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. $x + 1,\ x \neq 3/2$

HW 6.4

Jan 13-8:30 PM

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

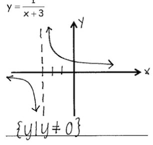
Domain: (-2,5) Range: (0,2]

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: $\{x \mid x \neq 1/3\}$

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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.

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

Jan 11-8:50 PM

# Composition of Functions

Jan 13-8:36 PM

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?**

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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.

Input = x → f → (Output from f / Becomes input for g) → g → 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.

① $(g \circ f)(x)$ = ② $g(f(x))$

$(g \circ f)(x) \neq (g \cdot f)(x)$

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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:

Inside Out

1. $f(g(1))$

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

$f(3) = 9-3 = 6$

2. $g(f(1))$

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

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

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

$f(-2) = 1$

$f(1) = -2$

right to left

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

$f(3) = (3)^2 - 3 = 9-3 = 6$

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

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

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

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

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

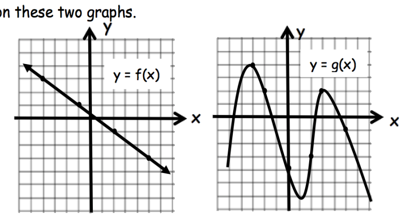
$g(4) = 2(4)+1 = 9$

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

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

Jan 13-8:41 PM

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




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

$(0,-4)$

$(-4,3)$

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

$(5,-3)$

$(-3,4)$

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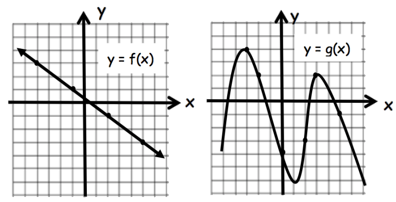


3. $g(g(-2)) =$ -3

$(-2,2)$

$(2,-3)$

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

$(-2,2)$

$(2,-1)$

Jan 13-8:44 PM

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. $h(g(x))$

$= h(x^2-1)$

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

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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. $g(h(x))$

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

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

$= x+2-1 = x+1$

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

a. 38

b. 54

c. 67

d. 84

temperature = ? h : 8 hrs

$I(8) = \frac{12(8) - (8)^2}{36} = \frac{8}{9}$

$T(8/9) = \sqrt{5000(8/9)}$

Jan 13-8:46 PM

Dec 5-7:44 AM