



UNDERSTAND

12. **Generalize** Does $f \circ g$ always equal $g \circ f$? Justify your response.
13. **Construct Arguments** Explain why the domain for the quotient of functions might not be the set of all real numbers.
14. **Error Analysis** Describe and correct the error a student made in finding the rule for the composition $f \circ g$ of the functions $f(x) = 3x^2 - x + 2$ and $g(x) = 2x + 1$.

$$\begin{aligned} f \circ g &= f(g(x)) \\ &= 3(2x + 1)^2 - 2x + 1 + 2 \\ &= 3(4x^2 + 4x + 1) - 2x + 1 + 2 \\ &= 12x^2 + 12x + 3 - 2x + 1 + 2 \\ &= 12x^2 + 10x + 6 \end{aligned}$$



15. **Make Sense and Persevere** Identify the rules for two functions, $f(x)$ and $g(x)$, for which $f \circ g = g \circ f$.
16. **Higher Order Thinking** Suppose two functions, $f(x)$ and $g(x)$ are only defined by the ordered pairs listed below.

 $f = (6, 7), (5, 2), (4, 1), (10, 8)$
 $g = (5, 4), (3, 6), (1, 5), (2, 10)$
 Find the ordered pairs that comprise $(f \circ g)(x)$.
17. **Mathematical Connections** How is the process of finding the rule for the composition of functions related to the order of operations in arithmetic?
18. **Make Sense and Persevere** Recalling that the identity function is $f(x) = x$, identify the rules for two functions $f(x)$ and $g(x)$, for which $f(g(x)) = x$.
19. **Construct Arguments** Is it possible that the result of subtracting two linear functions is a horizontal line? If so, give an example. What must be true about the two linear functions? If not, explain why it is not possible.

PRACTICE

Let $f(x) = 2x^2 + 5x - 1$ and $g(x) = 3x + 2$. Identify the rules for the following functions. SEE EXAMPLE 1

20. $f + g$ 21. $f - g$

22. Suppose the demand d , in units sold, for a company's jeans at price x , in dollars, is $d(x) = 600 - 4x$.



- a. If revenue = price \times demand, write the rule for the function $r(x)$, which represent the company's expected revenue in jean sales. Then state the domain of this function.
- b. If the price is \$40, how much revenue will the company earn? SEE EXAMPLE 2

23. Identify the rule and domain for $\frac{f}{g}$ when $f(x) = x^2 + 3x - 28$ and $g(x) = x + 7$.
SEE EXAMPLE 3

Let $f(x) = 4x - 5$ and $g(x) = -7x$. Identify the rules for the following functions. SEE EXAMPLE 4

24. $f(g(3))$ 25. $f(g(x))$

26. $g(f(2))$ 27. $g(f(x))$

Let $f(x) = x^2 + x$ and $g(x) = 9 - 2x$. Identify the rules for the following functions. SEE EXAMPLE 5

28. $f \circ g$ 29. $g \circ f$

30. A sporting goods store is running a summer sale on its snowboards. Kayden is interested in a snowboard that normally costs \$400. The store is offering a \$50 instant rebate, as well as a 10% discount. In which order should these special offers be applied to the cost of the snowboard in order to benefit Kayden? Explain. SEE EXAMPLE 6



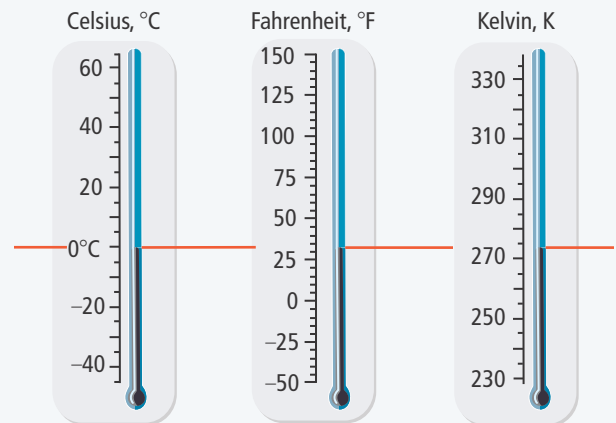
APPLY

- 31. Model With Mathematics** The cost (in dollars) to produce x shovels in a factory is given by the function $C(x) = 20x + 500$. The number of shovels that can be produced in h hours is given by the function $x(h) = 30h$.
- Find the rule for $C(x(h))$.
 - Find the cost when $h = 8$ hours.
 - Explain what the answer to part (b) represents.
- 32. Use Structure** A music store is running the following promotions.

- Use composition of functions to find the sale price of a \$90 purchase when the \$5 off discount is applied prior to the 15% off discount.
 - Use composition of functions to find the sale price of a \$90 purchase when the 15% off discount is applied prior to the \$5 off discount.
 - In which order is the deal better for the consumer? Explain.
- 33. Reason** From 2000 to 2015, the number of births, b , (in the hundreds) in Fairfield County can be modeled by the function $b(x) = 300 - 5x$. The number of deaths, d , (in the hundreds) can be modeled by the function $d(x) = 10x + 5$. The variable x represents the number of years since 2000.
- Which function operation can be used to represent the net increase in the population?
 - Write and simplify a function which represents the net increase in the population, p , against x , the number of years since 2000. State the domain of this function.

ASSESSMENT PRACTICE

- 34.** Given that $f(x) = x^2 + 8x + 3$ and $g(x) = -x - 7$, which of the following are true? Select all that apply.
- $f + g = x^2 + 7x - 4$
 - $f(g(x)) = x^2 + 6x - 4$
 - The domain of $\frac{f}{g}$ is the set of all real numbers.
 - $f(x) \cdot g(x) = -x^3 - 15x^2 + 53x + 21$
 - In the composition $g \circ f$, the output $f(x)$ is used as the input for g .
- 35. SAT/ACT** Find the value of $f(g(5))$ if $f(x) = 4x + 1$ and $g(x) = x^2 + 6$.
- 101
 - 124
 - 125
 - 676
 - 682
- 36. Performance Task** The temperature in degrees Celsius is 32 less than the Fahrenheit temperature, multiplied by five ninths. The temperature in degrees Kelvin is the number of degrees Celsius plus 273.



Part A Derive a conversion formula for finding the number of degrees Kelvin, given the temperature in Fahrenheit.

Part B Using your conversion formula from part (a), find the temperature in degrees Kelvin when the temperature is 27°F. Round to the nearest whole number if necessary.