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Squares and Square Roots

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Vocabulary

- * Square Root - a number that you can multiply by itself to get the number under the radical.
Ex. $\sqrt{121} = \pm 11$
- * Principal square root - the positive root.
- * Radical symbol - $\sqrt{36}$ ← symbol
- * Radicand - the number inside the radical symbol. Ex. $\sqrt{144}$ ← 144 is the radicand.
- * Perfect square - A number that has integers as its square root.

Examples:

$$\sqrt{36} = \pm 6$$

$$\sqrt{64} = \pm 8$$

$$\sqrt{100} = \pm 10$$

$$\sqrt{9} = \pm 3$$

$$\sqrt{25} = \pm 5$$

$$\sqrt{169} = \pm 13$$

$$\sqrt{4} = \pm 2$$

$$\sqrt{49} = \pm 7$$

$$\sqrt{81} = \pm 9$$

$$\sqrt{121} = \pm 11$$

$$\sqrt{144} = \pm 12$$

For example: 49 is a perfect square because $7^2 = 49$

Simplifying Roots

$$\sqrt{7 \cdot 3} = \sqrt{21} = \sqrt{4 \cdot 3} = 2\sqrt{3}$$

$$\sqrt{19 - 3} = \sqrt{16} = \pm 4$$

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$$\sqrt{6+9} = \sqrt{9} = \pm 3$$

$$\sqrt{25+11} = \sqrt{36} = \pm 6$$

$$\sqrt{99+22} = \sqrt{121} = \pm 11$$

$$\sqrt{45-20} = \sqrt{25} = \pm 5$$

$$\begin{aligned}\sqrt{20} &= \sqrt{4 \cdot 5} = \sqrt{4} \cdot \sqrt{5} \\ &= 2\sqrt{5}\end{aligned}$$

$$\sqrt{4-5} = \sqrt{-1} \text{ imaginary number - not real}$$

$$\begin{aligned}\sqrt{90} &= \sqrt{9 \cdot 10} = \sqrt{9} \cdot \sqrt{10} \\ &= 3\sqrt{10}\end{aligned}$$

$$\sqrt{\frac{25}{4}} = \pm \frac{5}{2} \quad \sqrt{\frac{36}{16}} = \pm \frac{6}{4} \div 2 = \boxed{\pm \frac{3}{2}}$$

$$\sqrt{\frac{169}{225}} = \boxed{\pm \frac{13}{15}}$$

Estimate each square root by identifying which two whole numbers it falls between.

$$\sqrt{47} \rightarrow \overset{=6}{\sqrt{36}} \quad \sqrt{47} \quad \overset{=7}{\sqrt{49}}$$

The $\sqrt{47}$ is between 6 and 7, but closer to 7.

Steps:

- 1) Find the perfect square lower than the radicand.
- 2) " higher than the radicand.
- 3) Determine which two whole #'s it is between.

Squares and Square Roots Continued...

$$\sqrt{75} \rightarrow \overset{=8}{\sqrt{64}} \sqrt{75} \overset{=9}{\sqrt{81}}$$

Between 8 and 9, but closer to 9.

$$\sqrt{10} \rightarrow \overset{=3}{\sqrt{9}} \sqrt{10} \overset{=4}{\sqrt{16}}$$

≈ 3.1

Between 3 and 4 but closer to 3.

$$\sqrt{33} \rightarrow \overset{=5}{\sqrt{25}} \sqrt{33} \overset{=6}{\sqrt{36}}$$

Between 5 and 6, but closer to 6.

$$2\sqrt{9}$$

$$= 2(3)$$

$$= \boxed{6}$$

$$4\sqrt{16} - 5$$

$$4(4) - 5$$

$$16 - 5$$

$$= \boxed{11}$$

$$4\sqrt{49}$$

$$4(7)$$

$$= \boxed{28}$$

$$\frac{1}{4}\sqrt{36} + 17$$

$$\frac{1}{4}(6) + 17$$

$$1.5 + 17$$

$$= \boxed{18.5}$$