

## Lesson 4.1 Math Lab: Assess Your Understanding, pages 268–271

1. Use the graphs of  $y = f(x)$  and  $y = g(x)$  on page 269 to sketch the graph of each function below, then identify its domain and range. Estimate the range, where necessary.

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

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

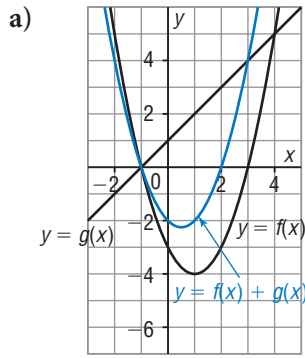
c)  $y = f(x) \cdot g(x)$

d)  $y = \frac{f(x)}{g(x)}$

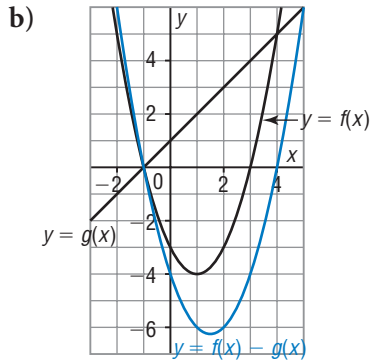


From the graphs:

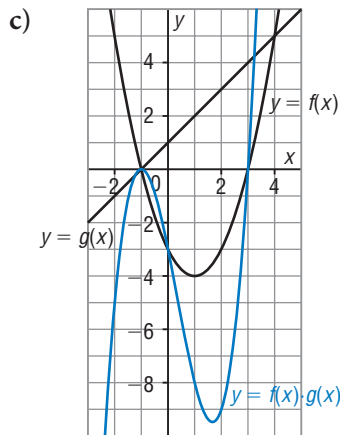
$x$	$f(x)$	$g(x)$	$f(x) + g(x)$	$f(x) - g(x)$	$f(x) \cdot g(x)$	$\frac{f(x)}{g(x)}$
-2	5	-1	4	6	-5	-5
-1	0	0	0	0	0	undefined
0	-3	1	-2	-4	-3	-3
1	-4	2	-2	-6	-8	-2
2	-3	3	0	-6	-9	-1
3	0	4	4	-4	0	0
4	5	5	10	0	25	1



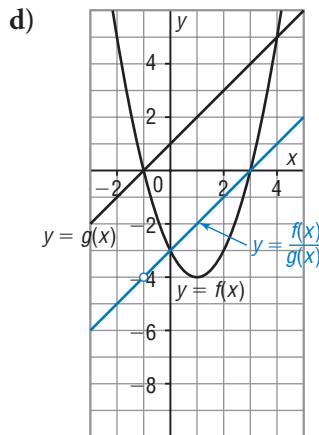
**Plot points at:**  $(-2, 4), (-1, 0), (0, -2), (1, -2), (2, 0), (3, 4)$   
**Join the points with a smooth curve.**  
**Domain:**  $x \in \mathbb{R}$   
**Range:**  $y \geq -2.25$



**Plot points at:**  $(-2, 6), (-1, 0), (0, -4), (1, -6), (2, -6), (3, -4), (4, 0)$   
**Join the points with a smooth curve.**  
**Domain:**  $x \in \mathbb{R}$   
**Range:**  $y \geq -6.25$



**Plot points at:**  $(-2, -5), (-1, 0), (0, -3), (1, -8), (2, -9), (3, 0)$   
**Join the points with a smooth curve.**  
**Domain:**  $x \in \mathbb{R}$   
**Range:**  $y \in \mathbb{R}$

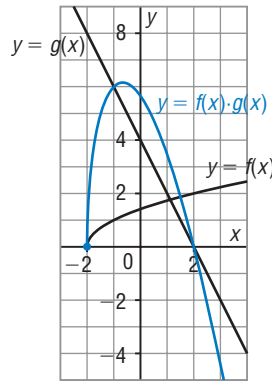


**Plot points at:**  $(-2, -5), (0, -3), (1, -2), (2, -1), (3, 0), (4, 1)$   
**Since these points lie on a line, draw an open circle at  $(-1, -4)$ , then draw a line through the points.**  
**Domain:**  $x \neq -1$   
**Range:**  $y \neq -4$

2. Use the graphs of  $y = f(x)$  and  $y = g(x)$ .
- a) State the domain and range of  $y = f(x)$ .



From the graph:  
domain:  $x \geq -2$ ; range:  $y \geq 0$



- b) State the domain and range of  $y = g(x)$ .



From the graph:  
domain:  $x \in \mathbb{R}$ ; range:  $y \in \mathbb{R}$

- c) Sketch the graph of  $y = f(x) \cdot g(x)$ .



From the graphs:

$x$	$f(x)$	$g(x)$	$f(x) \cdot g(x)$
-2	0	8	0
-1	1	6	6
0	$\approx 1.4$	4	$\approx 5.6$
1	$\approx 1.7$	2	$\approx 3.4$
2	2	0	0
3	$\approx 2.2$	-2	$\approx -4.4$

Plot points at:  $(-2, 0)$ ,  $(-1, 6)$ ,  $(0, 5.6)$ ,  $(1, 3.4)$ ,  $(2, 0)$ ,  $(3, -4.4)$   
Join the points with a smooth curve.

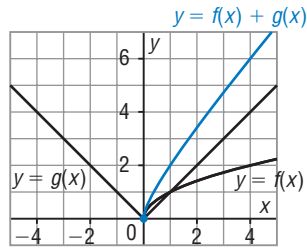
- d) What is the domain of  $y = f(x) \cdot g(x)$ ? How is it related to the domains of  $y = f(x)$  and  $y = g(x)$ ?



The domain of  $y = f(x) \cdot g(x)$  is:  $x \geq -2$

This domain is the same as the domain of  $y = f(x)$ . It is not equal to the domain of  $y = g(x)$ , which is all real numbers, because the graph of  $y = f(x) \cdot g(x)$  does not extend to the left of  $x = -2$ .

3. Use the graphs of  $y = f(x)$  and  $y = g(x)$ .



a) What are the domain and range of  $y = f(x)$ ?

The domain is:  $x \geq 0$   
The range is:  $y \geq 0$

b) What are the domain and range of  $y = g(x)$ ?

The domain is:  $x \in \mathbb{R}$   
The range is:  $y \geq 0$

c) Consider the function  $h(x) = f(x) + g(x)$ . Without graphing, determine the domain and the range of this function and justify your answer.

The domain of  $h(x)$  is the same as the domain of  $f(x)$ , because  $x$  cannot be negative; that is,  $x \geq 0$ .  
The range of  $h(x)$  is the same as the ranges of  $f(x)$  and  $g(x)$ ; that is, all real numbers greater than or equal to 0:  $y \geq 0$ .

d) Use the graphs in parts a and b to sketch the graph of  $h(x)$ . Use the graph to verify the domain and range.

From the graphs:

$x$	$f(x)$	$g(x)$	$f(x) + g(x)$
0	0	0	0
1	1	1	2
2	$\doteq 1.4$	2	$\doteq 3.4$
3	$\doteq 1.7$	3	$\doteq 4.7$
4	2	4	6

Plot points at:  $(0, 0)$ ,  $(1, 2)$ ,  $(2, 3.4)$ ,  $(3, 4.7)$ ,  $(4, 6)$

Join the points with a smooth curve.

From the graphs, the domain and range are the same as given in part c.