

Graphing Cube Root Functions

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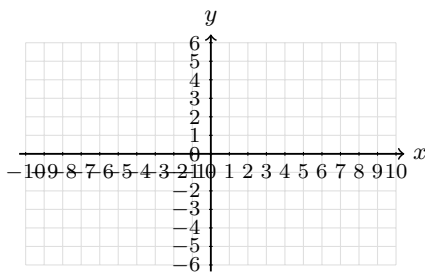
Quick Review

A **cube root function** is built from $f(x) = \sqrt[3]{x}$. Unlike a square root, a cube root can use negative inputs, so the domain and range of the parent function are both all real numbers. For $g(x) = a\sqrt[3]{x-h} + k$, the key center point is (h, k) . Use perfect cubes such as $-8, -1, 0, 1, 8$ to make a table. Cube-root graphs flatten near the center and keep moving left and right.

PRACTICE

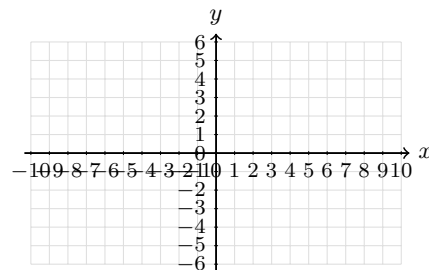
Graph each cube-root function or use the graph/table to answer.

1. Graph $y = \sqrt[3]{x}$. Plot the center point and the perfect-cube points.



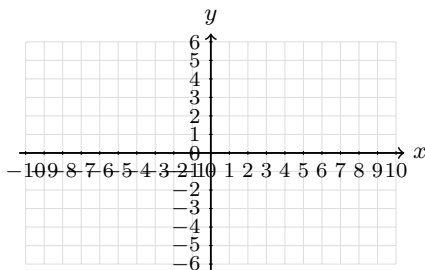
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2. Graph $y = \sqrt[3]{x-1}$. Mark the center point clearly.



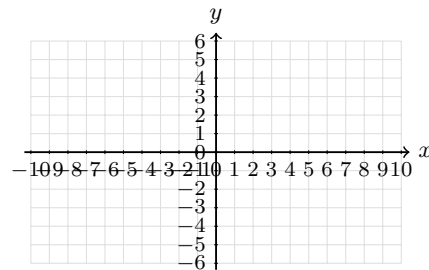
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3. Graph $y = \sqrt[3]{x+2}$. Use a table of perfect-cube steps.



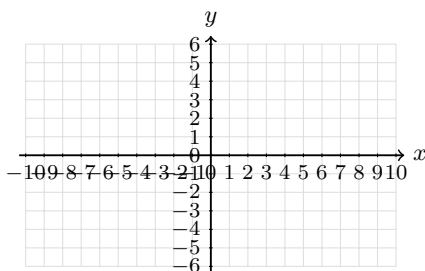
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4. Graph $y = \sqrt[3]{x} + 2$. Show the vertical shift.



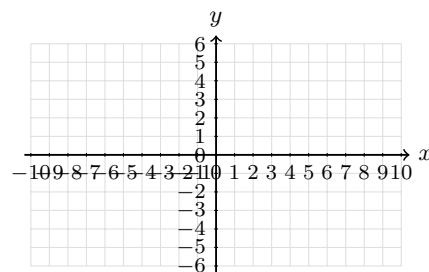
Answer: _____

5. Graph $y = -\sqrt[3]{x}$. Make the reflected shape clear.



Answer: _____

6. Graph $y = 2\sqrt[3]{x}$. Use the parent graph points and stretch the outputs.



Answer: _____



7. Graph $y = \sqrt[3]{x-2} - 1$. Label the center point.



Answer: _____

8. Graph $y = -\sqrt[3]{x+1} + 3$. Show the shift and reflection.



Answer: _____

9. Complete the table for $y = \sqrt[3]{x-2} + 1$, then graph the points.

x	-6	1	2	3	10
y					



Answer: _____

10. Complete the table for $y = 3 - \sqrt[3]{x+2}$, then graph the curve.

x	-10	-3	-2	-1	6
y					



Answer: _____

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

x	-8	-1	0	1	8
y					



Answer: _____

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

x	-7	0	1	2	9
y					



Answer: _____



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13. Use the graph. What is the center point, and how was the parent graph shifted?



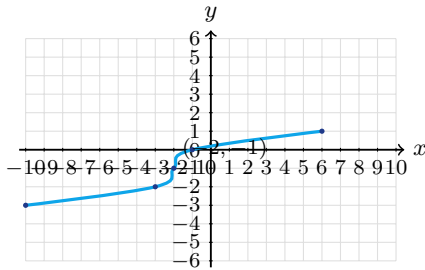
Answer: _____

14. Use the graph. Is the function increasing or decreasing? What is its center point?



Answer: _____

15. Which equation matches the graph: $y = \sqrt[3]{x+2} - 1$ or $y = \sqrt[3]{x-2} - 1$?



Answer: _____

16. Use the graph to find a in $y = a\sqrt[3]{x} + 1$.



Answer: _____

17. Use the graph to write a possible equation.



Answer: _____

18. Use the graph to write a possible equation.



Answer: _____



19. A cube-root graph has center $(-2, 1)$ and is vertically stretched by 2. Write an equation, then sketch it.



Answer: _____

20. A cube-root graph has center $(3, -2)$ and passes through $(4, 0)$. Write a possible equation, then sketch it.



Answer: _____

◆ Word Problems

21. A cube has volume 216 cubic inches. Use a cube root to find the edge length.

22. A storage cube has volume V cubic feet. Write a function for its side length and find the side length when $V = 64$.

23. A model cube's volume changes from 27 cm^3 to 125 cm^3 . How much did the edge length change?

24. The function $r(V) = \sqrt[3]{\frac{3V}{4\pi}}$ gives the radius of a sphere from its volume. What happens to the radius when the volume becomes 8 times as large?



Answer Keys

1. $(-8, -2), (0, 0)$
 $(8, 2)$

2. $(-7, -2), (1, 0)$
 $(9, 2)$

3. $(-10, -2), (-2, 0)$
 $(6, 2)$

4. $(-8, 0), (0, 2)$
 $(8, 4)$

5. $(-8, 2), (0, 0)$
 $(8, -2)$

6. $(-8, -4), (0, 0)$
 $(8, 4)$

7. $(-6, -3), (2, -1)$
 $(10, 1)$

8. $(-9, 5), (-1, 3)$
 $(7, 1)$

9. $(-6, -1), (2, 1)$
 $(10, 3)$

10. $(-10, 5), (-2, 3)$
 $(6, 1)$

11. $(-8, -5), (0, -1)$
 $(8, 3)$

12. $(-7, 6), (1, 2)$
 $(9, -2)$

13. $(1, 2)$; right 1, up 2

14. decreasing; $(0, 1)$

15. $y = \sqrt[3]{x+2} - 1$

16. $a = 2$

17. $y = \sqrt[3]{x-2} - 2$

18. $y = -\sqrt[3]{x+1} + 3$

19. $y = 2\sqrt[3]{x+2} + 1$

20. $y = 2\sqrt[3]{x-3} - 2$

21. 6 in

22. $s(V) = \sqrt[3]{V}$; 4 ft

23. 2 cm

24. the radius doubles

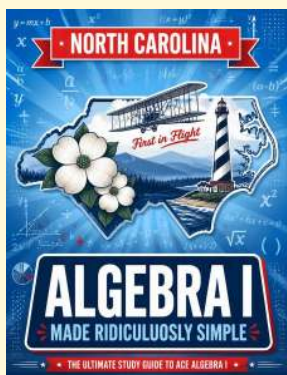
Step-by-Step Tutor Notes

1. Use inputs $-8, -1, 0, 1, 8$ because their cube roots are $-2, -1, 0, 1, 2$.
2. The expression $x - 1$ shifts the parent graph right 1, so the center point is $(1, 0)$.
3. Writing $x + 2$ as $x - (-2)$ shows a shift left 2, so the center is $(-2, 0)$.
4. Work one inverse operation at a time and keep both sides balanced. Adding 2 outside the cube root moves each parent-graph point up 2 units. After simplifying, the answer is $(-8, 0), (0, 2)$
 $(8, 4)$.
5. The negative sign changes every output to its opposite, creating a reflection over the x -axis.
6. Use the clue in the question first, then let the arithmetic finish the job. The coefficient 2 doubles every y -value from the parent cube-root graph. So the answer is $(-8, -4), (0, 0)$
 $(8, 4)$.
7. The center point is $(2, -1)$. From there, use horizontal changes $-8, -1, 0, 1, 8$.
8. The center point is $(-1, 3)$. The negative sign makes the graph decrease from left to right.
9. These inputs make the radicand $-8, -1, 0, 1, 8$, so the cube roots are easy to plot.
10. Move carefully through the arithmetic; one clean operation usually unlocks the next one. The radicands are $-8, -1, 0, 1, 8$. Subtract each cube root from 3. After simplifying, the answer is $(-10, 5), (-2, 3)$
 $(6, 1)$.
11. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Find the cube root first, multiply by 2, then subtract 1. After simplifying, the answer is $(-8, -5), (0, -1)$
 $(8, 3)$.
12. The center is $(1, 2)$. The coefficient -2 reflects the graph and doubles the vertical changes.
13. The middle point of the cube-root shape is $(1, 2)$, so the parent graph moved right 1 and up 2.
14. The graph falls as x increases, and its center point is the labeled middle point $(0, 1)$.
15. Focus on the main idea of the problem, then simplify carefully. The center point is $(-2, -1)$, so the inside must be $x + 2$. So the answer is $y = \sqrt[3]{x+2} - 1$.
16. From the center $(0, 1)$ to $(1, 3)$, a 1-unit cube-root output became a 2-unit rise.
17. The center point is $(2, -2)$ and the graph uses the parent scale, so shift right 2 and down 2.
18. The center point is $(-1, 3)$, and the graph decreases, so the cube root has a negative coefficient.
19. The center gives $x + 2$ and $+1$. A vertical stretch by 2 puts the coefficient 2 outside.
20. From the center to $(4, 0)$, the cube-root input changes by 1 and the output rises 2, so the coefficient is 2.
21. Set up the model from the story, then calculate carefully. Volume is $s^3 = 216$. Taking the cube root gives $s = 6$ inches.
22. The edge length is the cube root of the volume. Since $4^3 = 64$, the side length is 4 ft.
23. The original edge is $\sqrt[3]{27} = 3$ cm and the new edge is $\sqrt[3]{125} = 5$ cm, so it increased by 2 cm.
24. Cube root functions turn an 8-times volume change into a 2-times radius change because $\sqrt[3]{8} = 2$.



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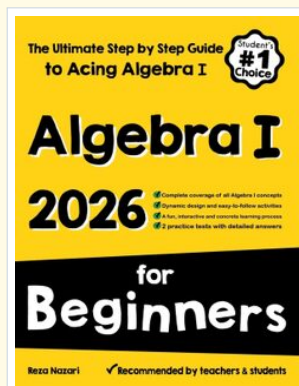
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