Sec. 6.4 Horizontal Stretches and Compressions

Horizontal Stretch – if y = f(x) becomes y = f(ax) where 0 < a < 1
Horizontal Compression – if y = f(x) becomes y = f(ax) where a > 1

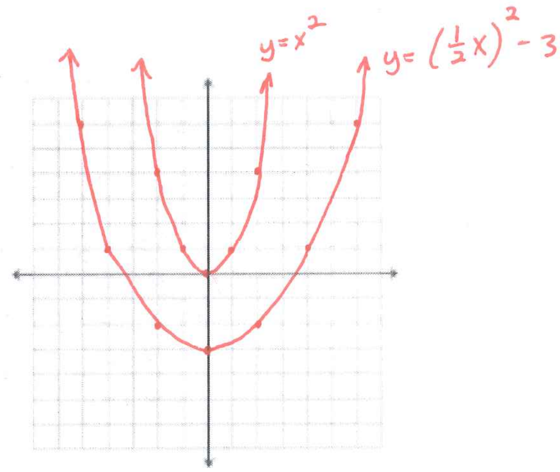
Ex. Graph $f(x) = x^2$
$f(x) = 4x^2$
$f(x) = (2x)^2$

What do you notice about the graphs? $f(x) = 4x^2$ and $f(x) = (2x)^2$ are the same

Vertical Stretch Horizontal Compression

Ex. Tell what happened to $y = \left(\frac{1}{2}x\right)^2 - 3$. Then graph by hand using $y = x^2$ as the transformation base.

HORIZONTAL STRETCH SF 2
VERTICAL TRANSLATION DOWN 3



Ex. What would the equation be if the graph of $y = x^3$ is transformed by the following:

a. Vertically translated down three units, horizontally stretched by a scale factor of 4 and reflected about the y – axis:

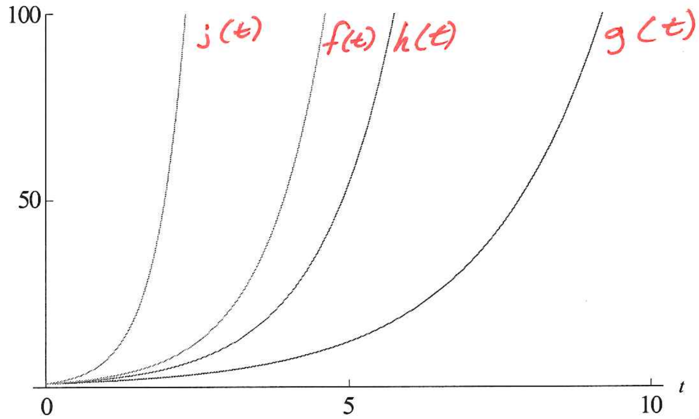
$y = \left(-\frac{1}{4}x\right)^3 - 3$

b. Translated up 3 units, vertically stretched by a scale factor of 6 and compressed horizontally by a scale factor of 1/7:

$y = 6(7x)^3 + 3$

c. Shifted down 1 unit, reflected about the x – axis and compressed vertically by a scale factor of 1/4 and stretched horizontally by a scale factor of 6:

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



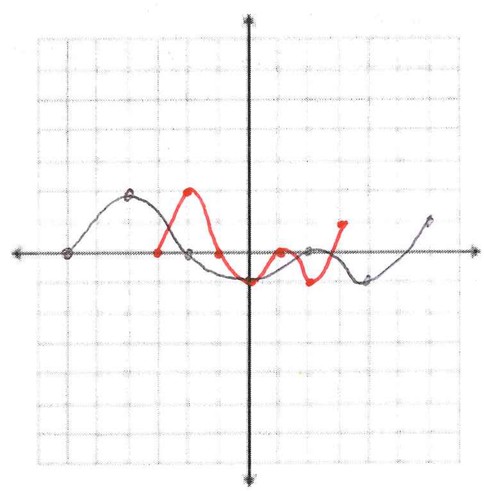
stretch sf 2   stretch sf $\frac{5}{4}$ compression sf $\frac{1}{2}$

Example: Match the functions $f(t) = e^{t}$, $g(t) = e^{0.5t}$, $h(t) = e^{0.8t}$, $j(t) = e^{2t}$ with their graphs.

Example: The values of the function $f(x)$ are shown in the table. Make table and a graph of the function $g(x) = f\left(\frac{1}{2}x\right)$. How do the two graphs compare?

x	$f(x)$
-3	0
-2	2
-1	0
0	-1
1	0
2	-1
3	1

x	$\frac{1}{2}x$	$f(x)$
-6	-3	0
-4	-2	2
-2	-1	0
0	0	-1
2	1	0
4	2	-1
6	3	1



Ex: Write a formula for each of the transformations of $f(x) = x^3 - 5$:

a) $y = f(2x)$

$y = (2x)^3 - 5$

$= 2^3x^3 - 5$

$y = 8x^3 - 5$

b) $y = 2f(x)$

$= 2(x^3 - 5)$

$y = 2x^3 - 10$

c) $y = f\left(-\frac{1}{3}x\right)$

$y = \left(-\frac{1}{3}x\right)^3 - 5$

$= \left(-\frac{1}{3}\right)^3 x^3 - 5$

$y = -\frac{1}{27}x^3 - 5$

d) $y = \frac{1}{5}f(3x)$

$y = \frac{1}{5}\left((3x)^3 - 5\right)$

$= \frac{1}{5}(27x^3 - 5)$

$y = \frac{27}{5}x^3 - 1$

Ex: Write the formula for each of the transformations of $Q(t) = 4e^{6t}$:

a) $y = Q\left(\frac{1}{3}t\right)$

$y = 4e^{6(\frac{1}{3}t)}$

$y = 4e^{2t}$

b) $y = \frac{1}{3}Q(t)$

$\frac{1}{3}(4e^{6t})$

$y = \frac{4}{3}e^{6t}$

c) $y = Q(2t) + 11$

$y = 4e^{6(2t)} + 11$

$y = 4e^{12t} + 11$

d) $y = 7Q(t-3)$

$7(4e^{6(t-3)})$

$7(4e^{6t-18})$

$y = 28e^{6t-18}$

HW: pg 253 – 256, #3-30 (m/3)