Evaluating Roots

Square Roots

What are all of the square roots of 25? ____________________

The ________________________________ of 25 is written $\sqrt{25}$, and is _____________ by definition.

Ex 1.

$\sqrt{81} =$

$\sqrt{\frac{9}{49}} =$

$-\sqrt{64} =$

$\sqrt{0} =$

$\sqrt{0.81} =$

Square roots

$\sqrt{1} = 1$
$\sqrt{4} = 2$
$\sqrt{9} = 3$
$\sqrt{16} = 4$
$\sqrt{25} = 5$
$\sqrt{36} = 6$
$\sqrt{49} = 7$
$\sqrt{64} = 8$
$\sqrt{81} = 9$
$\sqrt{100} = 10$
$\sqrt{121} = 11$
$\sqrt{144} = 12$
$\sqrt{169} = 13$

Cube Roots

$\sqrt[3]{8}$ (“the **cube root** of 8”) means the # whose cube is 8.

So, $\sqrt[3]{8} = \boxed{}$ since $(\boxed{})^3 = 8$.

Ex 2.

$\sqrt[3]{-8} =$

$\sqrt[3]{125} =$

Cube roots

$\sqrt[3]{1} = 1$
$\sqrt[3]{8} = 2$
$\sqrt[3]{27} = 3$
$\sqrt[3]{64} = 4$
$\sqrt[3]{125} = 5$
$\sqrt[3]{216} = 6$
$\sqrt[3]{1000} = 10$

Even and Odd nth Roots

$\sqrt[5]{32} = \boxed{}$ since $(\boxed{})^5 = 32$

$\sqrt[n]{a}$ is read “the ***n*th root** of a”

Ex 3.

$\sqrt[4]{16} =$

$-\sqrt[4]{16} =$

$\sqrt[4]{-16}$

$\sqrt[5]{-243} =$

$\sqrt[7]{-1} =$

Fourth roots

$\sqrt[4]{1} = 1$
$\sqrt[4]{16} = 2$
$\sqrt[4]{81} = 3$
$\sqrt[4]{256} = 4$
$\sqrt[4]{625} = 5$
$\sqrt[4]{10000} = 10$

Fifth roots

$\sqrt[5]{1} = 1$
$\sqrt[5]{32} = 2$
$\sqrt[5]{243} = 3$

Ex 4.

Find the square of each radical expression.

$\sqrt{15}$ $\qquad$ $-\sqrt{29}$

Numbers with square roots that are rational are called ____________________________.

ex: 25 is a perfect square since $\sqrt{25} = 5$, which is rational.

ex: 169 is a perfect square since $\sqrt{169} = 13$, which is rational.

ex: 5 is not a perfect square.

$\sqrt{a}$ is _____________ if a is a perfect square. ex: $\sqrt{144}$, $\sqrt{\frac{4}{9}}$

$\sqrt{a}$ is _____________ if a is not a perfect square and $a > 0$. ex: $\sqrt{3}$, $\sqrt{6}$

$\sqrt{a}$ is ____________________ if $a < 0$. ex: $\sqrt{-9}$, $\sqrt{-11}$

Ex 5.

Determine whether each number is rational, irrational, or not a real number.

$\sqrt{169}$

$\sqrt{17}$

$\sqrt{-4}$

Note: We can approximate square roots like $\sqrt{5}$ by knowing nearby perfect squares:

$\sqrt{4} < \sqrt{5} < \sqrt{9}$

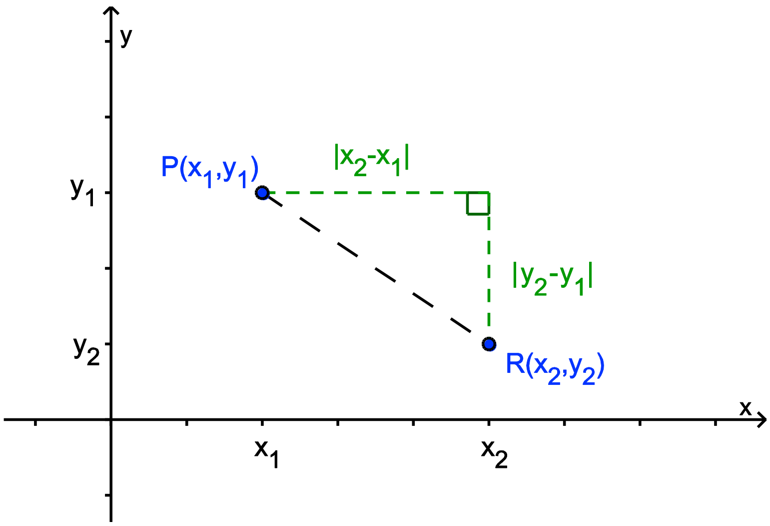
$2 < \sqrt{5} < 3$ $\leftarrow$ So, $\sqrt{5}$ is between 2 and 3. In fact, it is approximately 2.236.

Recall the Pythagorean Theorem: In right triangles, $(leg)^2 + (leg)^2 = (hyp)^2$.

Ex 6.

A ladder 10 ft long leans against a wall. The foot of the ladder is 6 ft from the base of the wall. How high up the wall does the top of the ladder rest?

The Distance Formula



Suppose you're looking for the distance from point P at (x_1, y_1) to point R at (x_2, y_2). Using the Pythagorean Theorem, we get:

$d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$

Taking the square root of each side, we get the **distance formula**:

$\boldsymbol{d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}$

Ex 7.

Find the distance between $(3, -5)$ and $(-2, 8)$.

Practice

1. Evaluate.

$-\sqrt{\frac{4}{25}}$	$\sqrt{-64}$	$\sqrt{0.64}$
$-\sqrt{0.04}$	$\sqrt[3]{-64}$	$\sqrt{144 + 25}$
$\sqrt[3]{\frac{-8}{125}}$	$\sqrt[4]{81}$	$\sqrt[4]{-81}$
$\sqrt[9]{-1}$	$-\sqrt[4]{10{,}000}$	

2. A rectangle has dimensions 5 ft by 12 ft. Find the length of its diagonal.

3. Find the distance between $(-6,3)$ and $(-2,-4)$.

Q: A bus driver was heading down a street in Walnut. He went right past a stop sign without stopping, went the wrong way on a one-way street, and then went on the left side of the road past a cop car. The cop did nothing, because he didn't break any traffic laws. Why not?