✏ PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

11. Communicate Precisely What is the domain and range of the radical function $h(x) = \sqrt{x + a} + b$? Is the function increasing or decreasing? Explain.

12. Model with Mathematics The graph of a cube root function has a horizontal translation that is three times the vertical translation. The vertical translation is negative.

 a. Write a function, g, that has these attributes.

 b. Graph your function and the parent function, f, to verify it is correct.

13. Error Analysis Helena is trying to write a radical function that is represented by the graph below. Describe and correct the error Helena made in writing the radical function.
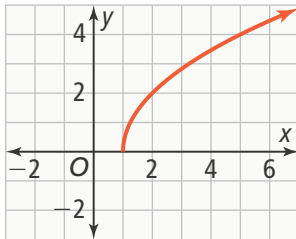
$f(x) = \sqrt{x - 1}$ ✗

14. Higher Order Thinking Rewrite the radical function $g(x) = \sqrt[3]{8x + 64} - 3$ to identify the transformations from the parent graph of $f(x) = \sqrt[3]{x}$. Explain how you rewrote the radical function.

15. Reason The parent function $f(x) = \sqrt{x}$ and a transformation of the parent function, $g(x)$, are reflections of each other over the x-axis. Write the function $g(x)$.

16. Mathematical Connections How do the transformations of a radical function compare to the transformations of an absolute value function?

PRACTICE

Graph the following functions. State the domain and range. Is the function increasing or decreasing? SEE EXAMPLE 1

17. $f(x) = \sqrt{x} + 2$

18. $f(x) = \sqrt[3]{x} - 4$

**19.** $f(x) = \sqrt[3]{x - 8}$

20. $f(x) = \sqrt{x + 6}$

21. Graph $f(x) = \sqrt[3]{x}$ and $g(x) = 3\sqrt[3]{x + 9} - 8$. What transformations of the graph of f produce the graph of g? What effect do the transformations have on the domain and range of g? SEE EXAMPLE 2

Rewrite the following radical functions to identify their transformations from the parent graph $f(x) = \sqrt{x}$. SEE EXAMPLE 3

22. $f(x) = \sqrt{16x}$

23. $f(x) = \sqrt{25x + 75}$

24. $f(x) = \sqrt{9x - 45}$

25. $f(x) = \sqrt{4x - 24} - 6$

What radical function is represented in each graph? SEE EXAMPLE 4

26.

27.
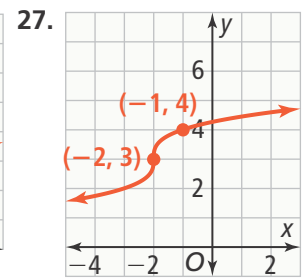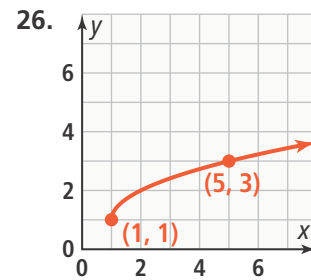
28. The hull speed, y, measured in knots, of a sailboat can be estimated by the function $y = 1.34\sqrt{x}$, where x is the waterline length of the sailboat, in feet. Luis works at a sailboat rental business with boats that have a waterline length between 25 ft and 64 ft. SEE EXAMPLE 5

 a. Graph the relationship between the hull speed of a sailboat and its waterline length.

 b. What are the minimum and maximum hull speeds of the sailboats at the rental business?

25 ft

LESSON 5-3 Graphing Radical Functions **261**

PRACTICE & PROBLEM SOLVING

APPLY

29. Make Sense and Persevere The radius of a sphere can be found using the function $r = \sqrt[3]{\frac{3V}{4\pi}}$, where V is the volume of the sphere. Heather filled a basketball with 448.92 in.^{3} of air.

$V = 448.92$ in.^{3}
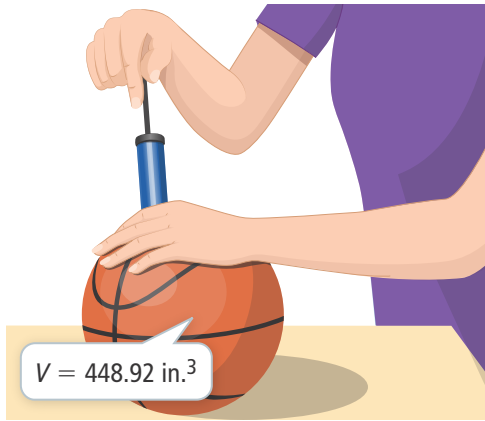
a. Graph the function.

b. Identify the domain and range of the graph.

c. Do the domain and range make sense in this context? Explain.

d. What is the length of the radius of the basketball?

30. A formula for calculating the distance to the horizon is $d = \sqrt{\frac{h}{0.57}}$, where d is the distance to the horizon, in miles, and h is the height above the surface, in feet.

Horizon 5 mi

a. Graph the function.

b. Reason What is your height above the surface if you can see a distance of 5 mi to the horizon?

ASSESSMENT PRACTICE

31. Choose yes or no to tell whether the function is an odd function.

a. $f(x) = 5\sqrt{x - 10} - 12$ ○ Yes ○ No

b. $f(x) = \frac{1}{4}\sqrt[3]{x}$ ○ Yes ○ No

c. $f(x) = \frac{1}{2}\sqrt{x + 8} - 1$ ○ Yes ○ No

d. $f(x) = 6\sqrt[3]{x}$ ○ Yes ○ No

e. $f(x) = 9\sqrt[3]{x - 7} + 8$ ○ Yes ○ No

32. SAT/ACT Which function has a graph with domain $x \geq -1$ and range $y \geq -2$?

Ⓐ $f(x) = \sqrt{x - 1} + 2$ Ⓑ $f(x) = \sqrt[3]{x + 1} - 2$

Ⓒ $f(x) = \sqrt[3]{x - 1} + 2$ Ⓓ $f(x) = \sqrt{x + 1} - 2$

33. Performance Task The table shows the domain and range of the function $f(x) = \sqrt[n]{x}$ for different values of n, where x is a positive real number.

n	Domain of $f(x) = \sqrt[n]{x}$	Range of $f(x) = \sqrt[n]{x}$
1	All real numbers	All real numbers
2	$x \geq 0$	$y \geq 0$
3	All real numbers	All real numbers
4		
5		
6		
7		
8		

Part A Identify the domain and range of the function $f(x) = \sqrt[n]{x}$ when $n = 4, 5, 6, 7,$ and 8.

Part B Make a conjecture about the values of n that gives a domain and range of all real numbers.

Part C Make a conjecture about the values of n that gives a domain of $x \geq 0$ and a range of $y \geq 0$.