

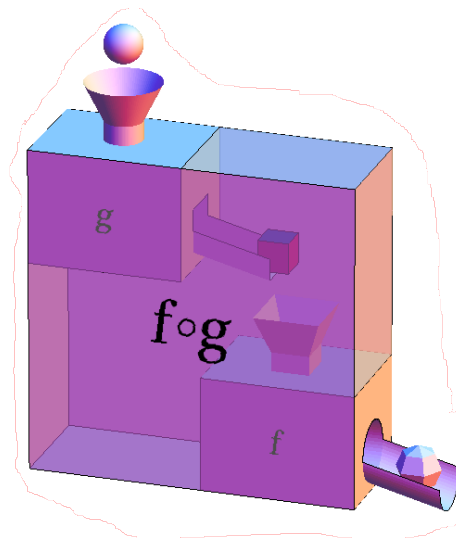
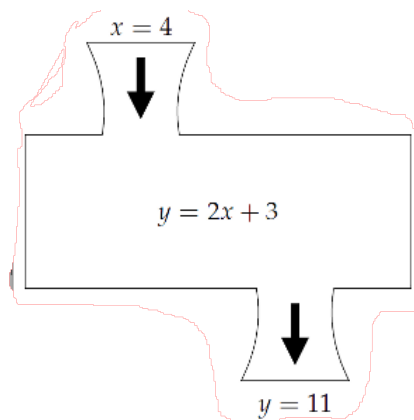
## Composite Functions.

Lesson 11

Composite Functions: Functions that are formed from two functions  $f(x)$  and  $g(x)$  in which the output of one of the functions is used as the input for the other function.

→  $f(g(x))$  is read as "f of g of x"

→  $(f \circ g)(x)$  is another way of writing  $(f(g(x)))$  and is read the same way.



Example 1. Evaluate a composite function.

If  $f(x) = 4x$  ,  $g(x) = x + 6$  and  $h(x) = x^2$  , determine

a.  $f(g(x))$       b.  $g(h(-2))$       c.  $h(h(2))$

Method I: Determine the value of the inner function and then substitute.

Evaluate the function in the inner brackets for the given value of  $x$  .

$$g(x) = x + 6$$

$$h(x) = x^2$$

$$h(x) = x^2$$

$$g(3) =$$

$$h(-2) =$$

$$h(2) =$$

$$g(3) =$$

$$h(-2) =$$

$$h(2) =$$

Then substitute this value into the outer function.

$$f(g(3)) = f(9)$$

$$f(g(3)) =$$

$$f(g(3)) =$$

Method II: Determine the composite function first and then substitute.

$$f(g(x)) = f(x + 6)$$

$$f(g(x)) = 4(x + 6)$$

$$f(g(x)) =$$

$$f(g(3)) =$$

$$f(g(3)) =$$

Your Turn    If  $f(x) = |x|$  and  $g(x) = x + 1$  determine  $f(g(-11))$   
using two different methods.

a.

Compose functions with restrictions.

Example 2: Consider the functions  $f(x) = \sqrt{x-1}$  and  $g(x) = x^2$  .

a. Determine  $(f \circ g)(x)$  and  $(g \circ f)(x)$  .

b. State the domain and range of  $f(x)$  ,  $g(x)$  ,  $(f \circ g)(x)$  ,  
and  $(g \circ f)(x)$  .

Notice that the order does matter when composing functions.

So,  $(f \circ g)(x) \neq (g \circ f)(x)$

Your Turn: Given the functions  $f(x) = \sqrt{x-1}$  and  $g(x) = -x^2$ ,  
determine  $(f \circ g)(x)$ .

State the domains of  $f(x)$ ,  $g(x)$  and  $(f \circ g)(x)$

Example 3: Determine the Composition of Two Functions.

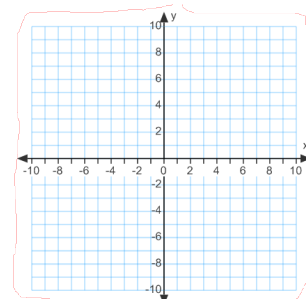
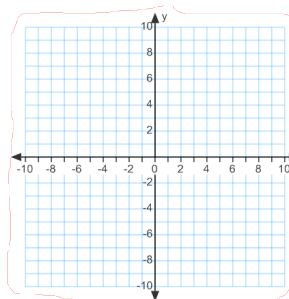
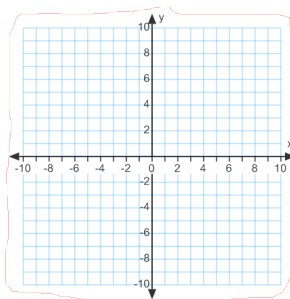
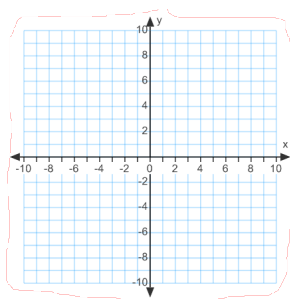
Let  $f(x) = x + 1$  and  $g(x) = x^2$ . Determine the equation of each composite function, graph it, and state its domain and range.

a.  $y = f(g(x))$

b.  $y = g(f(x))$

c.  $y = f(f(x))$

d.  $y = g(g(x))$



Domain:

Domain:

Domain:

Domain:

Range:

Range:

Range:

Range:

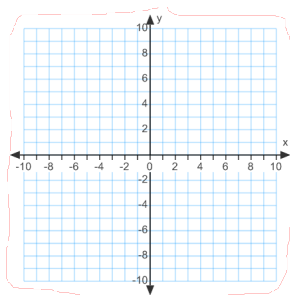
Your Turn: Let  $f(x) = x+1$  and  $g(x) = |x|$ . Determine the equation of each composite function, graph it, and state its domain and range.

a.  $y = f(g(x))$

b.  $y = g(f(x))$

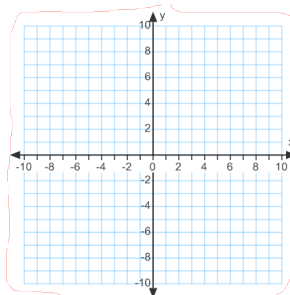
c.  $y = f(f(x))$

d.  $y = g(g(x))$



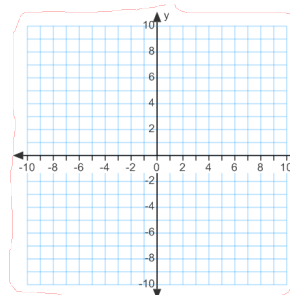
Domain:

Range:



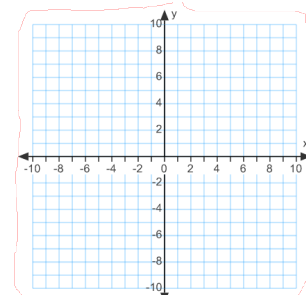
Domain:

Range:



Domain:

Range:



Domain:

Range:

Example 4: If  $h(x) = f(g(x))$ , determine  $f(x)$  and  $g(x)$  .

a.  $h(x) = (x - 2)^2 + (x - 2) + 1$

$$h(x) = (g(x))^2 + (g(x)) + 1$$

b.  $h(x) = \sqrt{x^3 + 1}$



Your Turn: If  $h(x) = f(g(x))$ , determine  $f(x)$  and  $g(x)$  .

a. 
$$h(x) = \sqrt[3]{x} + \frac{3}{3 + \sqrt[3]{x}}$$

Example 5:    Application of Composite Functions

A spherical weather balloon is being inflated. The balloon's radius,  $r$ , in feet, after  $t$  minutes is given by  $r = \sqrt{t}$

$$V(r) = \frac{4}{3} \pi r^3$$

a. Express the volume of the balloon as a function of time,  $t$ .

b. after how many minutes will the volume be  $4000 \text{ ft}^3$ ?

Your Turn:

A spherical weather balloon is being inflated. The balloon's radius,  $r$ , in feet, after  $t$  minutes is given by  $r = \sqrt{t}$

- a. Express the surface area of the balloon as a function of time,  $t$ .

$$SA(r) = 4\pi r^2$$

- b. After how many minutes will the surface area be  $180 \text{ ft}^2$ ?

# Homework

1. Text Pages 507 - 509, Exercises # 1 - 11, 13, 14, 17, 18, 20ab, C3
2. Handout BLM 10-4: "Composite Functions - Extra Practice".



## Attachments

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Translations Assignment 1.doc