QUIZ 1 Wed Days 1-3, function definition, evaluate f(__)=, state domain & range, identify & justify domain 'trouble'.

QUIZ 2 Thurs Days 4 & 5, operations with functions and composition.

TEST next Tuesday

HW 6.4

1. D: (-2, 5)
   R: (0, 2]
   It passes the vertical line test
2. Variable in Denominator
   D: {x|x ≠ -3}
   R: {y|y ≠ 0}
3. 6n - 13
4. 19
5. $x^2 + 3x - 1$
6. $3x^3 - x^2$
7. $\frac{3x-1}{x^2}, x \neq 0$
8. $\frac{x^2}{3x-1}, x \neq 1/3$
9. $18n^2 - 3n - 3$
10. 2
11. $2x^2 + x - 6$
12. $4x^3 - 8x^2 - 3x + 9$
13. $\frac{1}{(x+1)}, x \neq 3/2, -1$
14. $x + 1,\ x \neq 3/2$

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1. Find the domain and range from Warm-Up sheet question 3.

   Domain: (-2, 5)   Range: (0, 2]

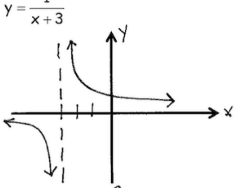
   Explain how you know it's a function. it passes the vertical line test

2. a. State the type of trouble.
   b. Find the domain algebraically.
   c. Sketch the graph.
   d. Use the graph to find the range.

   $y = \frac{1}{x+3}$

   a. var in denominator
   $x + 3 = 0$

   c.



   b. $\{x \mid x \neq -3\}$

   d. $\{y \mid y \neq 0\}$

Let $f(x) = 3x - 1$ and $g(x) = x^2$, find each of the following. State any domain restrictions.

3. $f(2n - 4) = 3(2n-4) - 1$
   $f(2n-4) = 6n - 13$

4. $(g - f)(-3) = g(-3) - f(-3)$
   $= 9 + 10 = 19$
   Aside: $g(-3) = (-3)^2 = 9$ $f(-3) = 3(-3) - 1 = -10$

5. $(f + g)(x) = f(x) + g(x)$
   $= 3x - 1 + x^2$
   $= x^2 + 3x - 1$

6. $(f \cdot g)(x) = f(x) \cdot g(x)$
   $= (3x-1)(x^2)$
   $= 3x^3 - x^2$

7. $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)} = \frac{3x-1}{x^2}$
   D: $\{x \mid x \neq 0\}$

8. $\left(\frac{g}{f}\right)(x) = \frac{g(x)}{f(x)} = \frac{x^2}{3x-1}$
   D: $\{x \mid x \neq 1/3\}$
   $3x - 1 \neq 0$
   $x \neq \frac{1}{3}$

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Let $f(x) = 2x - 3$ and $g(x) = 2x^2 - x - 3$, find each of the following. State any domain restrictions.

PEMDAS

9. $g(3n) = 2(3n)^2 - (3n) - 3$
$= 2(9n^2) - 3n - 3$
$= 18n^2 - 3n - 3$

10. $(g - f)(2) = g(2) - f(2)$
$= 3 - 1$
$= 2$

Aside:
$g(2) = 2(2)^2 - 2 - 3$
$= 8 - 5$

$f(2) = 2(2) - 3$
$= 4 - 3$

11. $(f + g)(x) = f(x) + g(x)$
$= 2x - 3 + 2x^2 - x - 3$
$= 2x^2 + x - 6$

12. $(f \cdot g)(x) = f(x) \cdot g(x)$
$= (2x - 3)(2x^2 - x - 3)$
$= 4x^3 - 2x^2 - 6x^2 + 3x - 6x + 9$
$= 4x^3 - 8x^2 - 3x + 9$

13. $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$
denom $\neq 0$ $= \frac{2x - 3}{(2x - 3)(x + 1)}$ $\neq 0$

$2x - 3 \neq 0 \mid x + 1 \neq 0$

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

$D: \{x \mid x \neq \frac{3}{2}, -1\}$

14. $\left(\frac{g}{f}\right)(x) = \frac{g(x)}{f(x)}$
$= \frac{(2x - 3)(x + 1)}{(2x - 3)}$
$= x + 1$

$D: \{x \mid x \neq \frac{3}{2}\}$

Aside:
$2x^2 - x - 3$
$= 2x^2 - 3x + 2x - 3$
$= x(2x - 3) + 1(2x - 3)$
$= (2x - 3)(x + 1)$

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Composition of Functions

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Composition of Functions → the output from the first function becomes the input for the second function; combines the rules of two functions.

~~Consider: A gardener has a rectangular garden that is 14 feet by 6 feet that he would like to cover with topsoil at a cost of $1.50 per square foot of garden space. How much would it cost to cover the garden with topsoil?~~ ~~**How would you solve this problem?**~~

$x \longrightarrow \boxed{f(x)} \longrightarrow y = f(x)$

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~~In this example, we needed the area of the garden to be able to calculate the cost of the topsoil. This is similar to the way composition works.~~

$\boxed{\text{Input} = x} \longrightarrow \boxed{f} \xrightarrow[\text{Becomes input for } g]{\text{Output from } f} \boxed{g} \longrightarrow \boxed{\text{Final Output} = y}$

There are two types of notation for the composition above, they both mean the same thing: evaluate in function f then take that answer and substitute into function g.

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

$(g \cdot f)(x) =$ multiply $g(x) \cdot f(x)$

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Given: $f(x) = x^2 - 3$, $g(x) = 2x + 1$, and $h(x) = \sqrt{x-3}$ find each of the following:

1. $f(g(1))$

$g(1) = 2(1)+1 = 3$

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

$= 9 - 3 = 6$

2. $g(f(1))$

$f(1) = 1^2 - 3 = 1 - 3 = -2$

$g(-2) = 2(-2)+1 = -4+1 = -3$

3. $f(f(-2))$

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

$= 4 - 3 = 1$

$f(1) = 1^2 - 3 = -2$

4. $(g \circ f)(3) = g(f(3))$

$f(3) = 3^2 - 3 = 6$

$g(6) = 2(6)+1 = 12+1 = 13$

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Given: $f(x) = x^2 - 3$, $g(x) = 2x + 1$, and $h(x) = \sqrt{x-3}$ find each of the following:

5. $(g \circ h)(7) = 5$

$= g(h(7))$

$h(7) = \sqrt{7-3} = \sqrt{4} = 2$

$g(2) = 2(2)+1 = 5$

6. $f(h(g(4)))$

$g(4) = 2(4)+1$ 9

$h(9) = \sqrt{9-3} = \sqrt{6}$ X

$f(\sqrt{6}) = (\sqrt{6})^2 - 3 = 6 - 3 =$ 3

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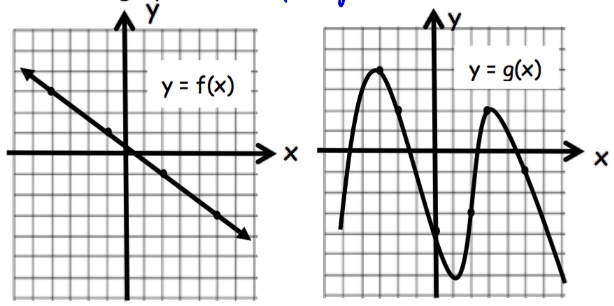
The graphs below are the functions y = f(x) and y = g(x). Evaluate each of the following questions based on these two graphs.

$x \to y$



1. $f(g(0)) = $ 3

$g(x) = y$

① $g(0) = -4$

② $f(-4) = 3$

2. $(g \circ f)(5) = g(f(5)) = 4$

$f(5) = -3$

$g(-3) = 4$

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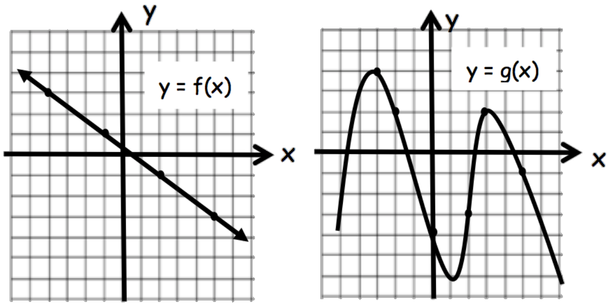

3. $g(g(-2)) = $ -3

4. $(f \circ g)(-2) = $ -1

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Sometimes we want to write a rule of composition with functions; in other words, we want to write the composition as a new function in terms of x.

Given: $f(x) = 2x - 3$, $g(x) = x^2 - 1$, and $h(x) = \sqrt{x+2}$, find each of the following:

1. $f(g(x))$

$f(x^2-1) = 2(x^2-1) - 3$
$= 2x^2 - 2 - 3$
$= 2x^2 - 5$

2. $h(g(x))$

$h(x^2-1) = \sqrt{(\quad) + 2}$
$= \sqrt{(x^2-1) + 2}$
$= \sqrt{x^2 - 1 + 2}$
$= \sqrt{x^2 + 1}$

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Given: $f(x) = 2x - 3$, $g(x) = x^2 - 1$, and $h(x) = \sqrt{x+2}$, find each of the following:

3. $g(f(x))$

$= g(2x-3) = (2x-3)^2 - 1$
$(2x-3)(2x-3) - 1$
$= 4x^2 - 6x - 6x + 9 - 1$
$= 4x^2 - 12x + 8$

4. $g(h(x)) = x+1$

$g(\sqrt{x+2}) = (\sqrt{x+2})^2 - 1$
$= x + 2 - 1$
$= x + 1$

Jan 13-8:45 PM

Scientists modeled the intensity of the sun, I, as a function of the number of hours since 6:00 am, h, using the function $\boxed{I(h) = \frac{12h - h^2}{36}}$. They then model the temperature of the soil, T, as a function of the intensity using the function $\boxed{T(I) = \sqrt{5000I}}$. Which of the following is closest to the temperature of the soil at 2:00 pm?

$T(I(h))$

a. 38 b. 54

c. 67 d. 84

$h \to \boxed{I} \xrightarrow{I(h)} \boxed{T} \xrightarrow{T(I)}$

h = # hrs since 6 Am

2pm → h = 8

$$\boxed{I(8) = \frac{12(8)-8^2}{36} = \frac{96-64}{36} = \frac{32}{36} = \frac{8}{9}} \to T\left(\frac{8}{9}\right) = \sqrt{5000\left(\frac{8}{9}\right)} = 66.\overline{66} = \frac{200}{3}$$

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Dec 2-8:45 PM