Sec. 6.3 Vertical Stretches and Compressions

1. Compressions and Stretches

a. Vertical Stretch – if y = f(x) becomes y = a f(x) where a > 1
b. Vertical Compression – if y = f(x) becomes y = a f(x) for 0 < a < 1

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

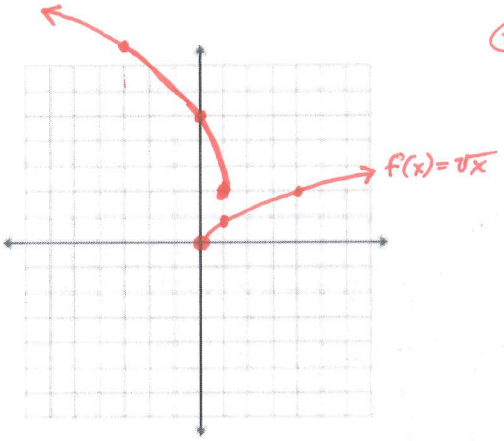
a. Shift left 2 units and reflect about the x – axis: $y=(x+2)^3$ $y=-(x+2)^3$

b. Shift down 2 units, reflect about the y – axis and stretched vertically by 4: $y=x^3-2$ $y=(-x)^3-2$ $y=4(-x)^3-2$ $y=-4x^3-2$

Ex. Graph the function $f(x) = 3\sqrt{1-x}+2$ using transformations. Start with the graph of the basic function and show all stages.

$f(x)=3\sqrt{-x+1}+2$ ← ④ TRANSLATE UP 2

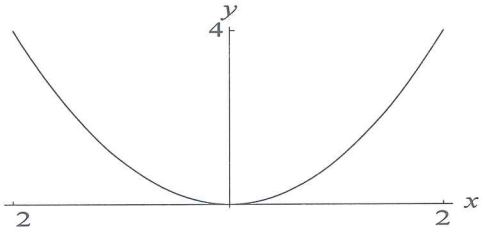
③ VERT STRETCH SF 3 ↑ HORIZONTAL REFLECTION ACROSS Y-AXIS ↑ ① TRANSLATE LEFT 1

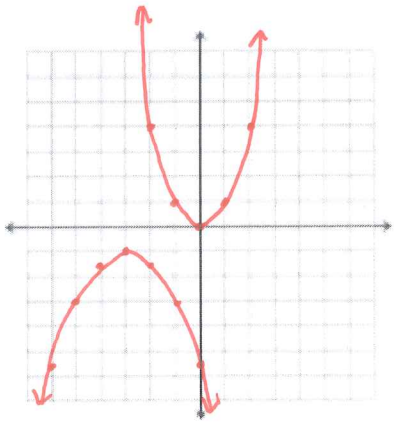


Transform $f(x)=\sqrt{x}$

Ex. The function $y = f(x)$ has the graph shown: Graph the function $g(x) = -\frac{1}{2} f(x+3) - 1$.

① Translate left 3 and down 1 ④ ③ Reflect across y-axis ② Vertical compression SF 1/2





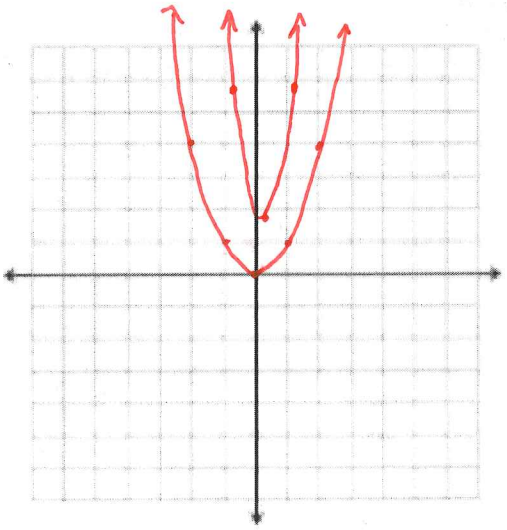
Stretch Factors and Average Rates of Change:

If $g(x) = k \cdot f(x)$, then on any interval, Average rate of change of $g = k \cdot$ (Average rate of change of f) .

Ex. The function $s(t)$ gives the distance (miles) in terms of time (hours). If the average rate of change of $s(t)$ on $0 \le t \le 4$ is 70 mph, what is the average rate of change of ½ s(t) on this interval?

$\frac{1}{2}(70) = 35$ mph

Ex. Find the vertical stretch of the graph $f(x) = 4x^2 - 2x + 2$ by hand through completing the square. Find the vertex, intercepts, and graph by hand from the original quadratic function.



$f(x) = 4\left(x^2 - \frac{1}{2}x \quad\right) + 2$

$= 4\left(x^2 - \frac{1}{2}x + \frac{1}{16}\right) + 2 - \frac{1}{4}$

$f(x) = 4\left(x - \frac{1}{4}\right)^2 + 1\frac{3}{4}$

↑ VERTICAL STRETCH SF 4

↑ TRANSLATE RIGHT 1/4 AND UP 1 3/4

$-\frac{1}{2} \cdot \frac{1}{2} = \left(-\frac{1}{4}\right)^2 = \frac{1}{16}$

$\frac{1}{16} \cdot \frac{4}{1} = \frac{4}{16} = \frac{1}{4}$

HW: pg 246-249, #3-42 (m/3)