

8.1

Friday, August 24, 2012
10:57 AM

Square Roots

- ex) 2 is a square root of 4 because $2^2=4$
3 is a square root of 9 because $3^2=9$
-5 is a square root of 25 because $(-5)^2=25$

In general,

b is a square root of a if $b^2=a$

ex) find two square roots of 49.

7 and -7

$\sqrt{\quad}$ is called a radical sign

the number inside the $\sqrt{\quad}$ is the radicand.

Principal Square Root

The principal square root of x is the positive square root of x, denoted \sqrt{x}

ex) $\sqrt{49}=?$ We decided 7 and -7 were the square roots
we take the positive one for the principal sqrt
so $\sqrt{49}=7$

We call this simplifying the radical. ($\sqrt{49}=7$) $\sqrt{\quad}$

Sometimes we might want $-\sqrt{x}$

ex) Simplify $-\sqrt{36} = -6$

Not always integers

ex) $\sqrt{1/4} = 1/2$

not always rational

ex) $\sqrt{10} \approx 3.162277$

To find these use calculators $\sqrt{\quad}$ key.

Warning! You can't find the square root of a negative number in the reals.

ex) $\sqrt{-9}$ no # squared gives a -9.

more in ch. 10

~~$3 \times 3 = 9$~~ ~~$-3 \times -3 = 9$~~

Square Roots with Variables

For any real # x

$$\sqrt{x^2} = |x|$$

ex) Simplify: $36 = 6^2$
 $\sqrt{36x^2} = \sqrt{(6x)^2} = |6x| = \boxed{6|x|}$

$$\sqrt{x^2 + 4x + 4} = \sqrt{(x+2)^2} = |x+2|$$

Square Root Functions

the principal square root is a function

$$f(x) = \sqrt{x}$$

Cube Roots

Just as the square root of x is a number a : $a^2 = x$
 the cube root " " " " $a^3 = x$

ex) 2 is a cube root of 8 since $2^3 = 8$

• -3 is a cube root of -27 since $(-3)^3 = -27$

$$\hookrightarrow \underbrace{-3 * -3 * -3}$$

$$9 * -3 = -27$$

In general,

the cube root of x , $\sqrt[3]{x}$, is

$$\sqrt[3]{x} = y \text{ if } y^3 = x$$

Note that $\sqrt[3]{8} = 2$ since $2^3 = 8$

but $\sqrt[3]{8} \neq -2$ since

For any real x

$$\sqrt[3]{x^3} = x$$

On calculator, $\sqrt[3]{x}$ $\sqrt[3]{}$ $\sqrt[3]{x}$

n^{th} Roots

We talked about $\sqrt{}$, $\sqrt[3]{}$, but there are also

$\sqrt[4]{}$ (fourth root) $\sqrt[5]{}$, $\sqrt[6]{}$, ... or in general $\sqrt[n]{}$ (" n^{th} root")

If n is odd, $\sqrt[n]{}$ is an odd root and $\sqrt[n]{x^n} = x$

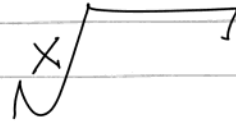
" " "even," " even root and $\sqrt[n]{x^n} = |x|$

In $\sqrt[n]{x}$, n is the index.

$$\textcircled{\text{ex}} \sqrt[5]{32} = 2 \text{ since } 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$$

$$\sqrt[7]{-16384} = -4 \text{ since } (-4)^7 = -16384$$

$$\sqrt[9]{729} = 3 \text{ since } 3^6 = 729$$



Notice: $\sqrt[4]{-16}$ is not defined in reals because
no # raised to the 4th is negative.

$$\textcircled{\text{ex}} \sqrt[5]{32x^5} = \sqrt[5]{(2x)^5} = 2x$$

$$\sqrt[9]{729x^{12}} = \sqrt[9]{(3x^2)^6} = |3x^2| = 3x^2$$