

Part 2: Transforming from a Basic Function to Something NOT so Basic.

$$f(x) \rightarrow \dots \rightarrow a f(b(x-c)) + d$$

The Moves:

1. $f(x)$ Basic Function

2. $a f(x)$ $(x, y) \mapsto (x, ay)$

$(1, 1) \mapsto (1, 5)$
 $\sqrt{x} \mapsto 5\sqrt{x}$ vertical stretch

3. $a f(bx)$ $(x, y) \mapsto (\frac{1}{b}x, y)$

$(1, 5) \mapsto (\frac{1}{2}, 5)$
 $5\sqrt{x} \mapsto 5\sqrt{2x}$ horizontal "stretch"

4. $a f(b(x-c))$ $(x, y) \mapsto (x+c, y)$

$(\frac{1}{2}, 5) \mapsto (\frac{1}{2}+3, 5) = (\frac{7}{2}, 5)$
 $5\sqrt{2x} \mapsto 5\sqrt{2(x-3)}$ Right Shift

5. $a f(b(x-c)) + d$ $(x, y) \mapsto (x, y+d)$

$(\frac{7}{2}, 5) \mapsto (\frac{7}{2}, 16)$
 $5\sqrt{2(x-3)} \mapsto 5\sqrt{2(x-3)} + 11$ up shift

$$\frac{1}{2} + 3 \cdot \frac{2}{2} = \frac{7}{2}$$

A New Way to Think about Lines

$$g(x) = 2(x-3) - 11$$

$$y = m(x-x_1) + y_1$$

Vertical stretch
 Right 3
 Down 11

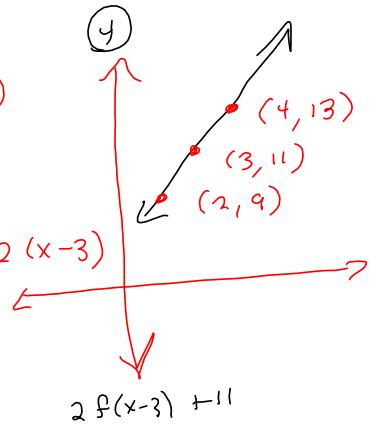
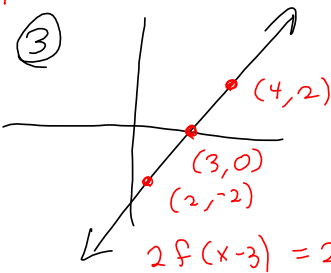
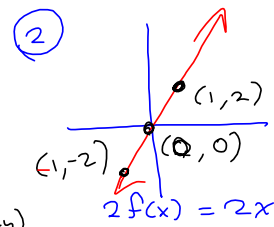
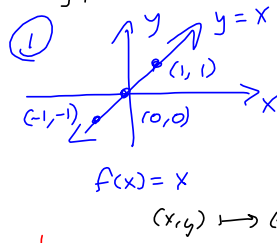
- ① $f(x)$
- ② $af(x)$
- ?

- ① x
- ② $2x$
- ③ $2(x-3)$ DELAY
- ④ $2(x-3) + 11$

$$2x - 6 - 11$$

$$2x - 17$$

UP 11



$$g(x) = 2\sqrt{5x-15} - 11 = 2\sqrt{5(x-3)} - 11$$

① $f(x) = \sqrt{x}$

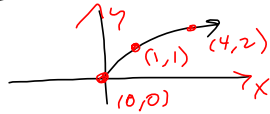
② $2\sqrt{x}$

③ $2\sqrt{5x}$

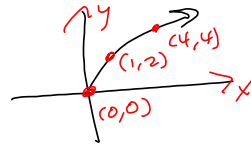
④ $2\sqrt{5(x-3)}$

⑤ $2\sqrt{5(x-3)} - 11$

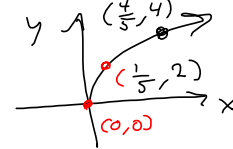
① $y = \sqrt{x} = f(x)$



② $2f(x) = 2\sqrt{x}$

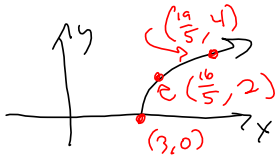


③ $2\sqrt{5x} = 2f(5x)$



$5x - 15$
 $= 5(x - 3)$
 Horizontal "shrink"
 Right shift

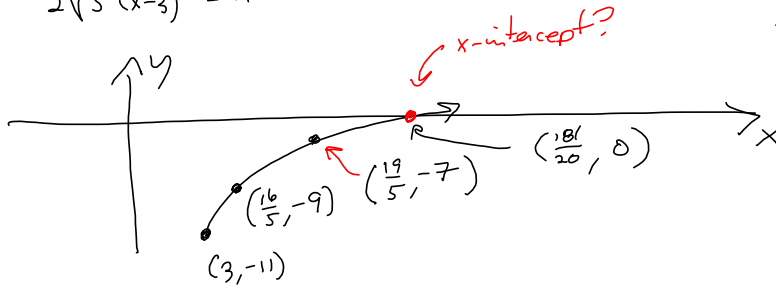
④ $2f(5(x-3)) = 2\sqrt{5(x-3)}$



$$\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$$

$$\frac{4}{5} + \frac{15}{5} = \frac{19}{5}$$

⑤ $2\sqrt{5(x-3)} - 11 = 2f(5(x-3)) - 11$



x-int:

$$2\sqrt{5(x-3)} - 11 = 0$$

$$2\sqrt{5(x-3)} = 11$$

$$\sqrt{5(x-3)} = \frac{11}{2}$$

$$5(x-3) = \left(\frac{11}{2}\right)^2 = \frac{121}{2} = \frac{121}{4}$$

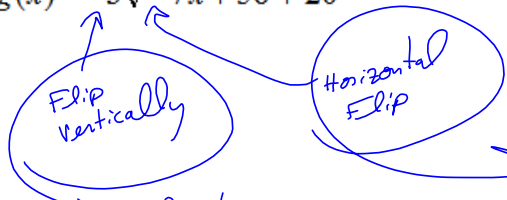
$$5x - 15 = \frac{121}{4}$$

$$5x = \frac{121}{4} + \frac{60}{4} = \frac{181}{4}$$

$$x = \frac{181}{20}$$

$$g(x) = -3\sqrt{-7x + 56} + 20$$

$$\begin{aligned} -7x + 56 \\ = -7(x - 8) \end{aligned}$$



Reflect about x-axis

Reflect about the y-axis

① \sqrt{x}

$(1, 1)$

② $-3\sqrt{x}$

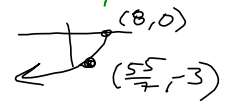
$(1, -3)$ Vertical Flip

③ $-3\sqrt{-7x}$

$(-\frac{1}{7}, -3)$ Horizontal Flip

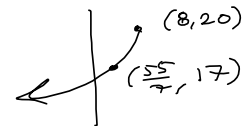
④ $-3\sqrt{7(x-8)}$

$(-\frac{1}{7} + 8, -3) = (\frac{55}{7}, -3)$



⑤ $-3\sqrt{7(x-8)} + 20$

$(\frac{55}{7}, 17)$



$$g(x) = \frac{2}{3x+18} - 5 = \frac{2}{3(x+6)} - 5$$

$f(x) = \frac{1}{x}$

$3x+18 = 3(x+6)$

$$\frac{2}{3(x+6)} - 5 = \frac{\frac{2}{3}}{x+6} - 5$$

- ① $\frac{1}{x}$
 - ② $2 \cdot \frac{1}{x} = \frac{2}{x}$ $(x, 2y)$
 - ③ $\frac{2}{3x}$ $(\frac{1}{3}x, y)$
 - ④ $\frac{2}{3(x+6)}$ $(x-6, y)$
 - ⑤ $\frac{2}{3(x+6)} - 5$ $(x, y-5)$
- Counter intuitive }
 Makes Sense }
- $(x, y) \mapsto (x, \frac{2}{3}y)$
 vertical shrink

