PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

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 $g(x) = 2x + 1$.

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

✗

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 $d(x) = 600 - 4x$.

Revenue = Price × Demand

a. If revenue = price × 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

PRACTICE & PROBLEM SOLVING

APPLY

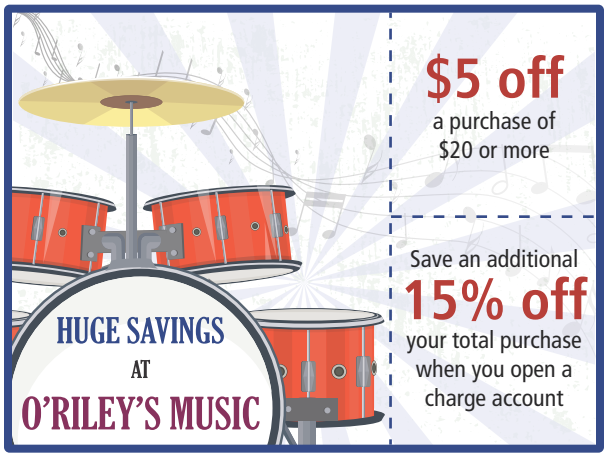
31. Model With Mathematics The cost (in dollars) to produce x shovels in a factory is given by the function $C(x) = 20x + 500$. The number of shovels that can be produced in h hours is given by the function $x(h) = 30h$.

a. Find the rule for $C(x(h))$.

b. Find the cost when $h = 8$ hours.

c. Explain what the answer to part (b) represents.

32. Use Structure A music store is running the following promotions.



a. 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.

b. 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.

c. 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.

a. Which function operation can be used to represent the net increase in the population?

b. 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.

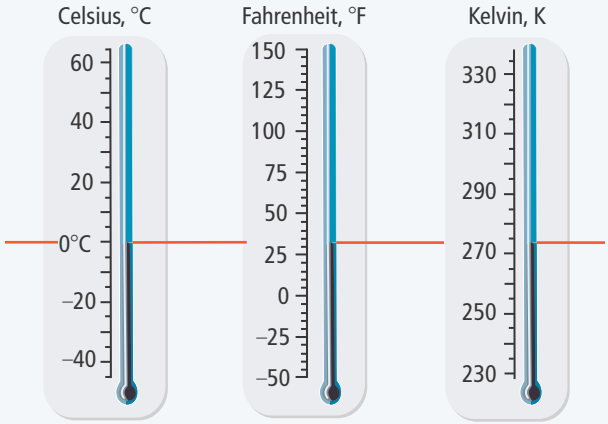
Ⓓ $f(x) \cdot g(x) = -x^3 - 15x^2 + 53x + 21$

Ⓔ 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.