Let's check this out on Desmos!

KeyConcept Square Root Function

Parent Function:	$f(x) = \sqrt{x}$
Type of Graph:	curve
Domain:	$\{x \mid x \geq 0\}$
Range:	$\{y \mid y \geq 0\}$
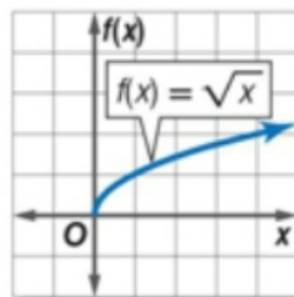
KeyConcept Graphing $y = a\sqrt{x + h} + k$

Step 1 Draw the graph of $y = a\sqrt{x}$. The graph starts at the origin and passes through $(1, a)$. If $a > 0$, the graph is in quadrant I. If $a < 0$, the graph is reflected across the x-axis and is in quadrant IV.

Step 2 Translate the graph k units up if $k > 0$ and $|k|$ units down if $k < 0$.

Step 3 Translate the graph h units left if $h > 0$ and $|h|$ units right if $h < 0$.

moving up/down......

moving left/right....

changing shape/direction...

Examples 1–3 Graph each function. Compare to the parent graph. State the domain and range.
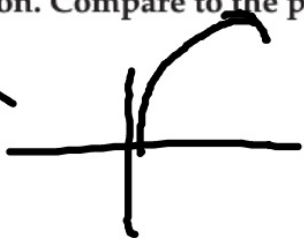
1–8. See Ch. 10 Answer Appendix.

1. $y = 3\sqrt{x}$

2. $y = -5\sqrt{x}$

3. $y = \frac{1}{3}\sqrt{x}$

4. $y = -\frac{1}{2}\sqrt{x}$

5. $y = \sqrt{x} + 3$

6. $y = \sqrt{x} - 2$

7. $y = \sqrt{x + 2}$

8. $y = \sqrt{x - 3}$

D: x ≥ 0
R: y ≥ 0
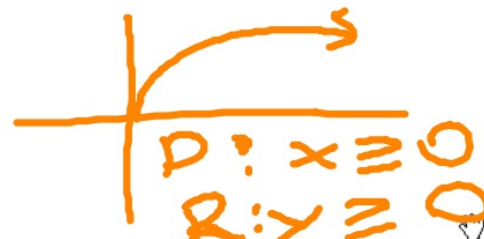
Example 4 **9. FREE FALL** The time t, in seconds, that it takes an object to fall a distance d, in feet, is given by the function $t = \frac{1}{4}\sqrt{d}$ (assuming zero air resistance). Graph the function, and state the domain and range. **See margin for graph; D = {$d \mid d \geq 0$}, R = {$t \mid t \geq 0$}.**

Example 5 Graph each function, and compare to the parent graph. State the domain and range.

10–13. See Ch. 10 Answer Appendix.

10. $y = \frac{1}{2}\sqrt{x} + 2$

11. $y = -\frac{1}{4}\sqrt{x} - 1$

12. $y = -2\sqrt{x + 1}$

13. $y = 3\sqrt{x - 2}$

D: x ≥ 3
R: y ≥ 0

D: x ≥ 0
R: y ≥ -2

Examples 1–3 Graph each function. Compare to the parent graph. State the domain and range.

14. $y = 5\sqrt{x}$

15. $y = \frac{1}{2}\sqrt{x}$

16. $y = -\frac{1}{3}\sqrt{x}$
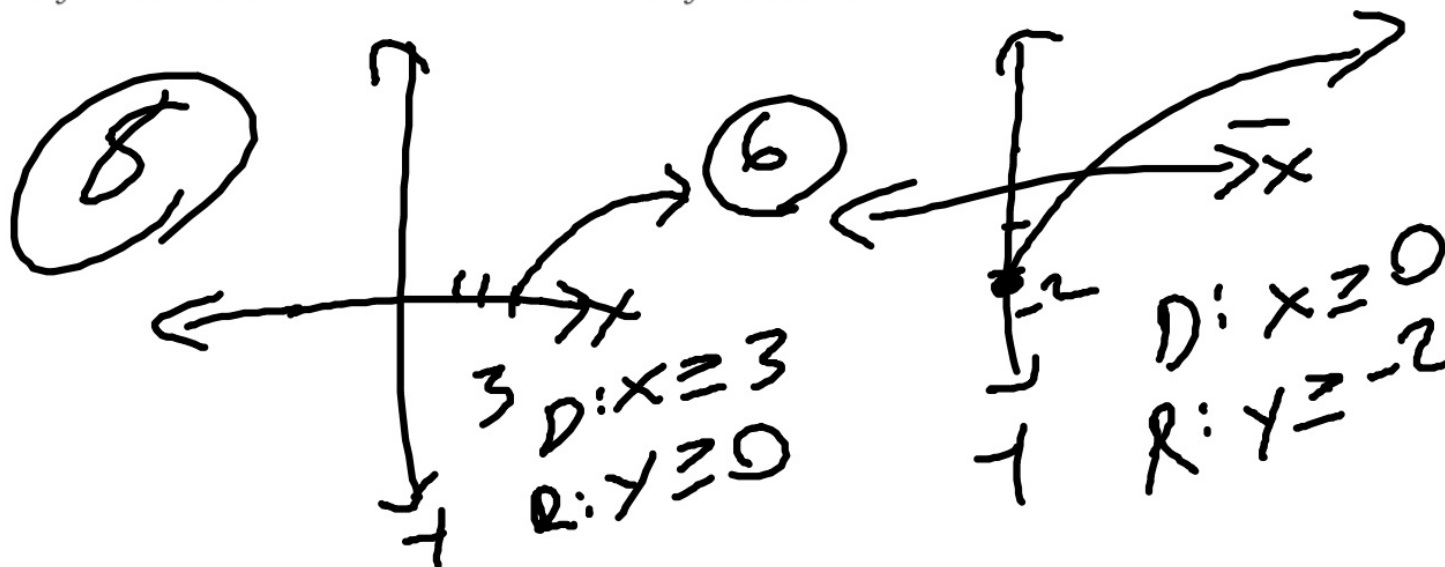
17. $y = 7\sqrt{x}$

18. $y = -\frac{1}{4}\sqrt{x}$

19. $y = -\sqrt{x}$

20. $y = -\frac{1}{5}\sqrt{x}$

21. $y = -7\sqrt{x}$

22. $y = \sqrt{x} + 2$

23. $y = \sqrt{x} + 4$

24. $y = \sqrt{x} - 1$

25. $y = \sqrt{x} - 3$

26. $y = \sqrt{x} + 1.5$

27. $y = \sqrt{x} - 2.5$

28. $y = \sqrt{x + 4}$

29. $y = \sqrt{x - 4}$

30. $y = \sqrt{x + 1}$

31. $y = \sqrt{x - 0.5}$

32. $y = \sqrt{x + 5}$

33. $y = \sqrt{x - 1.5}$
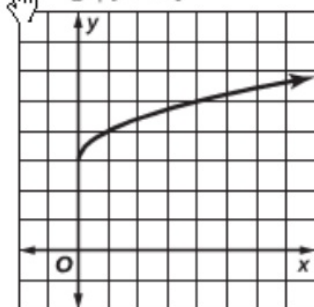
Lesson 10-1

1. vertical stretch of $y = \sqrt{x}$;
$D = \{x \mid x \geq 0\}$,
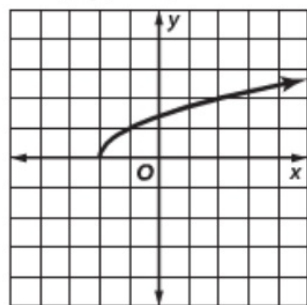$R = \{y \mid y \geq 0\}$
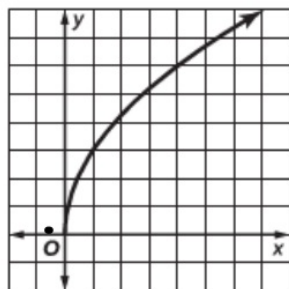
3. vertical compression of
$y = \sqrt{x}$; $D = \{x \mid x \geq 0\}$,
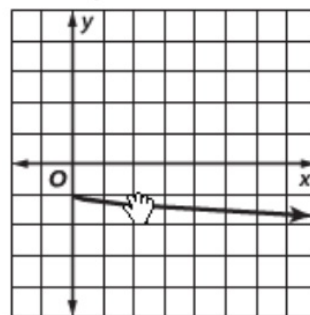$R = \{y \mid y \geq 0\}$
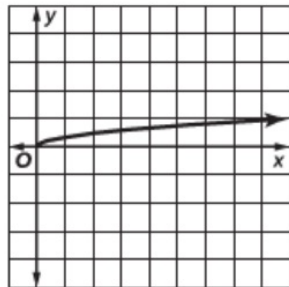
5. translated up 3 units;
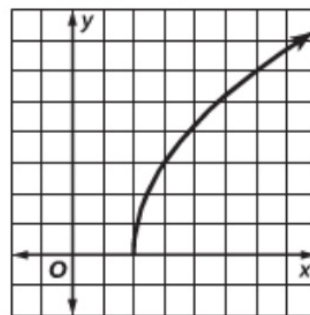$D = \{x \mid x \geq 0\}$,
$R = \{y \mid y \geq 3\}$

7. translated left 2 units;
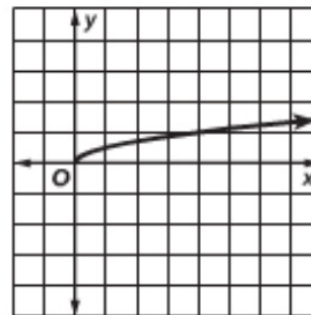$D = \{x \mid x \geq -2\}$,
$R = \{y \mid y \geq 0\}$

11. vertical compression of $\sqrt{x}$,
and reflected across the
x-axis and translated
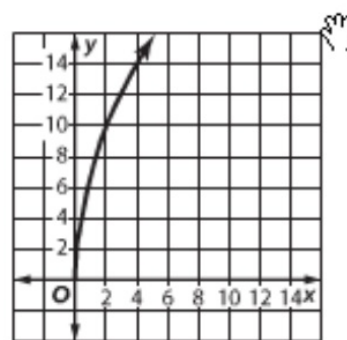down 1 unit; $D = \{x \mid x \geq 0\}$,
$R = \{y \mid y \leq -1\}$

I 13. translated right 2 units and
vertical stretch of $\sqrt{x}$;
$D = \{x \mid x \geq 2\}$,
$R = \{y \mid y \geq 0\}$

15. vertical compression of $\sqrt{x}$;
$D = \{x \mid x \geq 0\}$,
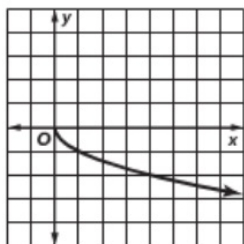$R = \{y \mid y \geq 0\}$

17. vertical stretch of $\sqrt{x}$;
$D = \{x \mid x \geq 0\}$,
$R = \{y \mid y \geq 0\}$

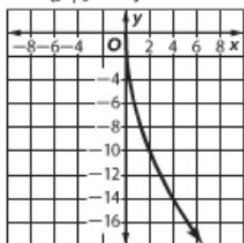**19.** reflected across the *x*-axis;
$D = \{x \mid x \geq 0\}$,
$R = \{y \mid y \leq 0\}$

21. vertical stretch of $\sqrt{x}$ and
reflected across the *x*-axis;
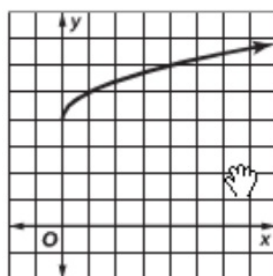$D = \{x \mid x \geq 0\}$,
$R = \{y \mid y \leq 0\}$
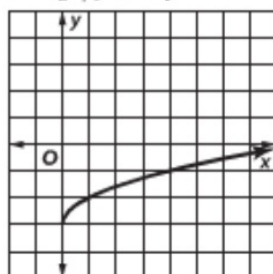
23. translated up 4 units;
$D = \{x \mid x \geq 0\}$,
$R = \{y \mid y \geq 4\}$

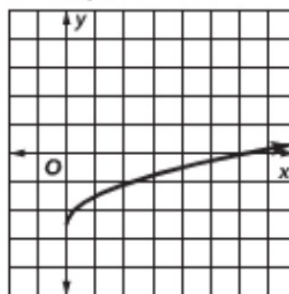**25.** translated down 3 units;
$D = \{x \mid x \geq 0\}$,
$R = \{y \mid y \geq -3\}$

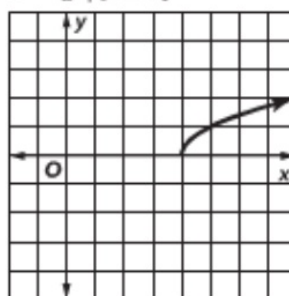**27.** translated down 2.5 units;
$D = \{x \mid x \geq 0\}$,
$R = \{y \mid y \geq -2.5\}$

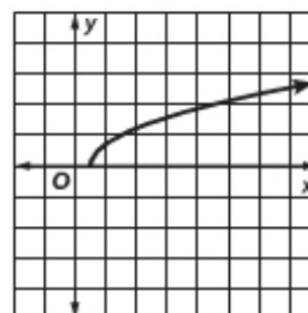**29.** translated right 4 units;
$D = \{x \mid x \geq 4\}$,
$R = \{y \mid y \geq 0\}$

31. translated right 0.5 unit;
$D = \{x \mid x \geq 0.5\}$,
$R = \{y \mid y \geq 0\}$

33. translated right 1.5 units;
$D = \{x \mid x \geq 1.5\}$,
$R = \{y \mid y \geq 0\}$