

$$5\sqrt{2x-4} - 8 = 5\sqrt{2(x-2)} - 8$$

$5\sqrt{2x} = 10\sqrt{x}$  so you can skip the horiz. shrink.

$(1, 1) \rightarrow 5\sqrt{x} \rightarrow 5\sqrt{2x} \rightarrow 5\sqrt{2(x-2)}$   
 $(1, 5)$   $(\frac{1}{2}, 5)$   $(\frac{\sqrt{2}}{2}, 5)$

$\rightarrow 5\sqrt{2(x-2)} - 8$   
 $(\frac{\sqrt{2}}{2}, -3)$

$5(2x-4)^2 - 8$

$5(2(x-2))^2 - 8$

Another one you can chat me on horiz. shrink, because you can pull out the '2'.

$(2(x-2))^2 = 2^2(x-2)^2 = 4(x-2)^2$

$(AB)^2 = A^2B^2$

$3(x-2) = 3x-6$  Products distribute over

$(2x)^3 = 2^3x^3$  sums.

Powers distribute over products like ...

$\rightarrow 5(2(x-2))^2 - 8 = 20(x-2)^2 - 8$

Takes out horiz. stretch.

$5\sqrt{2x-4} - 8$

$= 5\sqrt{2(x-2)} - 8 = 5\sqrt{2}\sqrt{x-2} - 8$  could be viewed as a single vertical stretch by a factor of  $5\sqrt{2}$

- ①  $\sqrt{x}$   
 $(1, 1)$
- ②  $5\sqrt{2}\sqrt{x}$   
 $(1, 5\sqrt{2})$
- ③  $5\sqrt{2}\sqrt{x-2}$   
 $(3, 5\sqrt{2})$
- ④  $5\sqrt{2}\sqrt{x-2} - 8$   
 $(3, 5\sqrt{2} - 8)$

- ①  $\sqrt{x}$   
 $(1, 1)$
- ②  $5\sqrt{x}$   
 $(1, 5)$
- ③  $5\sqrt{2x}$   
 $(\frac{1}{2}, 5)$
- ④  $5\sqrt{2(x-2)}$   
 $(\frac{\sqrt{2}}{2}, 5)$

⑤  $5\sqrt{2(x-2)} - 8$   
 $(\frac{\sqrt{2}}{2}, -3)$

I prefer you not dodge the horiz. stretch/shrink, because it doesn't work in trig/calc. on sine, cosine, tangent, etc.

$5 \tan(2x-4) - 8$  you can't do that "factor out the '2'" thing.

$\tan(2x) \neq 2 \tan x$

Recall  $f+g$ ,  $f-g$ ,  $f \cdot g$ , and their domains.

$$D(f+g) = D(f-g) = D(f \cdot g) = D(f) \cap D(g)$$

$$D\left(\frac{f}{g}\right) = D(f) \cap D(g) \cap \{x \mid g(x) \neq 0\}$$

$$= \{x \mid x \in D(f) \text{ and } x \in D(g) \text{ and } g(x) \neq 0\}$$

$$\frac{x-2}{x-3} = f(x), \quad g(x) = \sqrt{2x+6}$$

$$D(f) = \{x \mid x \neq 3\}$$

Need:  $x-3 \neq 0$   
 $x \neq 3$

$$= (-\infty, 3) \cup (3, \infty)$$

$$D(g) = \{x \mid x \geq -3\} = [-3, \infty)$$

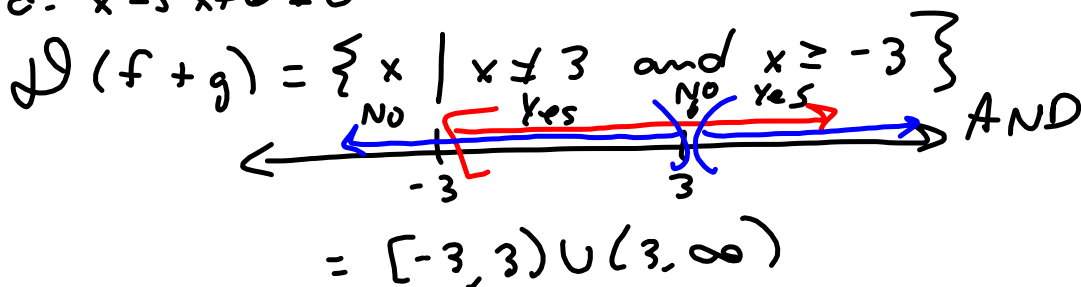
Need:  $2x+6 \geq 0$   
 $2x \geq -6$   
 $x \geq -3$

$$(f+g)(x) = f(x) + g(x) = \frac{x-2}{x-3} + \sqrt{2x+6}$$

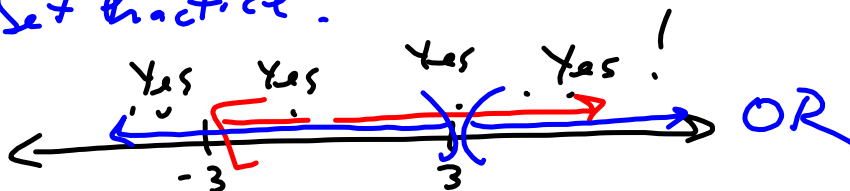
Need

$$x^2 - 5x + 6$$

Need:  $x^2 - 5x + 6 \neq 0$



Set practice:



$$= \{x \mid x \neq 3 \text{ OR } x \geq -3\}$$

$$= (-\infty, \infty)$$

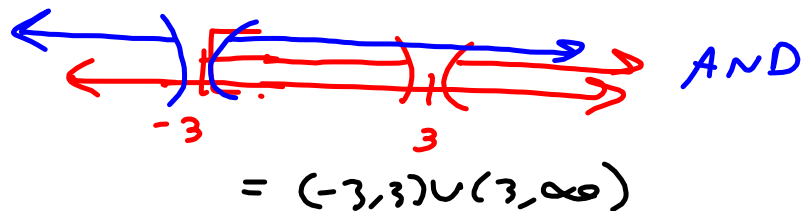
$$\frac{x-2}{x-3} = f(x), g(x) = \sqrt{2x+6}$$

$$\left(\frac{f}{g}\right)(x) = \frac{\frac{x-2}{x-3}}{\sqrt{2x+6}} = \frac{x-2}{(x-3)\sqrt{2x+6}}$$

Need  $\{x \mid x \in \mathcal{D}(f) \text{ and } x \in \mathcal{D}(g) \text{ and } g(x) \neq 0\}$

$$= \{x \mid x \neq 3 \text{ and } x \geq -3 \text{ and } x \neq -3\}$$

$$\begin{aligned} g(x) &\neq 0 \\ \sqrt{2x+6} &\neq 0 \\ 2x+6 &\neq 0 \\ 2x &\neq -6 \\ x &\neq -3 \end{aligned}$$



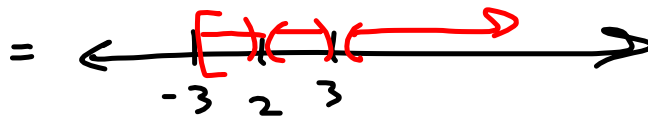
$$\left(\frac{g}{f}\right)(x) = \frac{\sqrt{2x+6}}{\frac{x-2}{x-3}}$$

$$\begin{aligned} \mathcal{D}\left(\frac{g}{f}\right) &= \left\{ x \mid x \in \mathcal{D}(f) \text{ and } x \in \mathcal{D}(g) \text{ and } f(x) \neq 0 \right\} \\ &= \left\{ x \mid x \neq 3 \text{ and } x \geq -3 \text{ and } \frac{x-2}{x-3} \neq 0 \right\} \\ &= \left\{ x \mid x \neq 3 \text{ and } x \geq -3 \text{ and } x \neq 2 \right\} \end{aligned}$$

$$\frac{x-2}{x-3} \neq 0$$

$$x-2 \neq 0$$

$$x \neq 2$$



$$= [-3, 2) \cup (2, 3) \cup (3, \infty)$$

$\frac{x-2}{x-3}$  in denom. make this change.

# COMPOSITION

$(f \circ g)(x) = f(g(x))$ , to be distinguished from  $(f \cdot g)(x) = f(x)g(x)$

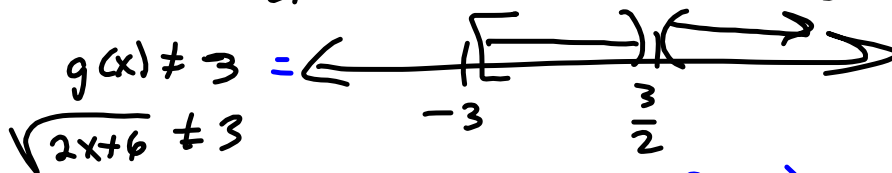
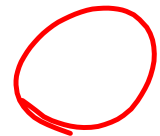
open circle.  
They're no longer close friends. Now  $f$  has turned cannibal.

Stop Right Here

$$(f \circ g)(x) = f(g(x)) = \frac{g(x)-2}{g(x)-3} = \frac{\sqrt{2x+6}-2}{\sqrt{2x+6}-3}$$

$$= \frac{\sqrt{2x+4}}{\sqrt{2x+3}} = \text{common student blunder.}$$

$$\begin{aligned} D(f \circ g) &= \{x \mid x \in D(g) \text{ and } \underline{g(x) \in D(f)}\} \\ &= \{x \mid x \geq -3 \text{ and } g(x) \neq 3\} \\ &= \{x \mid x \geq -3 \text{ and } x \neq \frac{3}{2}\} \end{aligned}$$



$$(\sqrt{2x+6})^2 \neq 3^2 = [-3, \frac{3}{2}) \cup (\frac{3}{2}, \infty)$$

$$2x+6 \neq 9$$

$$2x \neq 3$$

$$x \neq \frac{3}{2}$$

Goal: Collect 2.4 after questions.

Do S'2.5 S'2.5 due Monday  
S'2.6 will be done quickly.

Goal Test Wednesday on 2.1-2.5, with 2.6 Bonus.

$$f(x) = \frac{x-2}{x^2+5x+6}, \quad g(x) = \sqrt{3x-6}$$

$$D(f), D(g),$$

$$f+g, \quad D(f+g)$$

$$\frac{f}{g}, \quad D\left(\frac{f}{g}\right)$$

$$f \circ g, \quad D(f \circ g)$$