2.6

Operations on function:

5 operations

$+, -, x, \div$ 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.

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***

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***

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)

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- First exclusions: Anything that makes g(x) fail
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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 o g)(x) does not necessarily = (g o 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 them both ways you get the identity function.

$f(x) = x$ (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

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

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

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

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

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

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

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

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

1) Make an inverse:

Approach 1:

- Switch X for Y

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

- Solve for Y

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

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

x+8

(x+8)/4

$$\sqrt{\left(\frac{x+8}{4}\right)}$$

Attachments

Inverse demo.ggb