

## UNIT 3 • LINEAR AND EXPONENTIAL FUNCTIONS

### Lesson 7: Operating on Functions and Transformations

#### Instruction

#### Guided Practice 3.7.2

##### Example 1

Graph the following functions on the same set of axes:

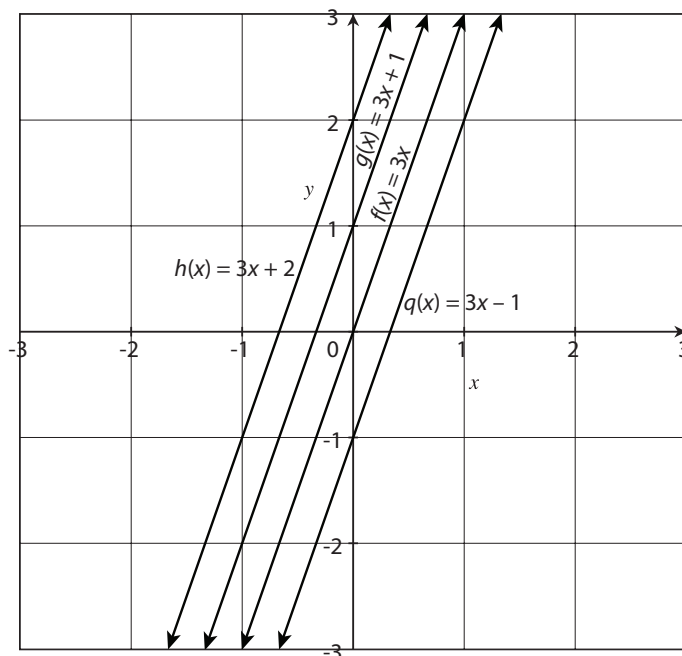
$$f(x) = 3x$$

$$h(x) = 3x + 2$$

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

$$q(x) = 3x - 1$$

1. Graph the functions.



2. What is the  $y$ -intercept of  $f(x)$ ?  $g(x)$ ?  $h(x)$ ?  $q(x)$ ?

The  $y$ -intercept of  $f(x)$  is 0.

The  $y$ -intercept of  $g(x)$  is 1.

The  $y$ -intercept of  $h(x)$  is 2.

The  $y$ -intercept of  $q(x)$  is -1.

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3. How could you describe the translation of  $h(x)$  from  $f(x)$ ?

The graph of  $h(x)$  is shifted up 2 units from the graph of  $f(x)$ .



4. How could you describe the translation of  $q(x)$  from  $f(x)$ ?

The graph of  $q(x)$  is shifted down 1 unit from the graph of  $f(x)$ .



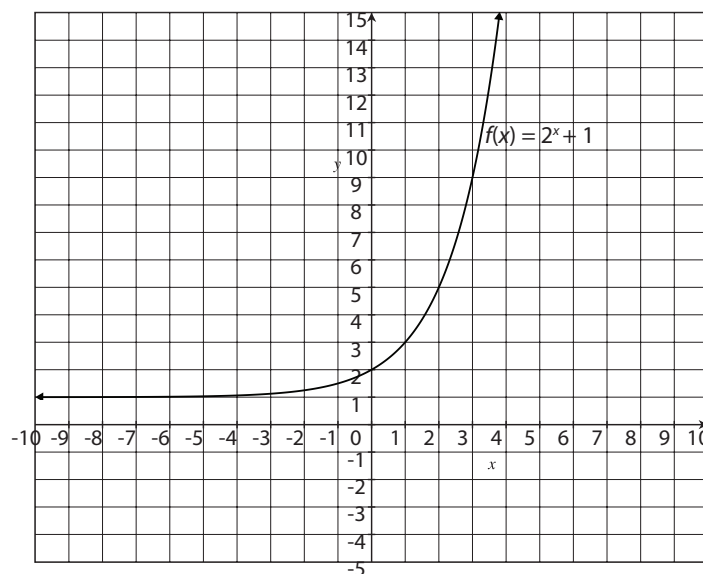
5. How could you describe the translation of  $q(x)$  from  $g(x)$ ?

The graph of  $q(x)$  is shifted down 2 units from the graph of  $g(x)$ .



#### Example 2

Given  $f(x) = 2^x + 1$  and the graph of  $f(x)$  below, graph  $g(x) = f(x) - 5$ .

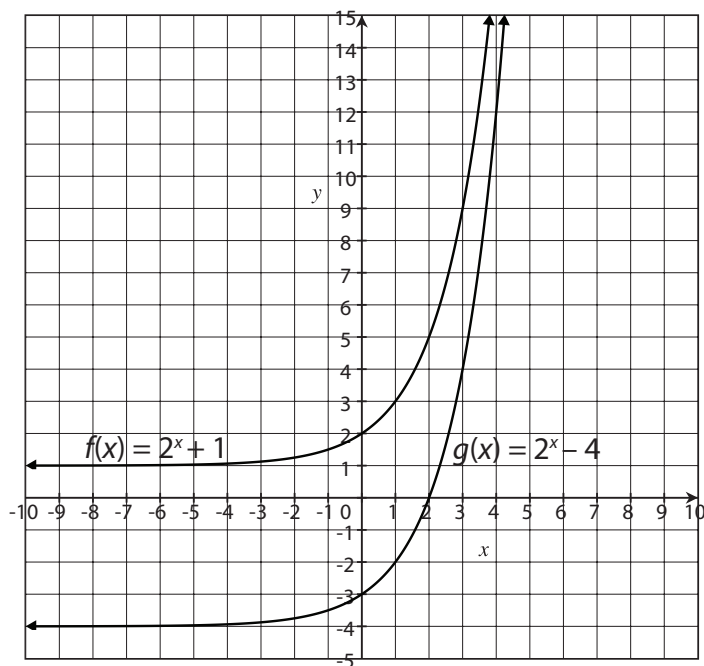


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1. Graph  $g(x)$ .



2. How are  $f(x)$  and  $g(x)$  related?

$g(x)$  is a vertical shift down 5 units of  $f(x)$ .

3. What are the steps you need to follow to graph  $g(x)$ ?

For each point on  $f(x)$ , plot a point 5 units lower on the graph and connect the points.



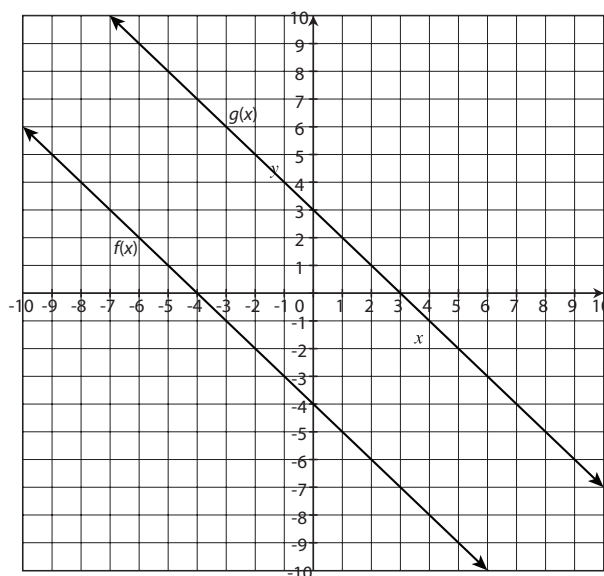
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#### Example 3

The graphs of two functions  $f(x)$  and  $g(x)$  are shown below. Write a rule for  $g(x)$  in terms of  $f(x)$ .



1. Write a function rule for the graph of  $f(x)$ .

$$f(x) = -x - 4$$



2. Write a function rule for the graph of  $g(x)$ .

$$g(x) = -x + 3$$



3. How are  $f(x)$  and  $g(x)$  related?

$g(x)$  is a vertical shift up 7 units from  $f(x)$ , since the vertical distance is the distance between the  $y$ -intercepts  $(-4$  and  $3)$ , and  $3 - (-4) = 7$ . You could also count the units on the graph.



4. Write a function rule for  $g(x)$  in terms of  $f(x)$ .

$$g(x) = f(x) + 7$$



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#### Problem-Based Task 3.7.2: Gym Fees

Paulo and Justin belong to the same gym. The graph below shows how much each man pays per month in gym fees. Both pay the same per-hour use fee, but Paulo gets an employee discount, so his monthly membership fee is different from Justin's membership fee. What is a function rule that represents Paulo's total monthly gym fees? What is a function rule that represents Justin's total monthly gym fees? What is the difference in their fees?

