

2.6

Operations on function:

**5** operations

$+$ ,  $-$ ,  $\times$ ,  $\div$  and composition "o"

Let's do some problems.

## Domain and Exclusions

1) Rational functions: Chapter 1 and last year  $f(x) = \frac{x(x-5)}{x^2-25}$

Even though the (x-5) can cancel, making  $f(x) = \frac{x}{(x+5)}$ , 5 is still a domain exclusion.

$$\text{Domain of } f(x) = \{x \mid x \neq -5, x \neq 5\}$$

You can not simplify away exclusions

2) Operations on function:  $f(x) = \frac{2}{x-3}$   $g(x) = \frac{x}{x^2-9}$  Find  $\frac{f}{g}(x) = \frac{\frac{2}{x-3}}{\frac{x}{x^2-9}} = \frac{2(x+3)}{x}$

Domain: Exclusions -

1) Exclusions from f **x=3**

2) Exclusions from g **x=-3, x=3**

3) Exclusions from the simplified form **x=0**

$$\text{Domain: } \{x \mid x \neq 0, x \neq -3, x \neq 3\}$$

You can not simplify away exclusions

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

1) Exclusions from g **x=-3**

2) Two steps:

- Identify exclusions from f, NOT EXCLUSIONS YET **x=2**

- For f exclusions, find what makes those values come out of g(x) **x=-6**

$$\text{Domain: } \{x \mid x \neq -3, x \neq -6\}$$

Notation:  $(f \circ g) = f(g(x))$

x goes into g(x), the result goes into f(x), that is your results

The function on the right goes into the function on the left.

The domain is tricky:

- First exclusions: Anything that makes g(x) fail
- Second exclusions: Anything that makes g(x) have an answer that would fail in f(x)

The domain is tricky:

- First exclusions: Anything that makes  $g(x)$  fail
- Second exclusions: Anything that makes  $g(x)$  have an answer that would fail in  $f(x)$

Step 1: Identify exclusions from  $g(x)$   
These are exclusions from  $(f \circ g)$

Step 2: Identify exclusions from  $f(x)$

Step 3: For each exclusion in step 2, you need solve for  $x$  such that  $g(x) =$  the exclusion.  
If that  $x$  is put in  $g(x)$  then  $(f \circ g)$  will fail.

Exclusions are all those from Step 1 and Step 3.

$(f \circ g)(x)$  does not necessarily =  $(g \circ f)(x)$

$$C(x) = (2x^2 - 3)^3 + 4$$

Create two functions that compose to make this function.

$$f(x) = 2x$$

$$g(x) = (1/2)x$$

What is special about these two?  
What happens if you compose them?

$$f(x) = 2x - 3$$

$$g(x) = (x+3)/2$$

$$2 \left( \frac{x+3}{2} \right) - 3$$

$$= x$$

$$\left( (2x-3) + 3 \right) / 2$$

$$= x$$

If two functions are inverses  
then when you compose <sup>both way</sup> them  
you get the identity function.

$$f(x) = x \quad (x, x)$$

$$f(x) = 3x$$

$$g(x) = \frac{1}{3}x$$

$$(f \circ g)(x) = 3\left(\frac{1}{3}x\right) = x$$



Invert  $f(x) = 4x^2 - 8$

Socks and shoes

(in the morning you put on your socks then shoes  
in the evening you take of your shoes then socks)

- Square
- Multiply by 4
- Subtract 8

Add 8  
Divide by 4  
Square root

$$\sqrt{\frac{x+8}{4}} = y$$

$$y = 4x^2 - 8$$

$$x = 4y^2 - 8$$

$$\frac{x+8}{4} = y^2$$

$$\sqrt{\frac{x+8}{4}} = \sqrt{y^2}$$

$$\sqrt{\frac{x+8}{4}} = y$$

$$\frac{\sqrt{x+8}}{2} = y$$

Invert  $f(x) = 4x^2 - 8$

1) Make an inverse:

Approach 1:

- Switch X for Y

- Solve for Y

$$x = 4y^2 - 8$$

$$\sqrt{\frac{(x+8)}{4}} = y$$

Approach 2:

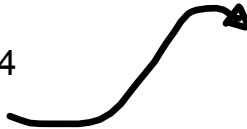
Socks and shoes

Socks and shoes

In the morning you **put on your socks** then shoes  
in the evening you **take of your shoes** then socks.

Backwards steps in backwards order

- Square
- Multiply by 4
- Subtract 8



- Add 8
- Divide by 4
- Square root

$$\begin{array}{l} x+8 \\ (x+8)/4 \\ \sqrt{\left(\frac{x+8}{4}\right)} \end{array}$$

## Attachments

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Inverse demo.ggb