Vocabulary

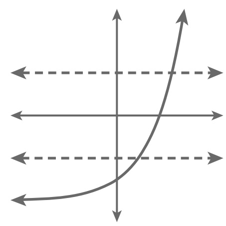
The table contains important vocabulary terms from Chapter 9. As you work through the chapter, fill in the page number, definition, and a clarifying example.

Term	Page	Definition	Clarifying Example
composition of functions			
one-to-one function			

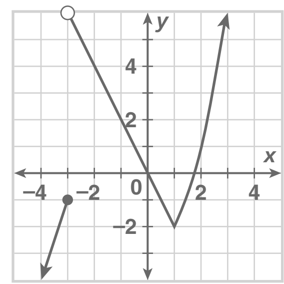
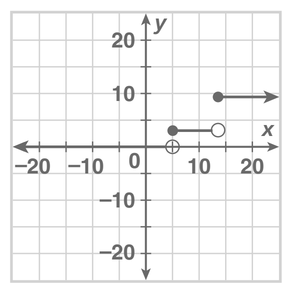
CHAPTER 9

Vocabulary

The table contains important vocabulary terms from Chapter 9. As you work through the chapter, fill in the page number, definition, and a clarifying example.

Term	Page	Definition	Clarifying Example
composition of functions	683	**The composition of functions f and g, written as $(f \circ g)(x)$ and defined as $f(g(x))$ uses the output of $g(x)$ as the input for $f(x)$.**	**If $f(x) = x^2$ and $g(x) = x + 1$, the composite function $(f \circ g)(x) = (x + 1)^2$.**
one-to-one function	691	**A function in which each y-value corresponds to only one x-value. The inverse of a one-to-one function is also a function.**	

Term	Page	Definition	Clarifying Example
piecewise function			
step function			

Term	Page	Definition	Clarifying Example
piecewise function	662	**A function that is a combination of one or more functions.**	$f(x) = \begin{cases} 3x + 8 \text{ if } x \leqslant -3 \\ -2x \text{ if } -3 < x < 1 \\ x^2 - 3 \text{ if } x \geqslant 1 \end{cases}$ 
step function	663	**A piecewise function that is constant over each interval in its domain.**	$f(x) = \begin{cases} 0 \text{ if } x < 5 \\ 3 \text{ if } 5 \leqslant x < 13 \\ 9 \text{ if } 13 \leqslant x \end{cases}$ 

CHAPTER 9

Chapter Review

9-1 Multiple Representations of Functions

1. Jose is climbing down a 1200-foot cliff at a rate of 15 feet per second. Create a table, a graph and an equation to represent the number of feet Jose has left to climb down the cliff with relation to time.

2. The height of a rocket at different times after it was fired is shown in the table.

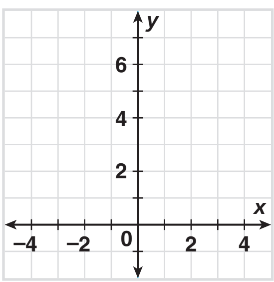
Time(s)	0	1	2	3	4	5
Height (ft)	120	168	184	168	120	40

a. Find an appropriate model for the height of the rocket.
b. Find the maximum height of the rocket.
c. How long will the rocket stay in the air?

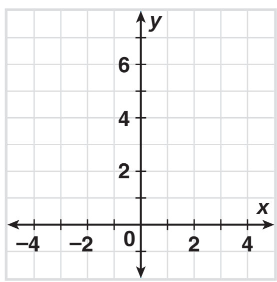
9-2 Piecewise Functions

Graph each function.

3. $f(x) = \begin{cases} 4 & \text{if } x < 0 \\ 2x + 1 & \text{if } x \geq 0 \end{cases}$



4. $f(x) = \begin{cases} 4 - x & \text{if } x < 2 \\ 1 + 2x & \text{if } x \geq 2 \end{cases}$

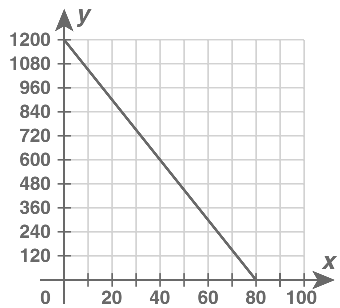


Chapter Review

Know it! Note

9-1 Multiple Representations of Functions

1. Jose is climbing down a 1200-foot cliff at a rate of 15 feet per second. Create a table, a graph and an equation to represent the number of feet Jose has left to climb down the cliff with relation to time.



Distance Left to Climb (feet)	Time (seconds)
1200	0
1050	10
900	20
750	30
600	40
450	50
300	60
150	70
0	80

$f(x) = 1200 - 15x$

2. The height of a rocket at different times after it was fired is shown in the table.

Time(s)	0	1	2	3	4	5
Height (ft)	120	168	184	168	120	40

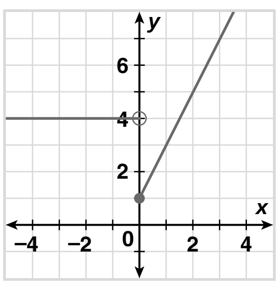
a. Find an appropriate model for the height of the rocket.
b. Find the maximum height of the rocket.
c. How long will the rocket stay in the air?

a. $-16t^2 + 64t + 120$
b. 184 feet
c. 5.4 seconds

9-2 Piecewise Functions

Graph each function.

3. $f(x) = \begin{cases} 4 & \text{if } x < 0 \\ 2x + 1 & \text{if } x \geq 0 \end{cases}$



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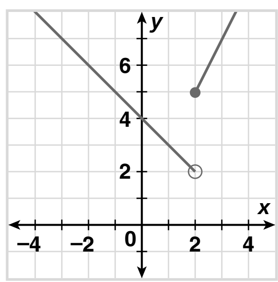
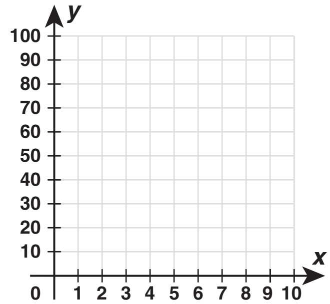
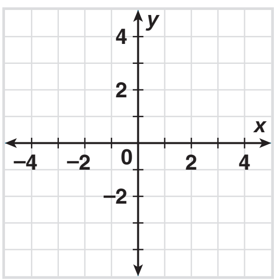


5. The cost of renting cross-country skis is \$45 for the first 4 hours and \$5 for each each additional hour. Sketch a graph of the cost of renting cross-country skis for 0 to 8 hours. Then write the piecewise function for the graph.



Write a piecewise function for each graph.

6.



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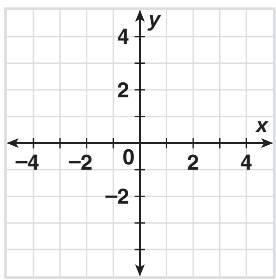

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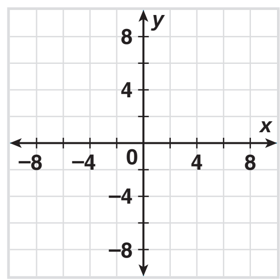


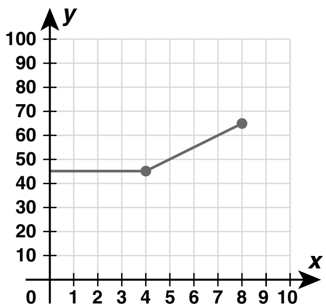
9-3 Transforming Functions

Identify the *x*- and *y*-intercepts of *f*(*x*). Without graphing *g*(*x*), identify its *x*- and *y*-intercepts.

9. $f(x) = 3x - 6$ and $g(x) = 2f(x)$

10. $f(x) = x^2 - 16$ and $g(x) = -f(x)$

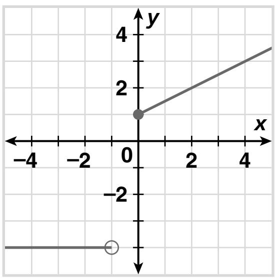
5. The cost of renting cross-country skis is \$45 for the first 4 hours and \$5 for each each additional hour. Sketch a graph of the cost of renting cross-country skis for 0 to 8 hours. Then write the piecewise function for the graph.



$$f(x) = \begin{cases} 45 & \text{if } 0 \le x < 4 \\ 5(x - 4) + 45 & \text{if } 4 \le x \le 8 \end{cases}$$

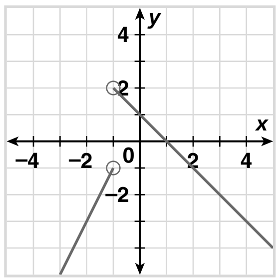
Write a piecewise function for each graph.

6.



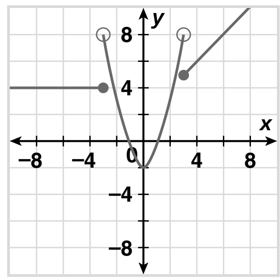
$$f(x) = \begin{cases} -4 & \text{if } x < -1 \\ 0.5x + 1 & \text{if } x \ge 0 \end{cases}$$

7.



$$f(x) = \begin{cases} -x + 1 & \text{if } x > -1 \\ 2x + 1 & \text{if } x < -1 \end{cases}$$

8.



$$f(x) = \begin{cases} x^2 - 1 & \text{if } -3 < x < 3 \\ 4 & \text{if } x \le -3 \\ x + 2 & \text{if } x \ge 3 \end{cases}$$

9-3 Transforming Functions

Identify the *x*- and *y*-intercepts of $f(x)$. Without graphing $g(x)$, identify its *x*- and *y*-intercepts.

9. $f(x) = 3x - 6$ and $g(x) = 2f(x)$

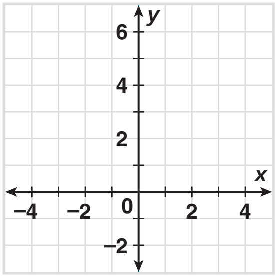
$f(x)$: x-intercept $= 2$;
y-intercept $= -6$
$g(x)$: x-intercept $= 2$;
y-intercept $= -12$

10. $f(x) = x^2 - 16$ and $g(x) = -f(x)$

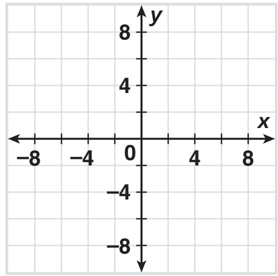
$f(x)$: x-intercept $= \pm 4$;
y-intercept $= -16$
$g(x)$: x-intercept $= \pm 4$;
y-intercept $= 16$

Given $f(x)$, graph $g(x)$.

11. $f(x) = |x| + 2$ and $g(x) = 2f(x) - 1$



12. $f(x) = x^2 + 3$ and $g(x) = -2f(x)$



9-4 Operations with Functions

Given $f(x) = \frac{4}{x - 1}$, $g(x) = x + 7$, and $h(x) = x^2 + 4x - 21$, find each function or value.

13. $(f - g)(5)$

14. $(g + h)(x)$

15. $\left(\frac{g}{h}\right)(5)$

16. $\left(\frac{h}{g}\right)(x)$

17. $(gh)(3)$

18. $(gf)(x)$

19. $g(f(-3))$

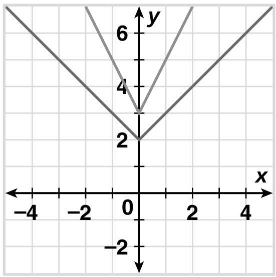
20. $h(g(x))$

21. Find $(g \circ f)$. State the domain of the composite function.

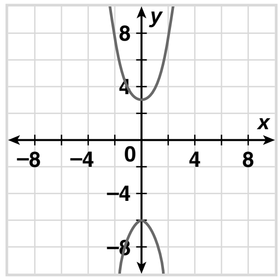
22. The local clothing store is having a 30% off sale. Preferred customers receive a coupon worth an additional 10% off. Write a composite function for the price a preferred customer pays for an item with an original price of p dollars.

Given $f(x)$, graph $g(x)$.

11. $f(x) = |x| + 2$ and $g(x) = 2f(x) - 1$



12. $f(x) = x^2 + 3$ and $g(x) = -2f(x)$



9-4 Operations with Functions

Given $f(x) = \frac{4}{x-1}$, $g(x) = x + 7$, and $h(x) = x^2 + 4x - 21$, find each function or value.

13. $(f - g)(5)$

-11

14. $(g + h)(x)$

$x^2 + 5x - 14$

15. $\left(\frac{g}{h}\right)(5)$

0.5

16. $\left(\frac{h}{g}\right)(x)$

$x - 3$

17. $(gh)(3)$

0

18. $(gf)(x)$

$\frac{4x + 28}{x - 1}$

19. $g(f(-3))$

6

20. $h(g(x))$

$x^2 + 18x + 56$

21. Find $(g \circ f)$. State the domain of the composite function.

$\frac{4}{x-1} + 7;\ x \neq 1$

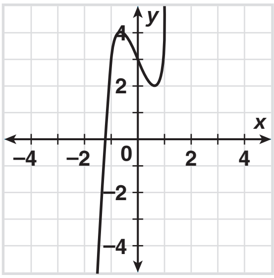
22. The local clothing store is having a 30% off sale. Preferred customers receive a coupon worth an additional 10% off. Write a composite function for the price a preferred customer pays for an item with an original price of p dollars.

$C(p) = 0.63p$

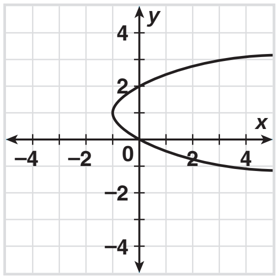
9-5 Functions and Their Inverses

State whether the inverse of each relation is a function.

23.



24.



Write the rule for the inverse of each function. Then state the domain and range of the inverse.

25. $f(x) = \frac{1}{2}x - 6$

26. $h(x) = \frac{7}{x - 3}$

27. $h(x) = x^2 - 25$

28. $h(x) = x^3 - 4$

9-6 Modeling Real-World Data

29. Use finite differences or ratios to determine which parent function would best model this set of data.

x	0	1	2	3	4
y	1	0	1	4	9

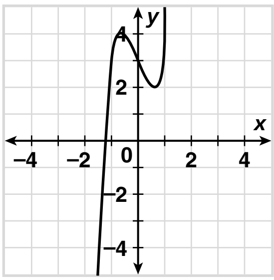
30. The table shows the mass g in grams of a radioactive substance remaining in a container t days after the beginning of the experiment. Find a model for the amount of radioactive substance remaining.

Time (days)	0	1	2	3	4	5	6
Mass (g)	2000	1834.08	1683.24	1544.2	1416.67	1299.67	1192.28

9-5 Functions and Their Inverses

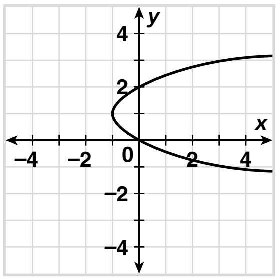
State whether the inverse of each relation is a function.

23.



Not a function

24.



Function

Write the rule for the inverse of each function. Then state the domain and range of the inverse.

25. $f(x) = \frac{1}{2}x - 6$

$f^{-1}(x) = 2x + 12$
D: all real
R: all real

26. $h(x) = \frac{7}{x - 3}$

$h^{-1}(x) = \frac{7}{x} + 3$
D: $\{x | x \neq 0\}$
R: $\{y | y \neq -3\}$

27. $h(x) = x^2 - 25$

$h^{-1}(x) =$
$\pm\sqrt{x + 25}$
D: $\{x | x \geq -25\}$
R: all real

28. $h(x) = x^3 - 4$

$h^{-1}(x) = \sqrt[3]{x + 4}$
D: all real
R: all real

9-6 Modeling Real-World Data

29. Use finite differences or ratios to determine which parent function would best model this set of data.

quadratic

x	0	1	2	3	4
y	1	0	1	4	9

30. The table shows the mass *g* in grams of a radioactive substance remaining in a container *t* days after the beginning of the experiment. Find a model for the amount of radioactive substance remaining.

$m(t) = 2000(0.917)^t$

Time (days)	0	1	2	3	4	5	6
Mass (*g*)	2000	1834.08	1683.24	1544.2	1416.67	1299.67	1192.28

Big Ideas

Know it! Note

Answer these questions to summarize the important concepts from Chapter 9 in your own words.

1. Explain a piecewise function.

2. Explain how to transform a piecewise function.

3. Explain how to perform operations on functions.

4. Explain how determine if the inverse of a function is a relation and how to write the rule for an inverse function.

For more review of Chapter 9:

- Complete the Chapter 9 Study Guide and Review on pages 708–711 of your textbook.
- Complete the Ready to Go On quizzes on pages 681 and 707 of your textbook.

Big Ideas

Answer these questions to summarize the important concepts from Chapter 9 in your own words.

1. Explain a piecewise function.

Answers will vary. Possible answer: A piecewise function is a combination of one or more functions. Each part of the function has a different rule or equation.

2. Explain how to transform a piecewise function.

Answers will vary. Possible answer: Transforming a piecewise function is similar to transforming a function; you just perform the transformation on each piece of the function.

3. Explain how to perform operations on functions.

Answers will vary. Possible answer: You perform operations on functions in the same way that you perform operations on numbers or expressions. You can add, subtract, multiply or divide by using the rules for functions.

4. Explain how determine if the inverse of a function is a relation and how to write the rule for an inverse function.

Answers will vary. Possible answer: To determine if an inverse of a function is a relation, apply the horizontal line test. The inverse is a function if no horizontal line passes through two points on the graph. To write a rule for an inverse function switch the *x* and *y* in the equation and then solve for *y*.

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