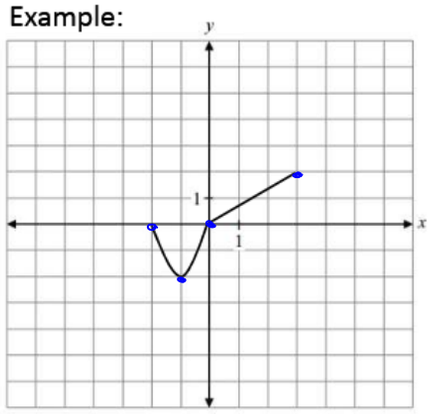
Stretching and Compressing

Example:



(−2, 0)
(−1, −2)
(0, 0)
(3, 2)

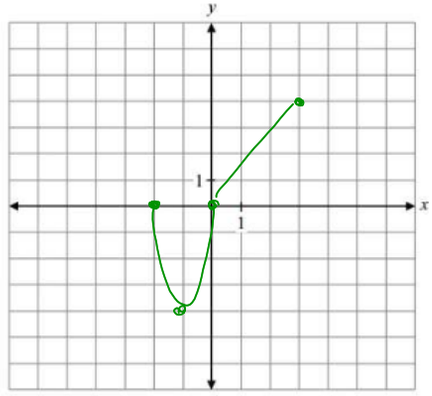
1) y = af(x)

The graph of y = af(x) consists of the graph of y = f(x) transformed by a <u>vertical factor</u> of a.

(x, y) → (x, 2y)

(−2, 0) (−2, 0)
(−1, −2) (−1, −4)
(0, 0) (0, 0)
(3, 2) (3, 4)

vertical stretch by a factor of 2
the y-values multiplied by 2



Example: y = 2f(x)

2) y = f(bx)

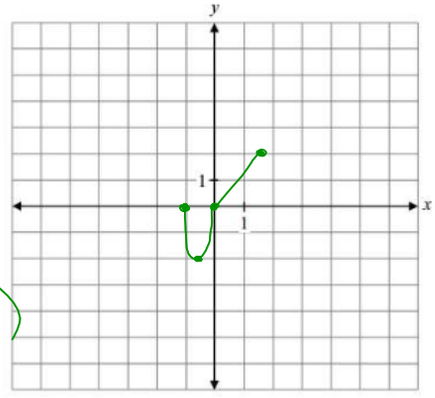
The graph of y = f(bx) consists of the graph of y = f(x) transformed by a <u>horizontal factor</u> of $\frac{1}{b}$.

Note: **Opposite Operation**

(x, y) → $(\frac{x}{b}, y)$

(x, y) → $(\frac{x}{2}, y)$ or $(\frac{1}{2}x, y)$

(−2, 0) (−1, 0)
(−1, −2) $(-\frac{1}{2}, -2)$
(0, 0) (0, 0)
(3, 2) $(\frac{3}{2}, 2)$
1.5

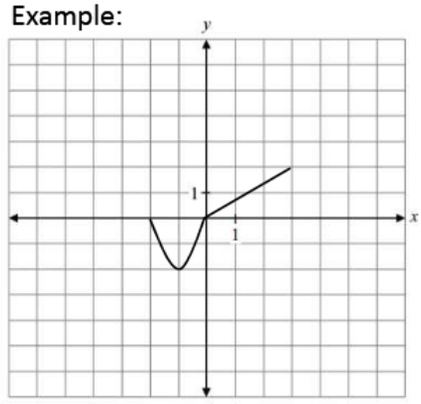


Example: y = f(2x)
b

Horizontal compression by a factor of 2
the x-values are divided by 2

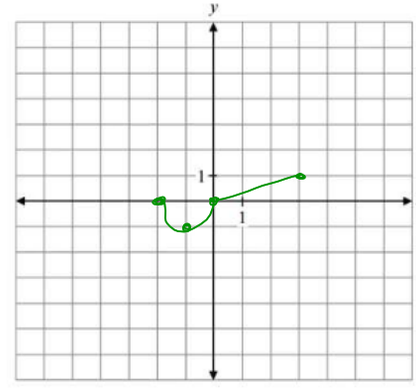
Stretching and Compressing

Example:



1) y = af(x)

The graph of y = af(x) consists of the graph of y = f(x) transformed by a <u>vertical factor</u> of a.



Example: $y = \frac{1}{2}f(x)$

(x, y) → (x, ay)

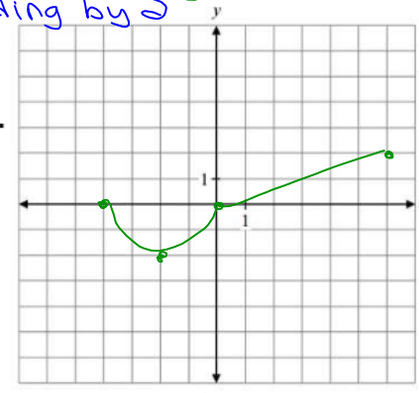
$(x,y) \rightarrow (x, \frac{1}{2}y)$ or $(x, \frac{y}{2})$

(-2, 0) (-2, 0)
(-1, -2) (-1, -1)
(0, 0) (0, 0)
(3, 2) (3, 1)

Vertical compression by a factor of 1/2
the y-values are dividing by 2

2) y = f(bx)

The graph of y = f(bx) consists of the graph of y = f(x) transformed by a <u>horizontal factor</u> of $\frac{1}{b}$.



Example: $y = f(\frac{1}{2}x)$

Note: **Opposite Operation**

(x, y) → $(\frac{x}{b}, y)$

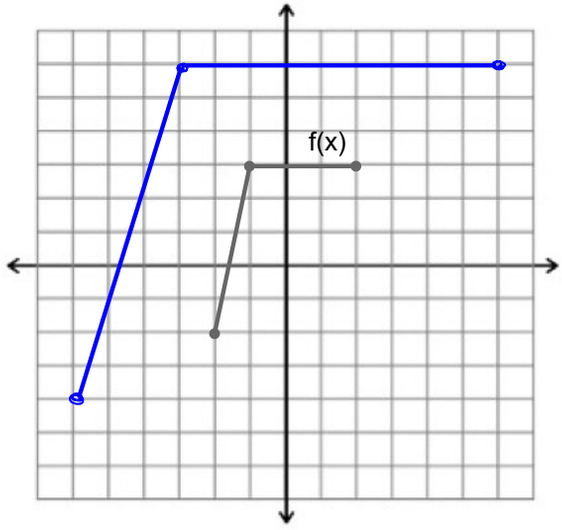
$(x,y) \rightarrow (\frac{x}{\frac{1}{2}}, y)$

$(x,y) \rightarrow (2x, y)$

(-2, 0) (-4, 0)
(-1, -2) (-2, -2)
(0, 0) (0, 0)
(3, 2) (6, 2)

horizontal stretch by a factor of 1/2
x-values are multiplying by 2

Ex 1) Given f(x)



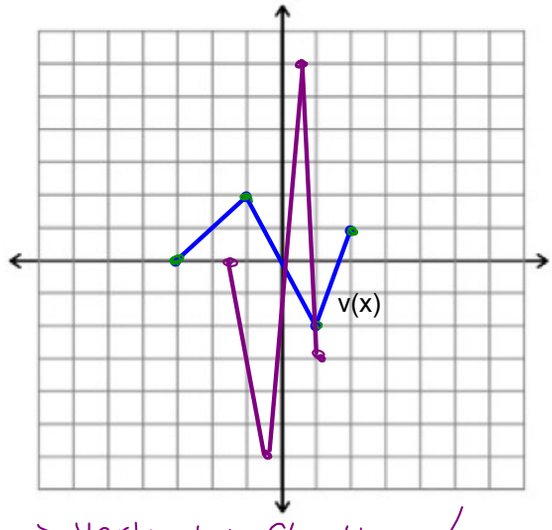
Graph:
$g(x) = 2f(\frac{1}{3}x)$
a b

$(x,y) \rightarrow (3x, 2y)$

$(-2,-2)$	$(-6,-4)$
$(-1,3)$	$(-3,6)$
$(2,3)$	$(6,6)$

Vertical stretch by a factor of 2
Horizontal stretch by a factor of $\frac{1}{3}$

Ex 2) Given v(x)



Graph:
$w(x) = -3v(2x)$

$(x,y) \rightarrow (\frac{x}{2}, -3y)$

$(-3,0)$	$(-\frac{3}{2},0)$
$(-1,2)$	$(-\frac{1}{2},-6)$
$(1,-2)$	$(\frac{1}{2},6)$
$(2,1)$	$(1,-3)$

→ Vertical reflection / reflects over the x-axis
→ Vertical stretch by a factor of 3
→ horizontal compression by a factor of 2

p. 201 #1-8, 11

worktext is wrong for these questions

5b → "compress by a factor of ~~3~~ 2"
6 → "compress by a factor of ~~2~~ 3"

In summary,

$y = f(x) \longrightarrow h(x) = af\,b(x - c) + d$

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

$af(b(x - c)) + d$ (opposite)

- stretch/compress vertically "y" — reflection over x-axis
- stretch/compress horizontally "x" — reflection over the y-axis
- horizontal shift left/right
- vertical shift up/down

Quiz → Tuesday, Feb 25

- Identify what each letter does

  $y = AfB(x+C) + D$

- State transformation in words

  #4 p.227 ex. $y = 2f(x+1)$ — stretch vertically by a factor of 2, moved left 1 unit

- Given 'words' write an equation

  #5 p.227 ex. reflection in y-axis and shifted up 1 unit. $y = f(-x) + 1$

- State the axis of reflection

  $f(-x)$ → y-axis

  $-f(x)$ → x-axis

- graph given a 'shape' $\left(\frac{x}{b} \pm c,\ ay \pm d\right)$ rule