EXAMPLE 4 Compare graphs with the graph $f(x) = x$

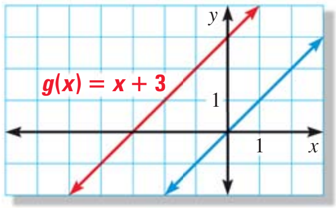
Graph the function. Compare the graph with the graph of $f(x) = x$.

a. $g(x) = x + 3$

b. $h(x) = 2x$

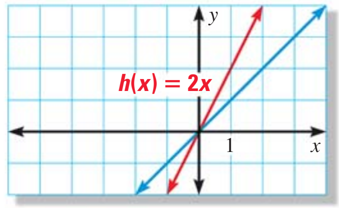
Solution

a.



Because the graphs of **g** and **f** have the same slope, $m = 1$, the lines are parallel. Also, the y-intercept of the graph of g is 3 more than the y-intercept of the graph of f.

b.



Because the slope of the graph of **h** is greater than the slope of the graph of **f**, the graph of h rises faster from left to right. The y-intercept for both graphs is 0, so both lines pass through the origin.

✓ GUIDED PRACTICE for Example 4

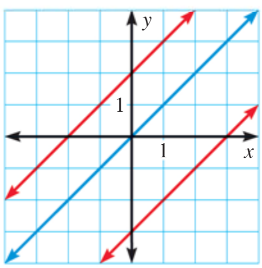
3. Graph $h(x) = -3x$. Compare the graph with the graph of $f(x) = x$.

CONCEPT SUMMARY *For Your Notebook*

Comparing Graphs of Linear Functions with the Graph of $f(x) = x$

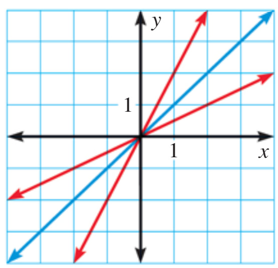
Changing m or b in the general linear function $g(x) = mx + b$ creates families of linear functions whose graphs are related to the graph of $f(x) = x$.

$g(x) = x + b$



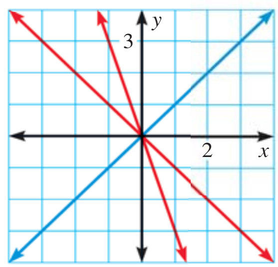
- The graphs have the same slope, but different y-intercepts.
- Graphs of this family are vertical translations of the graph of $f(x) = x$.

$g(x) = mx$ where $m > 0$



- The graphs have different (positive) slopes, but the same y-intercept.
- Graphs of this family are vertical stretches or shrinks of the graph of $f(x) = x$.

$g(x) = mx$ where $m < 0$



- The graphs have different (negative) slopes, but the same y-intercept.
- Graphs of this family are vertical stretches or shrinks with reflections in the x-axis of the graph of $f(x) = x$.