

Graphing Square Root Functions

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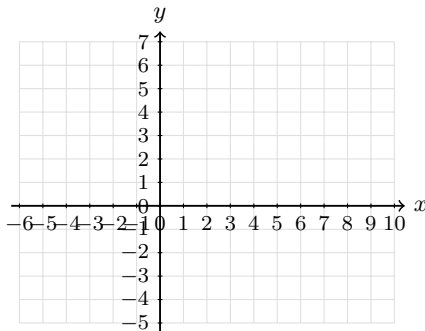
Q Quick Review

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.



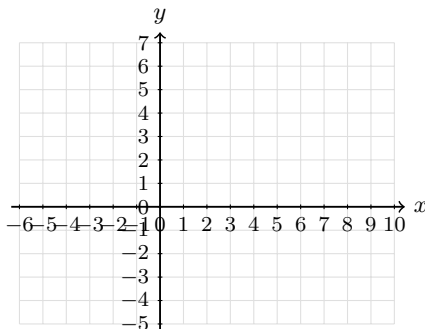
Answer: _____

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



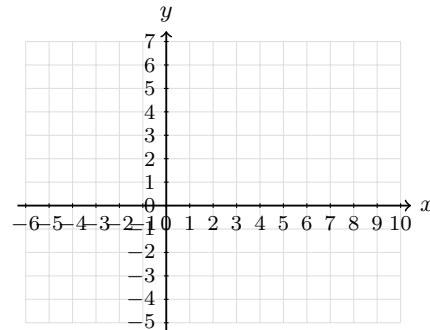
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3. Graph $y = \sqrt{x+2}$. Plot the endpoint and three clean points.



Answer: _____

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

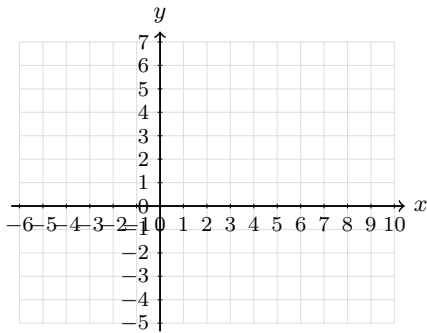


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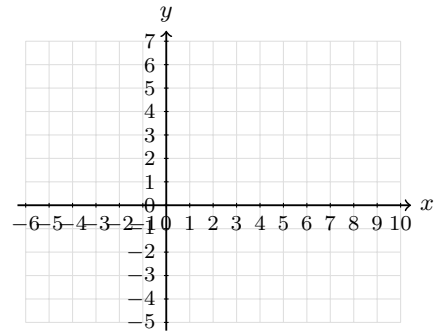
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5. Graph $y = -\sqrt{x} + 5$. Make the curve decrease from its endpoint.



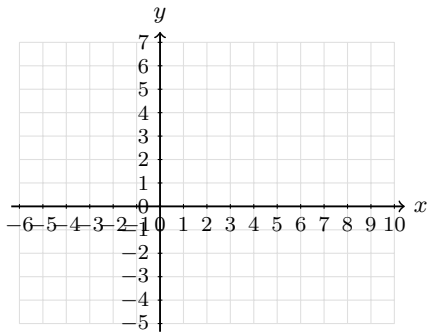
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6. Graph $y = \sqrt{x-1} + 2$. Label the endpoint.



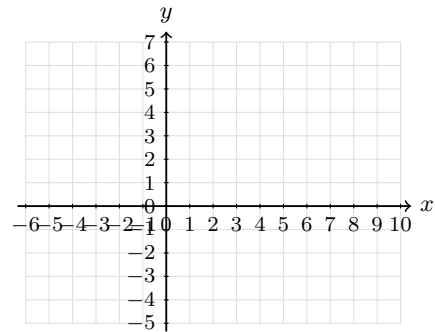
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7. Graph $y = 2\sqrt{x}$. Use perfect-square inputs to make the graph accurate.



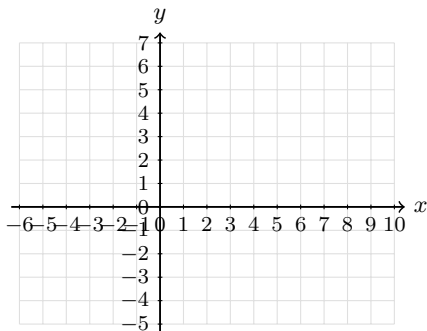
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8. Graph $y = -2\sqrt{x} + 6$. Plot the endpoint and two more points.



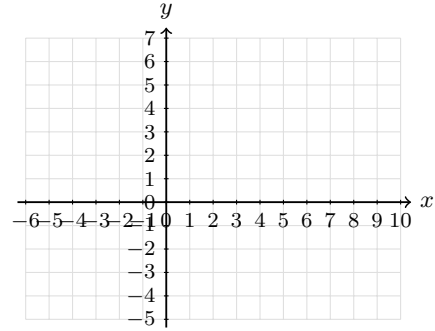
Answer: _____

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.

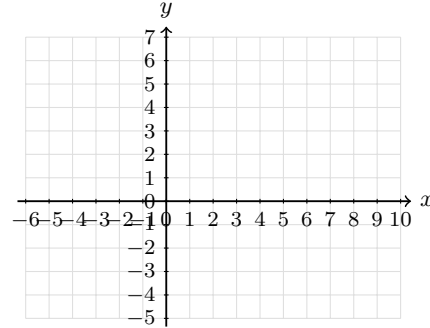
x	2	3	6
y			



Answer: _____

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

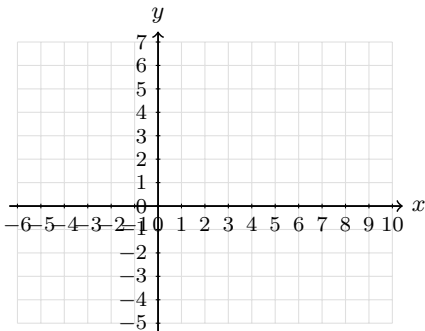
x	-1	0	3	8
y				



Answer: _____

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

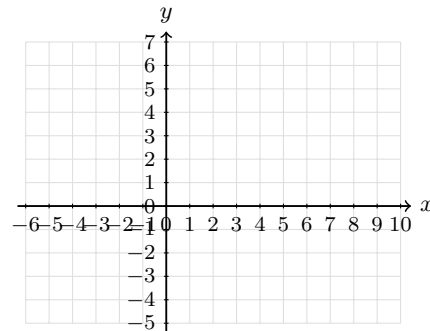
x	-5	-4	-1	4
y				



Answer: _____

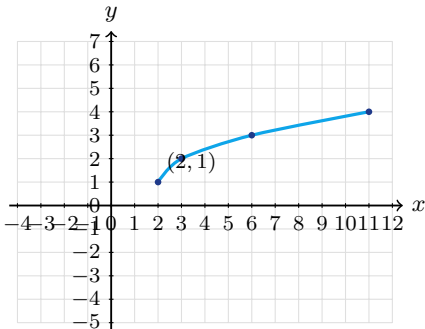
14. Complete the table for $y = 2\sqrt{x-1} - 3$, then graph it.

x	1	2	5	10
y				



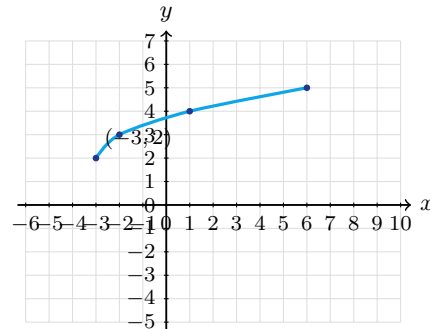
Answer: _____

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



Answer: _____

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



Answer: _____



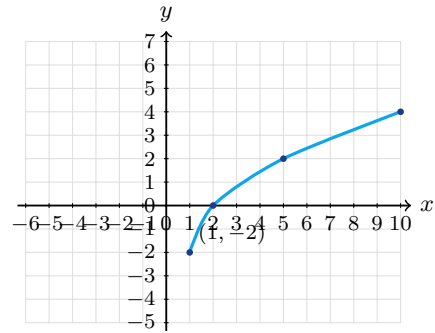
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17. Which equation matches the graph: $y = \sqrt{x} + 5$ or $y = 5 - \sqrt{x}$?



Answer: _____

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



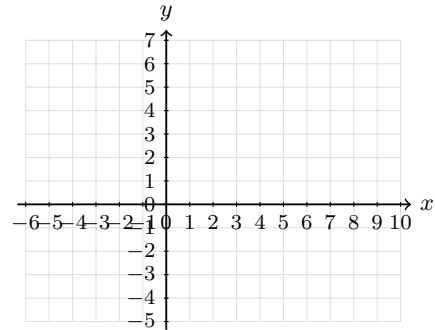
Answer: _____

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 $A = 81$.



Answer Keys

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

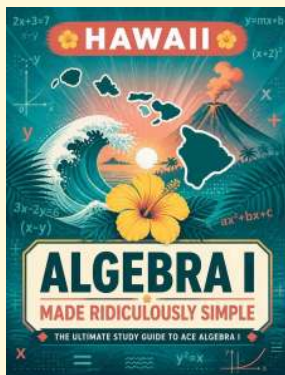
Step-by-Step Tutor Notes

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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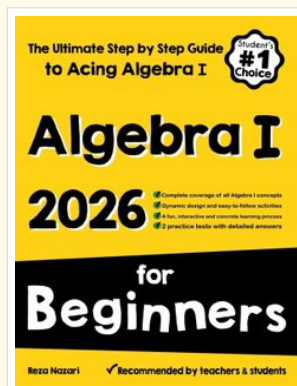
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