2-9 Square Roots and Cube Roots

Warm-up

Solve

1. $4x - 5 - 2x = 11$

   Solution

   $4x - 5 - 2x = 11$

   $2x - 5 = 11$ Combine like terms

   $+5 \quad +5$ Add 5 to each side

   $\frac{2x}{2} = \frac{16}{2}$ Divide each side by 2

   $x = 8$

   Check your answer

   $4(8) - 5 - 2(8) = 11$ Plug (8) in for x into the original equation

   $32 - 5 - 16 = 11$

   $11 = 11$ Yes, $x = 8$

2. $3(x - 2) = 12$

   Solution

   $\frac{3(x-2)}{3} = \frac{12}{3}$ Divide each side by 3

   $x - 2 = 4$

   $+2 \quad +2$ Add 2 to each side

   $x = 6$

   Check your answer

   $3(6 - 2) = 12$ Plug 6 in for x into the original equation

   $3(4) = 12$ Yes, $m = 4$

Square Root

The square root of a number is one of 2 equal factors. Every positive number has both a positive and a negative square root.

Example $\sqrt{9} = \pm 3$ $\quad 3 \bullet 3 = 9$ or $-3 \bullet -3 = 9$

$-\sqrt{9} = -3$ because the negative sign is outside the radical.

Estimating square roots - We use perfect squares to estimate square roots.

1^2	1
2^2	4
3^2	9
4^2	16
5^2	25

6^2	36
7^2	49
8^2	64
9^2	81
10^2	100

11^2	121
12^2	144
13^2	169
14^2	196
15^2	225

Try to know the perfect squares through 15.

Example 1 – Estimate $\sqrt{57}$ with in a range of 2 numbers.

Solution
Think of the 2 perfect squares near 57.
$\sqrt{49} < \sqrt{57} < \sqrt{64}$
$7 < \sqrt{57} < 8$
So, $\sqrt{57}$ is between 7 and 8!

Example 2 - Estimate $\sqrt{130}$ with in a range of 2 numbers.
Solution
Think of the 2 perfect squares near 130.
$\sqrt{121} < \sqrt{130} < \sqrt{144}$
$11 < \sqrt{130} < 12$
So, $\sqrt{130}$ is between 11 and 12.

Cube Root

Cube root of a number is one of 3 equal factors.

Example

$\sqrt[3]{8} = 2 \qquad 2 \bullet 2 \bullet 2 = 8$

$\sqrt[3]{-8} = -2 \qquad -2 \bullet -2 \bullet -2 = -8$

Estimating cube roots - We use perfect cubes to estimate cube roots.

1^3	1
2^3	8
3^3	27
4^3	64
5^3	125
6^3	216
7^3	343
8^3	512
9^3	729
10^3	1000

Example 3 - Estimate $\sqrt[3]{230}$ with in a range of 2 numbers.
Solution
Think of the 2 perfect cubes near 230.
$\sqrt[3]{216} < \sqrt[3]{230} < \sqrt[3]{343}$
$6 < \sqrt[3]{230} < 7$
So, $\sqrt[3]{230}$ is between 6 and 7.

Solving square and cube root equations

Example 4 - The area of a square is 29 cm^2. Find the length of a side of the square.

Solution

If you know the area of a square, then use the formula $A = s^2$.

$A = s^2$

$29 = s^2$ Plug 29 in for A.

$\sqrt{29} = \sqrt{s^2}$ Take the square root of each side.

$5.39 = s$

$s = 5.39$

The length of each side is 5.39 cm.

Example 5 - The volume of a cube is 27 cm^3. Find the length of a side of the cube.

Solution

If you know the volume of the cube, then use the formula $V = l \cdot w \cdot h = s^3$.

$V = s^3$

$27 = s^3$ Plug 27 in for V.

$\sqrt[3]{27} = \sqrt[3]{s^3}$ Take the square root of each side.

$3 = s$

$s = 3$

The length of each side is 3 in.

Rational vs. Irrational Numbers

Real Numbers – The set of rational and irrational numbers.

Rational Number – A number that can be written in fractional form.

Example: $5 = \frac{5}{1}$, $1.5 = \frac{3}{2}$, or $0.\overline{6} = \frac{2}{3}$

Irrational Number – A number that cannot be written in fractional form.

Example: $\sqrt{3} = 1.7320508...$ Non-terminating and non-repeating decimal.

Example 6 – Tell whether each number is rational or irrational.

a. $\sqrt{25}$ Solution: Rational, $\sqrt{25} = \pm 5$

b. $8.\overline{3}$ Solution: Rational, repeating decimal, $8.\overline{3} = 8\frac{1}{3}$

c. $\sqrt{1.44}$ Solution: Rational, terminating decimal, $\sqrt{1.44} = \pm 1.2 = \pm 1\frac{1}{5}$

d. $-\sqrt{8}$ Solution: Irrational, non-terminating, non-repeating decimal,

$-\sqrt{8} = -2\sqrt{2}$

Homework

- Read pg. 111 - 115
- Practice 17