NAME ______________________________

independent practice

Module 9 Using Functions
Lesson 6 Evaluating Composite Functions

Evaluate.

1. $(f \circ g)(4)$ and $(g \circ f)(4)$
$f(x) = -5x$
$g(x) = x + 6$

$(f \circ g)(4) = -50$

$(g \circ f)(4) = -14$

2. $(f \circ g)(-3)$ and $(g \circ f)(-3)$
$f(x) = x + 6$
$g(x) = x - 1$

$(f \circ g)(-3) = 2$

$(g \circ f)(-3) = 2$

3. $(f \circ g)(2)$ and $(g \circ f)(2)$
$f(x) = -x - 4$
$g(x) = x + 5$

$(f \circ g)(2) = -11$

$(g \circ f)(2) = -1$

4. $(f \circ g)(-6)$ and $(g \circ f)(-6)$
$f(x) = x - 2$
$g(x) = x - 8$

$(f \circ g)(-6) = -16$

$(g \circ f)(-6) = -16$

5. $(f \circ g)(0)$ and $(g \circ f)(0)$
$f(x) = x^3$
$g(x) = x^2$

$(f \circ g)(0) = 0$

$(g \circ f)(0) = 0$

6. $(f \circ g)(4)$ and $(g \circ f)(4)$
$f(x) = 3x$
$g(x) = \frac{x}{x - 3}$

$(f \circ g)(4) = 12$

$(g \circ f)(4) = \frac{4}{3}$

7. $(f \circ g)(-8)$ and $(g \circ f)(-8)$
$f(x) = x^2 - 20$
$g(x) = 4$

$(f \circ g)(-8) = -4$

$(g \circ f)(-8) = 4$

8. $(f \circ g)(2)$ and $(g \circ f)(2)$
$f(x) = \frac{3}{x - 4}$
$g(x) = 2x$

$(f \circ g)(2)$ is undefined

$(g \circ f)(2) = -3$

For each pair of functions, find $f(g(x))$ and $g(f(x))$.

9. $f(x) = -6x$
$g(x) = 3x$

$f(g(x)) = -18x$

$g(f(x)) = -18x$

10. $f(x) = x - 1$
$g(x) = -5x$

$f(g(x)) = -5x - 1$

$g(f(x)) = -5x + 5$

11. $f(x) = -x^2$
$g(x) = 2x$

$f(g(x)) = -4x^2$

$g(f(x)) = -2x^2$

12. $f(x) = -2\sqrt{x}$
$g(x) = 9x^2$

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

$g(f(x)) = 36x$

13. $f(x) = \frac{x + 2}{x - 2}$
$g(x) = 2$

$f(g(x))$ is undefined

$g(f(x)) = 2$

14. $f(x) = 2x^2$
$g(x) = x + 3$

$f(g(x)) = 2x^2 + 12x + 18$

$g(f(x)) = 2x^2 + 3$

15. $f(x) = \frac{x}{3}$
$g(x) = 9x$

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

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

16. $f(x) = 10$
$g(x) = \sqrt{x + 15}$

$f(g(x)) = 10$

$g(f(x)) = 5$

Determine whether the given functions are inverse functions.

17. $f(x) = 4x + 3$
$g(x) = 4x - 3$

$f(g(x)) = 16x - 9$

$g(f(x)) = 16x + 9$

The functions are NOT inverses.

18. $f(x) = 3x$
$g(x) = \frac{x}{3}$

$f(g(x)) = x$

$g(f(x)) = x$

The functions ARE inverses.

19. $f(x) = 4x + 8$
$g(x) = \frac{1}{4}x - 2$

$f(g(x)) = x$

$g(f(x)) = x$

The functions ARE inverses.

20. $f(x) = -2x + 1$
$g(x) = 2x - 1$

$f(g(x)) = -4x + 3$

$g(f(x)) = -4x + 1$

The functions are NOT inverses.

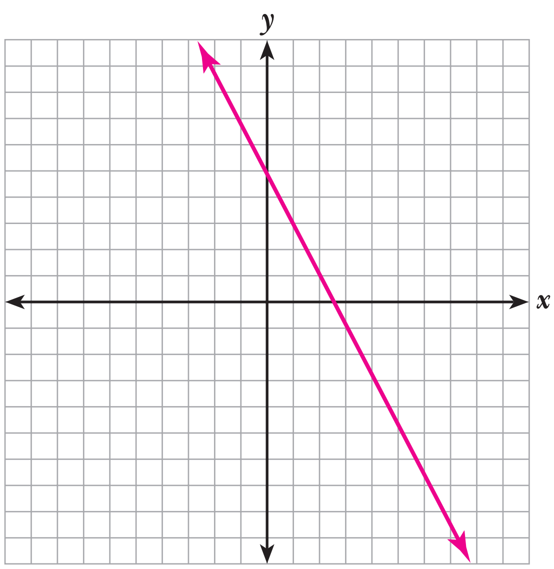
Journal

1. A student claims that the composition of the functions $f(x) = x + a$ and $g(x) = x + b$, where a and b are constants, is $f(g(x)) = x + (b + a)$. Prove or disprove their theory.
2. A manufacturer of big-screen TVs is offering a $100 and 10% off. If p is the original price of the television, write composite functions showing the discounts taken in both orders. Which discount should a smart customer insist be applied first? Explain.
3. A legislator wants to pass a bill in which a $100 million budget is decreased by 10% each year for two years. The legislator believes this action will reduce the budget to $80 million. Do you agree? Explain.
4. In this lesson, the sale price of Lizzie's shoes was found using the composite function $f(g(x)) = 0.32x$, showing two successive discounts of 60% and 20%. Write a general rule to show a composite function that can be used to find the sale price of an item after successive discounts of m% and n%. Explain your steps.
5. When is a composite function undefined? Give an example of functions $f(x)$ and $g(x)$ such that $f(g(x))$ is defined but $g(f(x))$ is not defined, in the real number system.

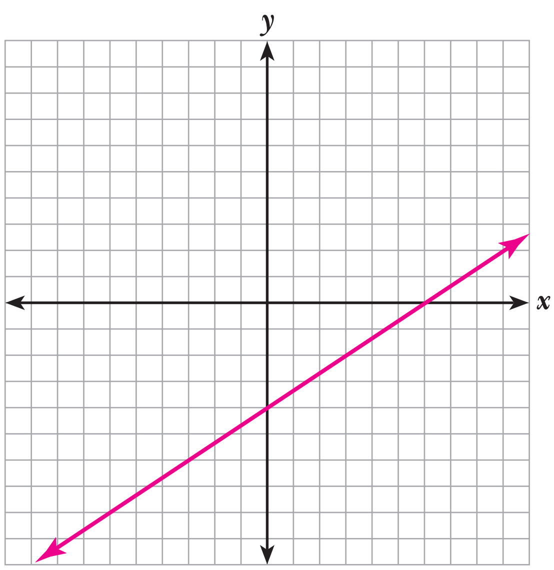
Cumulative Review

Graph each linear equation.

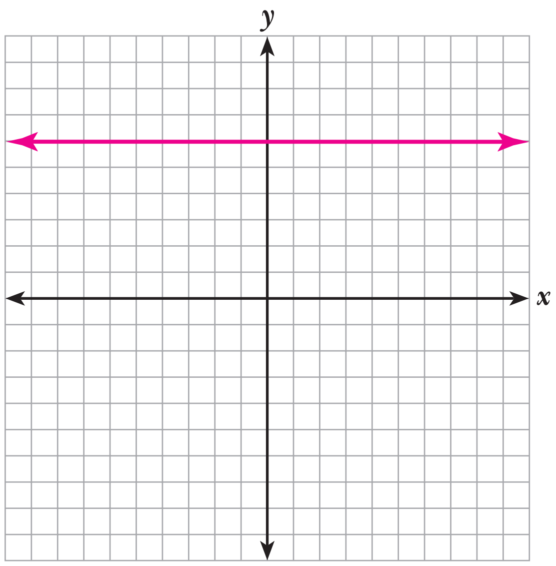
1. $y = -2x + 5$



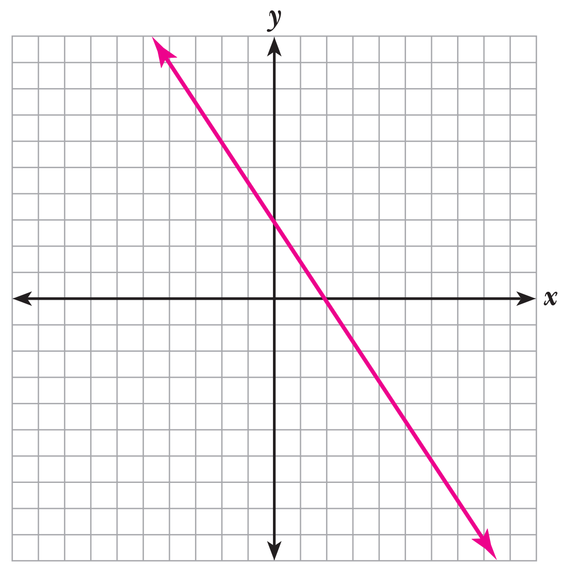
2. $y = \frac{2}{3}x - 4$



3. $y = 6$



4. $3x + 2y = 6$



Solve.

5. $2x + 4 = -4x + 4$

$x = 0$

6. $3(x + 2) = 8x - 9$

$x = 3$

7. $-x + 4 = -2x + 10$

$x = 6$

8. $\frac{1}{2}x - 8 = 5x + 1$

$x = -2$

9. $3x - 4 = 6x - 6$

$x = \frac{2}{3}$

10. $3(-2x + 6) = -4x + 2$

$x = 8$

Possible Journal Response

1. The student is correct. Using $x + b$ to evaluate $f(x) = x + a$ gives $f(x + b) = (x + b) + a$. According to the Associative Property, $(x + b) + a$ is equal to $x + (b + a)$.
2. If $g(p)$ shows the \$100 discount, and $f(p)$ shows the 10% discount, then $f(g(p)) = 0.1(p - 100) = 0.1p - 10$ and $g(f(p)) = 0.1p - 100$. No matter what p is, $g(f(p))$ is always less than $f(g(p))$ by \$90. The smart customer will insist that the 10% discount be taken first.
3. The bill should be carefully worded. Reducing the budget by 10% the first year results in 0.9(\$100 million) = \$90 million. Reducing the budget by 10% of that amount in the following year results in 0.9(\$90 million) = \$81 million, and the budget is reduced by only 19%.
4. To write the general rule, first express each discount as a fraction. An m% discount means $\frac{100 - m}{100}$ of the original price is being paid. A n% discount means $\frac{100 - n}{100}$ of the original price is being paid. To compose the functions, find the product. The sale price of the item after both discounts are applied is $\left(\frac{100 - m}{100}\right)\left(\frac{100 - n}{100}\right)$.
5. A composite function is undefined when the "inner" function produces an output that is not valid in the "outer" function. For example, if $f(x) = -10$ and $g(x) = \sqrt{x}$, then $g(f(x)) = \sqrt{-10}$ which is undefined. $f(g(x)) = -10$.