

# CHAPTER 4: Combining Functions Examples Booklet

40S Pre-Calculus

Winnipeg Adult Education Centre  
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## Unit Lessons

Lesson 1: Combining Functions Graphically

Lesson 2: Combining Functions Algebraically

Lesson 3: Introduction to Composite Functions

Lesson 4: Determining Restrictions on Composite Functions

## Homework:

Most assignments for practice will be from your workbook: Pearson Pre-Calculus 12. Other assignments will be handed out for marks as needed.

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## Learning Outcomes

At the end of this unit, you should be able to:

- Sketch the graphs of functions that are the sum, difference, product, or quotient of two functions.
- Write the equations of functions that are the sum, difference, product, or quotient of other functions, then determine their domains.
  - As well, estimate the range using graphing technology.
- Evaluate a composition of functions at a given  $x$  value.
- Determine an explicit equation for a composite function.
- Determine the domain of a composite function, including restrictions.

# Key Terms/Vocabulary

Sum

Difference

Product

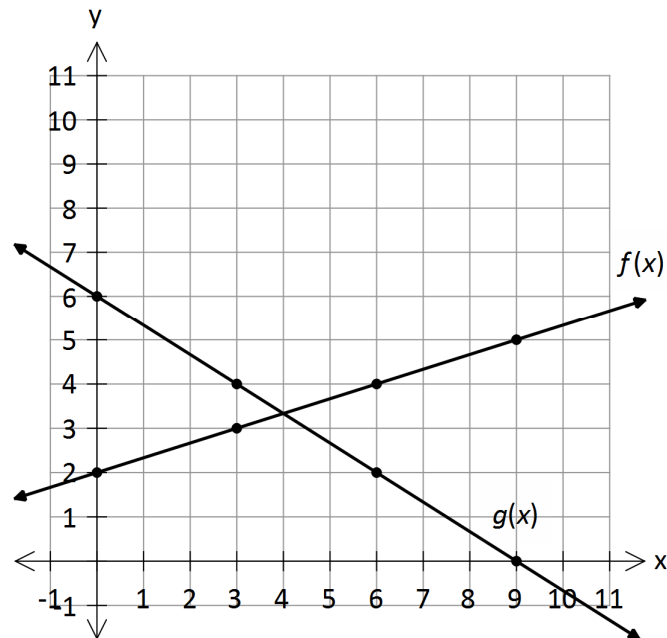
Quotient

Function

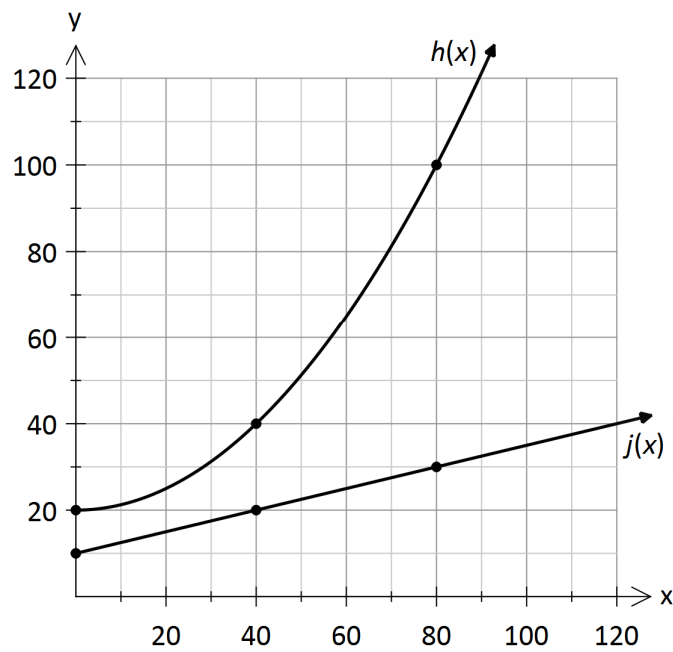
Composite Function

## Lesson 1: Combining Functions Graphically

Example 1: The graphs of  $f(x)$  and  $g(x)$  are shown. On the same grid, sketch the graph of the sum of these two functions:  $y = f(x) + g(x)$ .

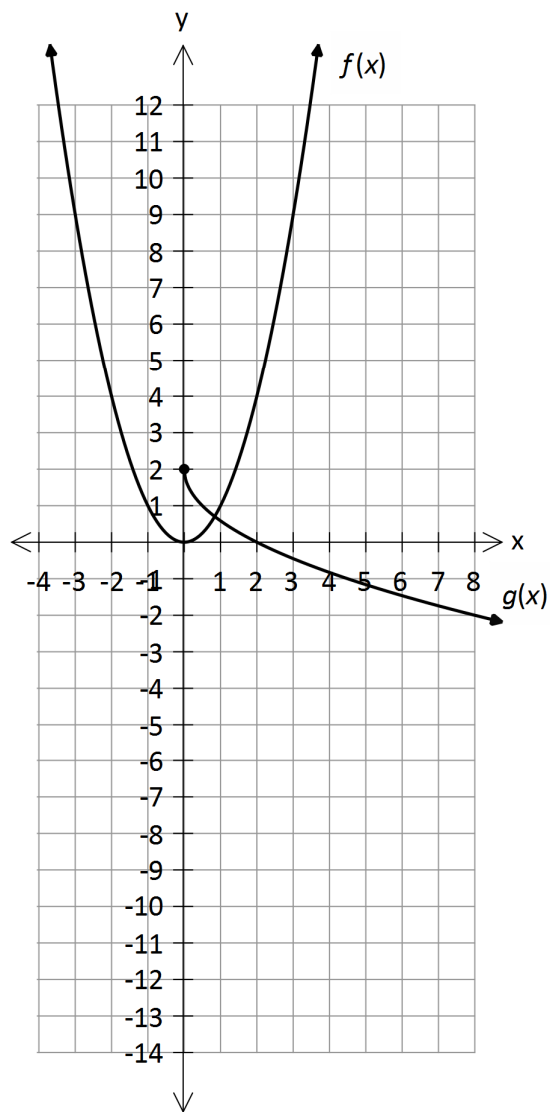


Example 2: The graphs of  $h(x)$  and  $j(x)$  are shown. On the same grid, sketch the graph of the difference of these two functions:  $y = h(x) - j(x)$ .



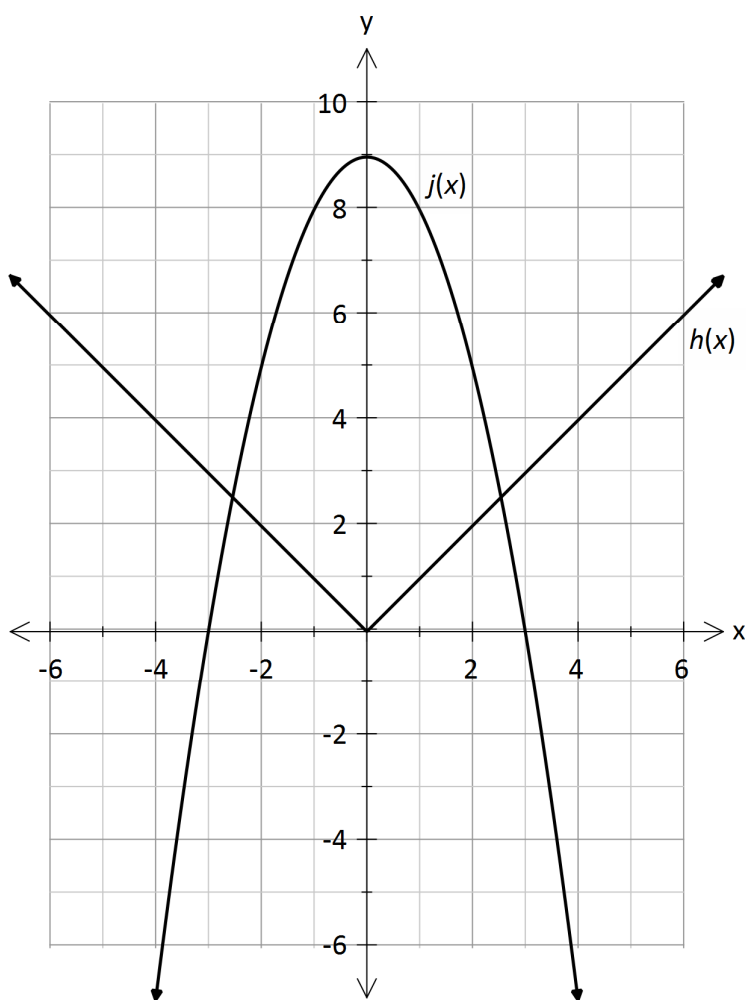
Example 3: The graphs of  $f(x)$  and  $g(x)$  are shown. On the same grid, sketch the graph of the product of these two functions:  $y = f(x) \cdot g(x)$ .

What are the domains of  $f(x)$ ,  $g(x)$ , and  $y = f(x) \cdot g(x)$ ?



Example 4: The graphs of  $h(x)$  and  $j(x)$  are shown. On the same grid, sketch the graph of the quotient of these two functions:  $y = \frac{h(x)}{j(x)}$ .

What are the domains of  $h(x)$ ,  $j(x)$ , and  $y = \frac{h(x)}{j(x)}$ ?



**Assignment Time!** Work on p.268- 1 – 3

## Lesson 2: Combining Functions Algebraically

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Example 1: Use  $f(x) = \sqrt{x-2}$  and  $g(x) = x + 1$ .

- State the domain of  $f(x)$  and of  $g(x)$ .
- Given that  $m(x) = f(x) + g(x)$ , write an explicit equation for  $m(x)$ , then determine its domain.
- Given that  $p(x) = f(x) \cdot g(x)$ , write an explicit equation for  $p(x)$ , then determine its domain.
- \*\*OPTIONAL\*\*** Use graphing technology to graph  $m(x)$  and  $p(x)$ , and use the graphs of each function to estimate the range of both functions.

Example 2: Use  $f(x) = \sqrt{-x}$  and  $g(x) = (x + 2)^2$ .

- State the domain of  $f(x)$  and of  $g(x)$ .
- Given that  $q(x) = \frac{f(x)}{g(x)}$ , write an explicit equation for  $q(x)$ , then determine its domain.
- \*\*OPTIONAL\*\*** Use graphing technology to graph  $q(x)$ , and use the graph to estimate the range of the function.



Example 3: Consider the function:  $m(x) = 2x^2 + 3x - 7$ .

- a) Write explicit equations for three functions  $f(x)$ ,  $g(x)$ , and  $n(x)$  so that  $m(x) = f(x) + g(x) + n(x)$ .
- b) Write explicit equations for two functions  $f(x)$  and  $g(x)$  so that  $m(x) = f(x) - g(x)$ .

Example 4: Consider the function:  $p(x) = x^2 - 2x - 15$ .

- a) Write explicit equations for two functions  $f(x)$ ,  $g(x)$ , so that  $p(x) = f(x) \cdot g(x)$ .
- b) Given that  $q(x) = x + 3$ , write explicit equations for two functions  $f(x)$  and  $g(x)$  so that  $q(x) = \frac{f(x)}{g(x)}$ .

**Assignment Time!** Work on p.278- 3 – 11 (not 5b), MC 1&2

### Lesson 3: Introduction to Composite Functions

Example 1: The tables below define two functions. Use these tables to determine the values requested below the tables.

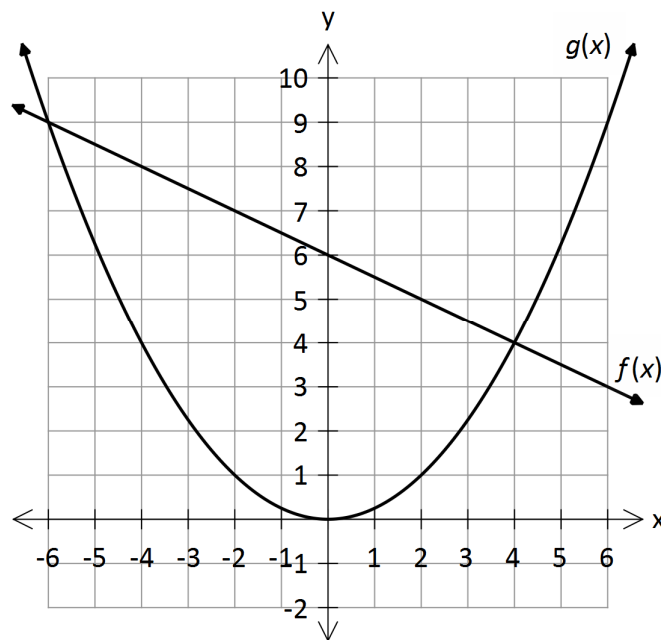
$x$	$f(x)$
-2	8
-1	3
0	0
1	-1
2	0

$x$	$g(x)$
-2	3
-1	2
0	1
1	0
2	1

a)  $f(g(2))$

b)  $g(g(-1))$

Example 2: Given the graphs of  $y = f(x)$  and  $y = g(x)$ , determine the values requested below the graphs.



a)  $g(f(0))$

b)  $f(g(1))$

Example 3: Given the functions  $h(x) = \sqrt{x+5}$  and  $m(x) = (x-1)^2$ , determine the values requested below:

a)  $m(h(4))$

b)  $h(m(13))$

Example 4: Given  $f(x) = x^2 + 3x$  and  $g(x) = 3x - 5$ , determine an explicit equation for each requested composite function, and state the domain of each composite function. (\*\*OPTIONAL\*\* Use graphing technology to graph each composite function and determine the range.)

a)  $f(g(x))$

b)  $g(f(x))$

c)  $f(f(x))$

**Assignment Time!** Work on p.298- 4 – 11, MC 1&2

## Lesson 4: Determining Restrictions on Composite Functions

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Example 1: Use the functions  $f(x) = 2x - 1$  and  $g(x) = x^2 - 2$ .

- State the domain of  $f(x)$  and of  $g(x)$ .
- Use graphing technology to sketch a graph of  $y = g(f(x))$  and determine the domain of this composite function.
- Use graphing technology to sketch a graph of  $y = g(g(x))$  and determine the domain of this composite function.

Example 2: Given the functions  $h(x) = \frac{1}{x-2}$  and  $j(x) = x^2 - x$ , determine an explicit equation of each composite function below, then state its domain.

a)  $j(h(x))$

b)  $h(j(x))$

**\*\*OPTIONAL\*\*** Verify your answers using graphing technology.

Example 3: Given the functions  $f(x) = \sqrt{x}$  and  $g(x) = -x^2 + 2x$ , determine an explicit equation for each composite function below, then state its domain.

a)  $g(f(x))$

b)  $f(g(x))$

**\*\*OPTIONAL\*\*** Verify your answers using graphing technology.

Example 4: For each function, determine possible functions  $f$  and  $g$  so that  $y = f(g(x))$ .

a)  $y = \frac{1}{\sqrt{x}}$

b)  $y = |2x - 1|^5$

**Assignment Time!** Work on p.314- 3, 4, 6, 8a, 10, MC 1&2