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b. $(3 - \sqrt{x+2})^2 = 4$

d. $3 + 5\sqrt{1 + 2x^2} = 13$

$x = \sqrt{3/2}$

$x = -\sqrt{3/2}$

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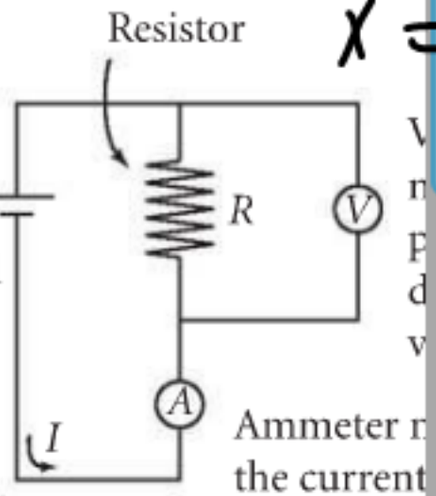

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$$3 + 5\sqrt{1+2x^2} = 13$$
$$-3 \qquad\qquad -3$$
$$\frac{5\sqrt{1+2x^2}}{5} = \frac{10}{5}$$
$$\left(\sqrt{1+2x^2}\right)^2 = (2)^2$$
$$1+2x^2 = 4$$
$$-1 \qquad -1$$
$$\frac{2x^2}{2} = \frac{3}{2}$$
$$\sqrt{x^2} = \sqrt{\frac{3}{2}}$$
$$|x| = \sqrt{\frac{3}{2}}$$

b. the swimmer's oxygen consumption at a swimming speed of 1.5 m/s

c. the swimmer's oxygen consumption after 40 s of swimming

$g = 3 + 2x$

4. Identify each equation as a composition of functions, a product of functions, or neither. If it is a composition or a product, then identify the two functions that combine to create the equation.

$f(g(x))$

$f(x) \cdot g(x)$

a. $y = 5\sqrt{3 + 2x}$

b. $y = 3 + (|x + 5| - 3)^2$

c. $y = (x - 5)^2(2 - \sqrt{x})$

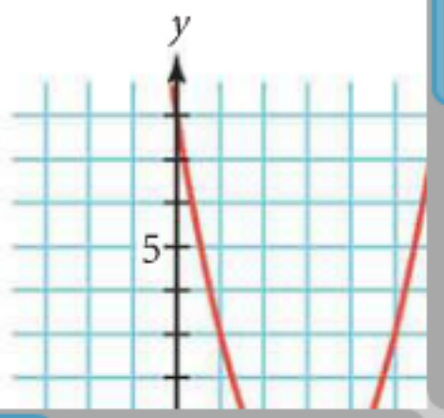
→ Composition

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

$g(x) = |x+5| - 3$

Reason and Apply

5. Consider the graph at right.



a. Write an equation for this graph.

b. Write two functions, f and g, such that the figure is the graph of $y = f(g(x))$.

6. The functions f and g are defined by these sets of input and

Unit 4 Linear Systems

- equations
  - Section 3.6 ⇒ Graphing & tables
  - Section 3.7 ⇒ Substitution & Elimination
- inequalities
  - Section 6.5 ⇒ Graphing
  - Section 6.6 ⇒ Linear Programming
    - Using system of inequalities to optimize a situation

Darcy is looking for a job. Job A offers $7.50/hr with a 50¢ raise every 6 months. Job B offers $10/hr with a 25¢ raise every year. Which job should Darcy take?

year	A	B
0	7.50	10.00
1	8.50	10.25
2	9.50	10.50
3	10.50	10.75
4	11.50	11.00

B ↑ A ↓

Recursive formulas

A

$u_0 = 7.50$

$u_n = u_{n-1} + 1$

B

$u_0 = 10$

$u_n = u_{n-1} + 0.25$

explicit form (equation)

x = # yrs y = salary

$y = 7.50 + 1x$ $y = 10 + 0.25x$

System of equations

2 or more equations where the variables stand for the same thing

- Solution to a system
  - Point that makes all equations true
  - table ⇒ x where the y's are the same
  - graph ⇒ where the lines cross

	A	B
3	10.5	10.5

a. $y = 5\sqrt{3 + 2x}$

b. $y = 3 + (|x + 5| - 3)^2$ @

c. $y = (x - 5)^2(2 - \sqrt{x})$

Reason and Apply

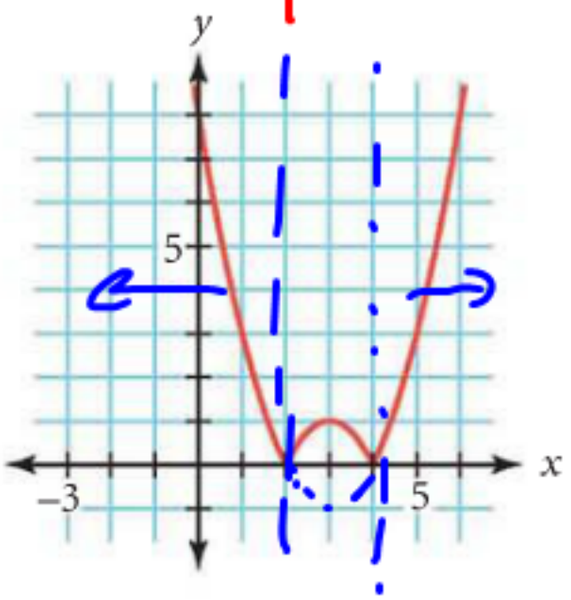
5. Consider the graph at right.

a. Write an equation for this graph.

b. Write two functions, f and g, such that the figure is the graph of $y = f(g(x))$.

$f(x) = |x|$ $\quad g(x) = (x-3)^2 - 1$

$y = |(x-3)^2 - 1|$



6. The functions f and g are defined by these sets of input and output values:

$g = \{(1, 2), (-2, 4), (5, 5), (6, -2)\}$

$f = \{(2, 1), (4, -2), (5, 5), (-2, 6)\}$

a. Find $g(f(2))$. @

b. Find $f(g(6))$

2. The functions f and g are defined by these sets of input and output values.

$g = \{(1, 2), (-2, 4), (5, 5), (6, -2)\}$

$f = \{(0, -2), (4, 1), (3, 5), (5, 0)\}$

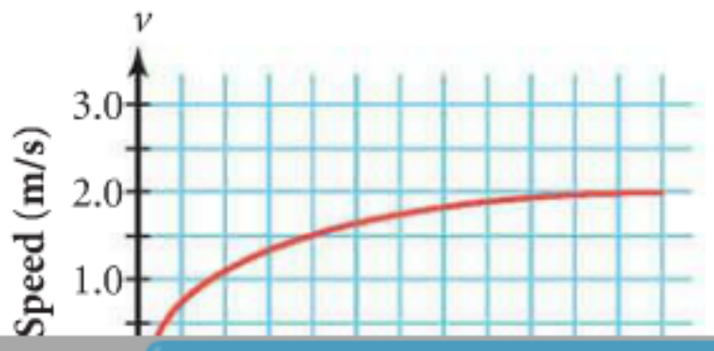
a. Find $g(f(4))$.

b. Find $f(g(-2))$.

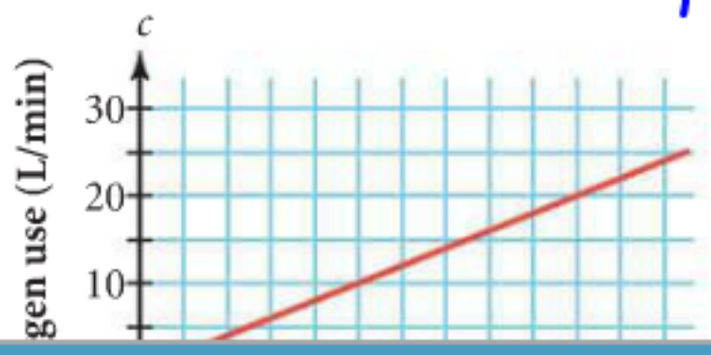
c. Find $f(g(f(3)))$.

3. **APPLICATION** Graph A shows a swimmer's speed as a function of time. Graph B shows the swimmer's oxygen consumption as a function of her speed. Time is measured in seconds, speed in meters per second, and oxygen consumption in liters per minute. Use the graphs to estimate the values.

Graph A



Graph B



Darcy is looking for a job. Job A offers $10/hr and a 25¢ raise every year. Job B offers $7.50/hr and a 50¢ raise every 6 months. Which job should she take?

year	A	B
0	10	7.50
1	10.25	8.50
2	10.50	9.50
3	10.75	10.50
4	11.00	11.50

A

B

recursive

A: $u_0 = 10$, $u_1 = u_{n-1} + 0.25$

B: $u_0 = 7.5$, $u_n = u_{n-1} + 1$

x = # yrs y = salary

explicit equation

A: $y = 10 + 0.25x$

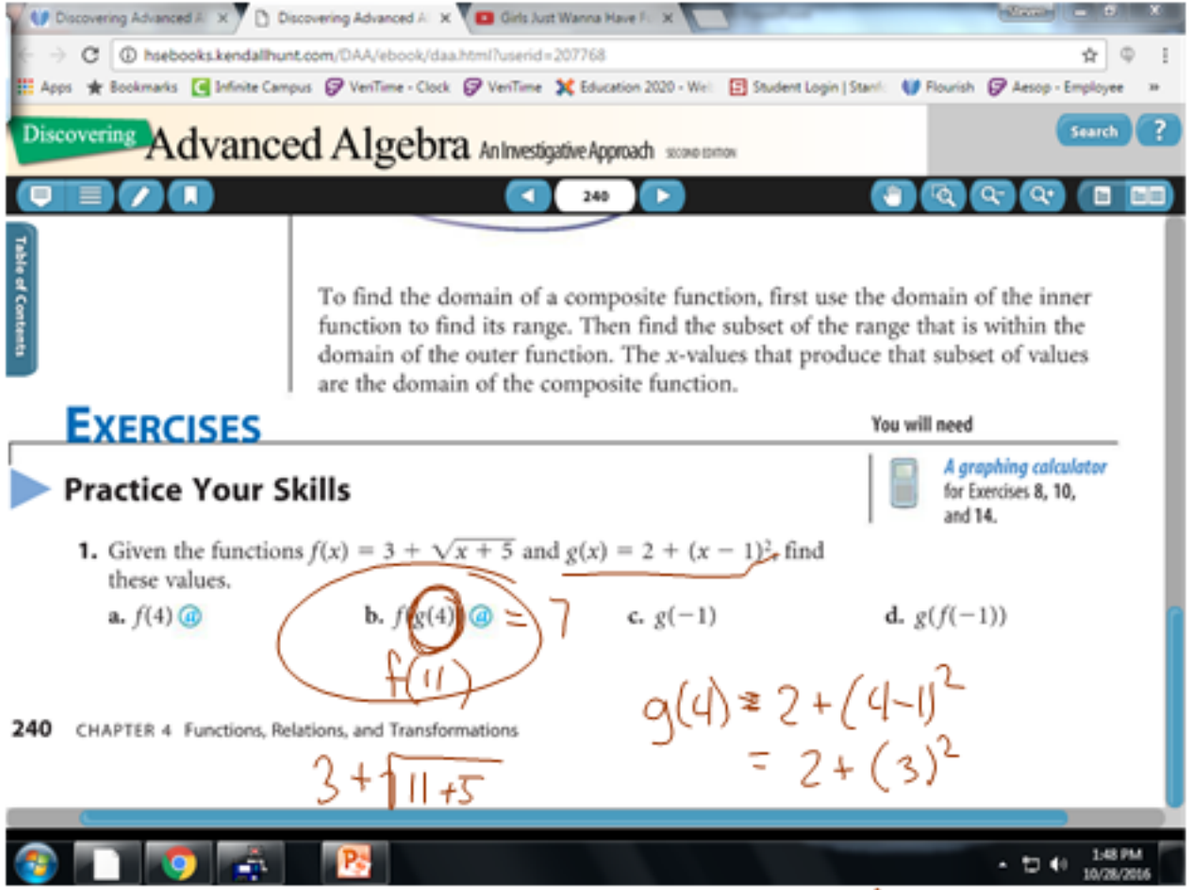
B: $y = 7.5 + 1x$

System of equations

more than 1 equation, where the variables stand for the same thing

Solution to a system

values that make all equations true at the same time. ⟸



To find the domain of a composite function, first use the domain of the inner function to find its range. Then find the subset of the range that is within the domain of the outer function. The x-values that produce that subset of values are the domain of the composite function.

EXERCISES

You will need

A graphing calculator for Exercises 8, 10, and 14.

Practice Your Skills

1. Given the functions $f(x) = 3 + \sqrt{x + 5}$ and $g(x) = 2 + (x - 1)^2$, find these values.

a. $f(4)$ **b.** $f(g(4))$ **c.** $g(-1)$ **d.** $g(f(-1))$

$g(4) = 2 + (4-1)^2$
$= 2 + (3)^2$
$= 2 + 9$
$= 11$

$f(11)$

$3 + \sqrt{11 + 5}$

$3 + \sqrt{16}$

$3 + 4$

7

$f(g(x))$

$f(2 + (x-1)^2)$

$3 + \sqrt{(2 + (x-1)^2) + 5}$

$f(g(x)) = 3 + \sqrt{7 + (x-1)^2}$

$f(g(4)) = 3 + \sqrt{7 + (4-1)^2}$

$= 3 + \sqrt{7 + 9}$

$3 + \sqrt{16} = 3 + 4 = 7$

What is a system of equations

Darcy is looking for a job. Job A pays $7.50/hr & promises a 50¢ raise every 6 months. Job B pays $10/hr & promises a 25¢ raise every year.
- Which job should she take?

year	A	B
0	7.50	10
1	8.50	10.25
2	9.50	10.50
3	10.50	10.75
4	11.50	11.00

B ↑ ↓ A

Job A recursive: $\begin{cases} u_0 = 7.50 \\ u_n = u_{n-1} + 1 \end{cases}$

explicit: $y = 7.50 + x$

Job B recursive: $\begin{cases} u_0 = 10 \\ u_n = u_{n-1} + 0.25 \end{cases}$

explicit: $y = 10 + 0.25x$

System of equations

$\begin{cases} y = 7.5x \\ y = 11 + 0.25x \end{cases}$ x = # yrs, y = salary

2 or more equations variables represent the same thing in both eqns.

Solution of a system.
- the value of the variables that make all eqns. true

graph ⇒ where the lines meet.