

Name _____ Date _____ Period _____

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

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

Objective: I can describe and graph the effect of a and b on $f(x) = a|bx|$ - vertical/horizontal stretches, compressions, and reflections.

Vocabulary

Vertical stretch/compression: $af(x)$; $|a| > 1$ **stretches** away from the x-axis, $0 < |a| < 1$ **compresses** toward it.

Horizontal stretch/compression: $f(bx)$; $|b| > 1$ **compresses** toward the y-axis, $0 < |b| < 1$ **stretches** away from it.

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

KEY IDEA

a in $f(x) = a|x|$: $|a| > 1$ stretches, $0 < |a| < 1$ compresses, $a < 0$ reflects over the x-axis.

b in $f(x) = |bx|$: $|b| > 1$ compresses, $0 < |b| < 1$ stretches, $b < 0$ reflects over the y-axis.

The vertex never moves from **(0, 0)** no matter what a or b is.

Let's Work Through It

Example 1 — Describe $f(x) = 2|x|$, compared to the parent function.

Effect: **vertical stretch** Vertex: **(0, 0)**

Example 2 — Describe $f(x) = (1/2)|x|$.

Effect: **vertical compression** Vertex: **(0, 0)**

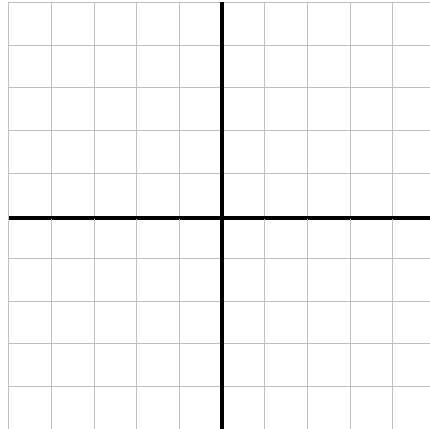
Example 3 — Describe $f(x) = -|x|$.

Effect: **reflection over the x-axis (opens down)** Vertex: **(0, 0)**

Example 4 — Describe $f(x) = |3x|$, then describe $f(x) = |(1/2)x|$.

$f(x) = |3x|$: **horizontal compression** $f(x) = |(1/2)x|$: **horizontal stretch**

Example 5 — Graph $f(x) = 2|x|$. Each square is 1 unit; both axes run -5 to 5. Is it steeper or flatter than the parent?



Steeper or flatter: **steeper, since $|a| = 2 > 1$ stretches it**

Your Turn

You Try 1 — Describe $f(x) = -4|x|$. It combines two effects.

Effect: **vertical stretch by 4, reflected over the x-axis**

You Try 2 — True or False: $f(x) = |-5x|$ looks different from $f(x) = 5|x|$. Explain.
