2.7: Find Square Roots and Compare Real Numbers

Goals: *Find square roots of numbers
*Approximate a square root between two integers
*Order real numbers
*Classify real numbers

Square Roots: One of two equal factors of a number

SYMBOL: $\sqrt{x}$ **Called the "radical" symbol. It asks the question: "What numbers, times itself, is *x*?"**
Once the question is answered, the radical sign goes away.

***All numbers have two square roots, a positive and a negative. This is because a negative times a negative is a positive.**

Evaluate the expression:

Ex: $-\sqrt{9}$

-3

Ex: $\sqrt{25}$

5

Ex: $\pm\sqrt{64}$

± 8

Ex: $-\sqrt{81}$

-9

Ex: $\pm\sqrt{100}$

± 10

Ex: $\sqrt{121}$

11

Ex: $-\sqrt{400}$

-20

Ex: $\sqrt{160{,}000}$

400

Ex: $\sqrt{4900}$

70

Ex: $\sqrt{0.0081}$

0.09

Ex: $\sqrt{0.000121}$

0.011

Solve: When asked to solve you are being asked for **all possible values of x.**

Ex: $x^2 = 144$

$x = \pm 12$

Ex: $x^2 = 64$

$x = \pm 8$

Ex: $x^2 = 1$

$x = \pm 1$

Approximate Square Roots: To approximate square roots, find the nearest perfect squares above and below the number you are trying to find the square root of. Use these known square roots to approximate the unknown.

Ex: $\sqrt{32}$

$\sqrt{25} < \sqrt{32} < \sqrt{36}$

$5 < \sqrt{32} < 6$

So $\sqrt{32}$ is between 5 and 6 (Closer to 6)

Ex: $\sqrt{103}$

$\sqrt{100} < \sqrt{103} < \sqrt{121}$

$10 < \sqrt{103} < 11$

Between 10 and 11. (Closer to 10)

Ex: $-\sqrt{48}$

$-\sqrt{49} < -\sqrt{48} < -\sqrt{36}$

$-7 < -\sqrt{48} < -6$

Ex: $-\sqrt{350}$

$-\sqrt{400} < -\sqrt{350} < -\sqrt{361}$

$-20 < -\sqrt{350} < -19$

Ex: The top of a folding table is a square whose area is 945 square inches. Approximate the side length of the tabletop to the nearest inch.

$A = s^2$

$945 = s^2$

s is between 30 and 31, but closer to 31. So approximately 31 inches

Ex: The top of a square box has an area of 320 square inches. Approximate the side length of the box top to the nearest inch.

The side length is between 17 and 18, but closer to 18. So approximately 18 inches

Evaluate the expression for the given value of x:

Ex: $-3\sqrt{x} + 36$ when $x = 64$

$-3\sqrt{64} + 6$

$-3 \cdot 8 + 6$

$24 + 6$

30

Ex: $54 - 8 \cdot \sqrt{x}$ when $x = 36$

$54 - 8 \cdot \sqrt{36}$

$54 - 8 \cdot 6$

$54 - 48$

6

<u>Extension</u>:

If $\sqrt{x}$ means to find the square root (the number times itself) that equals *x*, what do you think $\sqrt[3]{x}$ means?

It means "cube root" which is asking you to find the number that when you multiply it by itself three times, you get *x*

Evaluate:

Ex: $\sqrt[3]{8}$

2

Ex: $\sqrt[3]{27}$

3

Ex: $\sqrt[3]{64}$

4

<u>Irrational Number</u>: Any number that cannot be expressed as a fraction. π is a well known example. Other irrational numbers are square roots of non-perfect squares. Decimals that never end or repeat are irrational.

Classify the following numbers using all names that apply: (Simplify first if possible, then classify)

Number	Rational?	Irrational?	Integer?	Whole?
$\sqrt{24}$	**No**	**Yes**	**No**	**No**
$\sqrt{100}$	**Yes**	**No**	**Yes**	**Yes**
$-\sqrt{81}$	**Yes**	**No**	**Yes**	**No**
$-\sqrt{25}$	**Yes**	**No**	**Yes**	**No**
$\sqrt{361}$	**Yes**	**No**	**Yes**	**Yes**
$\sqrt{30}$	**No**	**Yes**	**No**	**No**

Order the following numbers from least to greatest:

Ex: $\frac{4}{3}, -\sqrt{5}, \sqrt{13}, -2.5, \sqrt{9}$

$-2.5, -\sqrt{5}, \frac{4}{3}, \sqrt{9}, \sqrt{13}$

*positive numbers are bigger.

*13 is bigger than 9, so $\sqrt{13}$ must be bigger than $\sqrt{9}$

*$\sqrt{9}$ = 3, which is bigger than $\frac{4}{3}$ so this is the smallest positive number

* Don't know $\sqrt{5}$ but 2.5 is the square root of the number you get when you multiply 2.5 times itself. (6.25)

So $-\sqrt{6.25}$ would be farther left on number line than $-\sqrt{5}$

Ex: $-\sqrt{10}, \frac{19}{5}, -3, \sqrt{12}, \sqrt{16}$

$-\sqrt{10}, -3, \sqrt{12}, \frac{19}{5}, \sqrt{16}$

Ex: $-\frac{9}{2}, 5.2, 0, \sqrt{7}, 4.1 - \sqrt{20}$

$-\frac{9}{2}, -\sqrt{20}, 0, \sqrt{7}, 4.1, 5.2$