3$ Steeper or flatter: **steeper** Vertex: **(0, 0)**

Example 3 — Name the transformation for $f(x) = (1/2)|x|$, then for $f(x) = |(1/2)x|$.

vertical compression by $1/2$ **horizontal stretch by 2**

Example 4 — Fill in the table for $y = 2|x|$ and $y = |2x|$, then compare the two rows.

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

The output rows are **identical**, so the graphs are **the same**

Example 5 — Same idea for $y = -3|x|$ and $y = |-3x|$. Do these two also match?

x	-2	-1	0	1	2
$y = -3 x $	-6	-3	0	-3	-6
$y = -3x $	6	3	0	3	6

The output rows are **opposites**, so the graphs are **different - one opens down, one opens up**

Your Turn

You Try 1 — Name the transformation for $f(x) = 5|x|$, then for $f(x) = |5x|$.

vertical stretch by 5 **horizontal compression by 1/5**

You Try 2 — Fill in the table for $y = 4|x|$ and $y = |4x|$, then state whether they produce the same graph and how your table shows it.

x	-2	-1	0	1	2
$y = 4 x $	8	4	0	4	8
$y = 4x $	8	4	0	4	8

same graph - every x gives the same output in both rows