

# Graphing Square Root Functions

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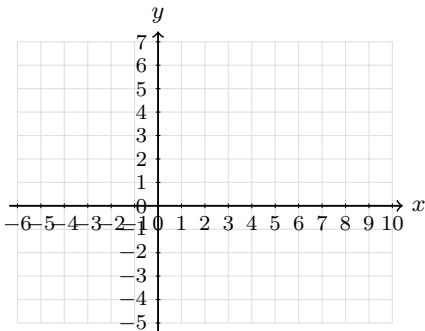
## Quick Review

A **square root function** is built from the parent graph  $f(x) = \sqrt{x}$ . Its graph starts at an endpoint and then grows to the right. For  $g(x) = a\sqrt{x-h}+k$ , the endpoint is  $(h, k)$ . The domain begins at  $x = h$  because the expression under the radical must be nonnegative, and the range begins at  $y = k$  if  $a > 0$  or ends at  $y = k$  if  $a < 0$ . Read the endpoint first, then use perfect-square steps like 0, 1, 4, 9 to plot clean points.

## PRACTICE

Graph each square-root function or use the graph/table to answer.

1. Graph  $y = \sqrt{x}$ . Plot the endpoint and three perfect-square points.



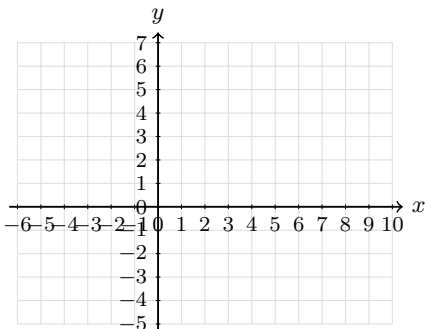
Answer: \_\_\_\_\_

2. Graph  $y = \sqrt{x-4}$ . Plot the endpoint and at least two more points.



Answer: \_\_\_\_\_

3. Graph  $y = \sqrt{x+2}$ . Plot the endpoint and three clean points.



Answer: \_\_\_\_\_

4. Graph  $y = \sqrt{x} + 3$ . Show how the parent graph has moved.

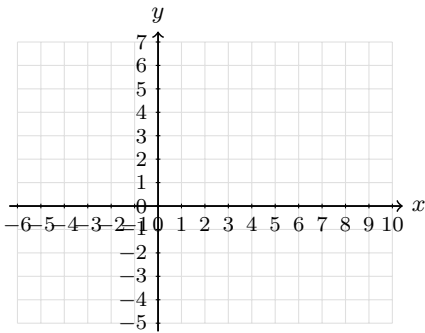


Answer: \_\_\_\_\_



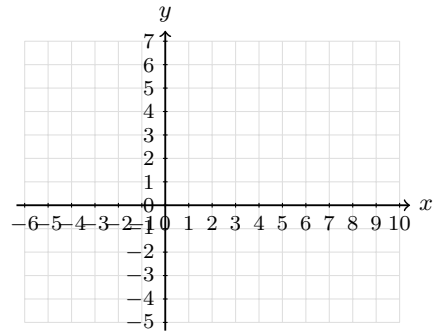
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5. Graph  $y = -\sqrt{x} + 5$ . Make the curve decrease from its endpoint.



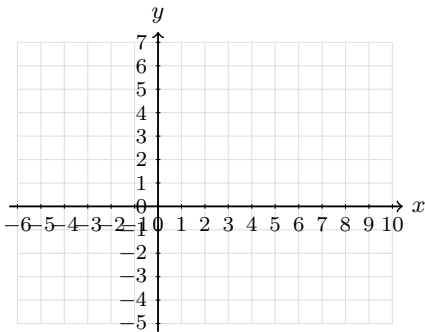
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6. Graph  $y = \sqrt{x-1} + 2$ . Label the endpoint.



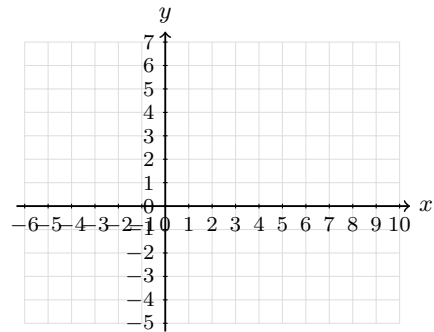
Answer: \_\_\_\_\_

7. Graph  $y = 2\sqrt{x}$ . Use perfect-square inputs to make the graph accurate.



Answer: \_\_\_\_\_

8. Graph  $y = -2\sqrt{x} + 6$ . Plot the endpoint and two more points.



Answer: \_\_\_\_\_

9. Graph  $y = \sqrt{x+4} - 2$ . Label the endpoint on the coordinate plane.



Answer: \_\_\_\_\_

10. Graph  $y = -\sqrt{x-3} + 1$ . Show the reflected square-root curve.



Answer: \_\_\_\_\_



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11. Complete the table for  $y = \sqrt{x-2} + 1$ , then graph the points and draw the curve.

$x$	2	3	6
$y$			



Answer: \_\_\_\_\_

12. Complete the table for  $y = 4 - \sqrt{x+1}$ , then graph the curve.

$x$	-1	0	3	8
$y$				



Answer: \_\_\_\_\_

13. Complete the table for  $y = \sqrt{x+5} - 2$ , then graph it.

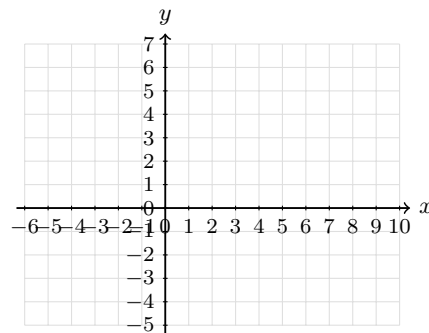
$x$	-5	-4	-1	4
$y$				



Answer: \_\_\_\_\_

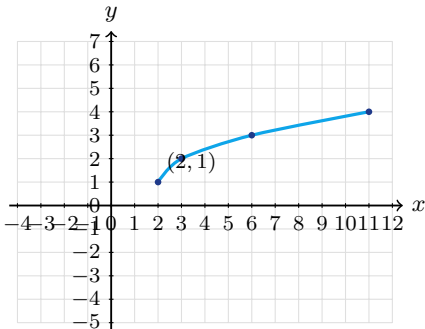
14. Complete the table for  $y = 2\sqrt{x-1} - 3$ , then graph it.

$x$	1	2	5	10
$y$				



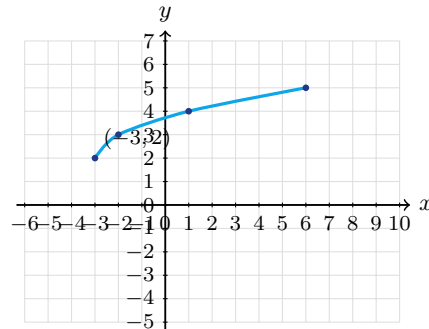
Answer: \_\_\_\_\_

15. Use the graph. What are the endpoint and domain?



Answer: \_\_\_\_\_

16. Use the graph. Write the domain and range.



Answer: \_\_\_\_\_



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17. Which equation matches the graph:  $y = \sqrt{x} + 5$  or  $y = 5 - \sqrt{x}$ ?



Answer: \_\_\_\_\_

18. Use the graph to find  $a$  in  $y = a\sqrt{x-1} - 2$ .



Answer: \_\_\_\_\_

19. A square-root graph starts at  $(-2, 1)$  and rises through  $(2, 3)$ . Write a possible equation, then sketch it.



Answer: \_\_\_\_\_

20. A square-root graph starts at  $(1, 5)$  and passes through  $(5, 3)$ . Write a possible equation, then sketch it.



Answer: \_\_\_\_\_

◆ Word Problems

21. A square garden has area 196 square feet. Use a square root to find the side length.

\_\_\_\_\_

22. A coaster's speed after dropping  $h$  meters is modeled by  $v(h) = \sqrt{19.6h}$ . Find the speed after a 20-meter drop and state the domain in context.

\_\_\_\_\_

23. The time for one swing of a pendulum is modeled by  $T = 2\pi\sqrt{L/9.8}$ , where  $L$  is the length in meters. Find the swing time when  $L = 2.45$  meters.

\_\_\_\_\_

24. A square display area has area  $A$  square inches. Write a function for the side length and find the side length when  $A = 81$ .

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## Answer Keys

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. <math>(0, 0), (1, 1)</math><br/><math>(4, 2), (9, 3)</math></p> <p>2. <math>(4, 0), (5, 1), (8, 2)</math></p> <p>3. <math>(-2, 0), (-1, 1)</math><br/><math>(2, 2), (7, 3)</math></p> <p>4. <math>(0, 3), (1, 4)</math><br/><math>(4, 5), (9, 6)</math></p> <p>5. <math>(0, 5), (1, 4)</math><br/><math>(4, 3), (9, 2)</math></p> <p>6. <math>(1, 2), (2, 3)</math><br/><math>(5, 4), (10, 5)</math></p> <p>7. <math>(0, 0), (1, 2)</math><br/><math>(4, 4), (9, 6)</math></p> <p>8. <math>(0, 6), (1, 4)</math><br/><math>(4, 2), (9, 0)</math></p> <p>9. <math>(-4, -2), (-3, -1)</math><br/><math>(0, 0), (5, 1)</math></p> <p>10. <math>(3, 1), (4, 0), (7, -1)</math></p> | <p>11. <math>(2, 1), (3, 2), (6, 3)</math></p> <p>12. <math>(-1, 4), (0, 3)</math><br/><math>(3, 2), (8, 1)</math></p> <p>13. <math>(-5, -2), (-4, -1)</math><br/><math>(-1, 0), (4, 1)</math></p> <p>14. <math>(1, -3), (2, -1)</math><br/><math>(5, 1), (10, 3)</math></p> <p>15. <math>(2, 1); x \geq 2</math></p> <p>16. <math>x \geq -3; y \geq 2</math></p> <p>17. <math>y = 5 - \sqrt{x}</math></p> <p>18. <math>a = 2</math></p> <p>19. <math>y = \sqrt{x+2} + 1</math></p> <p>20. <math>y = 5 - \sqrt{x-1}</math></p> <p>21. 14 ft</p> <p>22. <math>v(20) \approx 19.8; h \geq 0</math></p> <p>23. <math>T \approx 3.14</math> sec</p> <p>24. <math>s(A) = \sqrt{A}; 9</math> in</p> |
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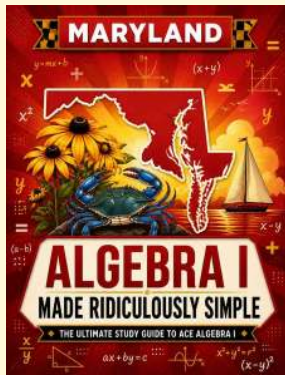
### Step-by-Step Tutor Notes

1. Start at the endpoint  $(0, 0)$ . Then use  $x = 1, 4, 9$  because their square roots are 1, 2, 3.
2. The expression  $x - 4$  shifts the parent graph right 4 units, so the endpoint is  $(4, 0)$ .
3. Write  $x + 2$  as  $x - (-2)$ , so the endpoint is  $(-2, 0)$ . Add 1, 4, 9 to the starting  $x$ -value.
4. Work one inverse operation at a time and keep both sides balanced. Adding 3 outside the radical moves every parent-graph point up 3 units. After simplifying, the answer is  $(0, 3), (1, 4)$   
 $(4, 5), (9, 6)$ .
5. The negative sign reflects the graph downward, and the  $+5$  places the endpoint at  $(0, 5)$ .
6. For  $y = \sqrt{x - h} + k$ , the endpoint is  $(h, k)$ . Here that point is  $(1, 2)$ .
7. First identify the feature of the graph or equation that matches the wording of the question. The factor 2 doubles each parent-graph  $y$ -value, so the graph rises more steeply. That leads to  $(0, 0), (1, 2)$   
 $(4, 4), (9, 6)$ .
8. Start at  $(0, 6)$ . The coefficient  $-2$  makes the outputs drop by 2, 4, 6 from that height.
9. The endpoint is  $(-4, -2)$ . From there, move right by 1, 4, 9 and up by 1, 2, 3.
10. The endpoint is  $(3, 1)$ . Because of the negative sign, the curve moves downward as  $x$  increases.
11. Substitute each listed  $x$ -value. The radicands are 0, 1, 4, so the outputs are 1, 2, 3.
12. The radicands are 0, 1, 4, 9. Subtract their square roots from 4 to get the table values.
13. These  $x$ -values make the radicand 0, 1, 4, 9, which keeps the graph points exact.
14. The endpoint is  $(1, -3)$ . After that, square-root outputs 1, 2, 3 become vertical changes of 2, 4, 6.
15. The graph begins at  $(2, 1)$  and continues to the right, so the input values start at  $x = 2$ .
16. The leftmost point is  $(-3, 2)$ , and the graph rises from there. That sets the starting values for  $x$  and  $y$ .
17. The graph starts at 5 and decreases, so the square-root part must be subtracted from 5.
18. From  $(1, -2)$  to  $(2, 0)$ , the square-root input changes by 1 and the output rises 2, so  $a = 2$ .
19. The endpoint gives  $h = -2$  and  $k = 1$ . Since  $(2, 3)$  is 4 units right and 2 units up, the parent scale fits.
20. The graph starts at  $(1, 5)$  and moves downward. Four units to the right,  $\sqrt{4} = 2$ , so the point drops to 3.
21. If the side length is  $s$ , then  $s^2 = 196$ . Taking the positive square root gives  $s = 14$  ft.
22. Substitute  $h = 20$ :  $v = \sqrt{392} \approx 19.8$  m/s. A drop height cannot be negative, so  $h \geq 0$ .
23. Use the given numbers to build the model, then finish the calculation.  $T = 2\pi\sqrt{2.45/9.8} = 2\pi\sqrt{0.25} = 2\pi(0.5) = \pi \approx 3.14$  seconds.
24. Area of a square is  $s^2 = A$ , so the side length is  $s = \sqrt{A}$ . When  $A = 81$ ,  $s = 9$  inches.



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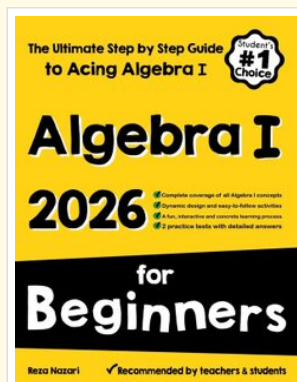
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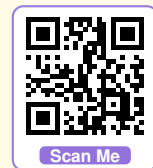
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