MULTIPLYING AND DIVIDING INTEGERS

To multiply integers, just multiply. When the signs are different, the answer is negative. When the signs are the same, the answer is positive. We will look at how this rule is developed and applied to multiplication of integers.

Since division is the inverse operation of multiplication, the same rules apply for giving a sign to an answer. To divide integers, just divide. When the signs are different, the answer is negative. When the signs are the same, the answer is positive. We will look at writing related division statements for multiplication statements, how the rule for division is developed, and then apply the rule for division of integers.

Integer Operations

The integers are a set of numbers that contain the whole numbers and their opposites. There are no decimals or fractions in the set of integers.

Integers: {… –4, –3, –2, –1, 0, 1, 2, 3, 4 …}

Multiplication and Division of Integers

These two operations have very simple rules.

Rule 1: When the signs of each number are the **same**, the answer is automatically **positive**.

Example 4: Find the products.

$(-8)(-5) = +40 = 40$

$(9)(6) = 54$

$56 \div 7 = 8$

$(-64) \div (-16) = +4 = 4$

Rule 2: When the signs of the two numbers are **different**, the answer is **negative**.

Example 5: Find the quotients.

$(-6)(7) = -42$

$(10)(-3) = -30$

$100 \div (-20) = -5$

$(-72) \div 12 = -6$

Be sure to consider only one pair of numbers at a time. If three numbers are multiplied together, consider the first two, and then the third.

Example 6: Find the product of (–4)(–3)(–5).

$$(-4)\times(-3)\times(-5) \;=\; 12\times(-5) \;=\; -60$$

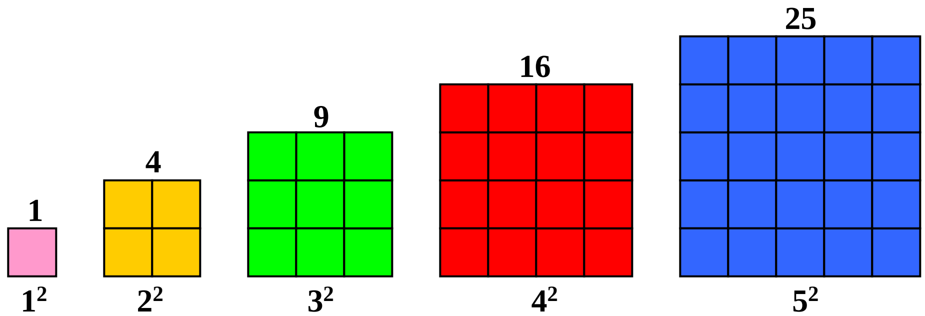
Click on the bricks below to play a game.

Perfect Squares and Square Roots

Perfect Squares

Perfect squares are numbers that are squares of integers.

Some examples of perfect squares are shown in the figure below. The first five squares of the counting numbers are shown.



Square Notation	Perfect Square
1^2 (1-squared)	**1**
2^2 (2-squared)	**4**
3^2 (3-squared)	**9**
4^2 (4-squared)	**16**
5^2 (5-squared)	**25**

Example 1: Find the first 12 perfect squares of the counting numbers.

$$1^2 = 1 \times 1 = 1 \qquad 7^2 = 7 \times 7 = 49$$
$$2^2 = 2 \times 2 = 4 \qquad 8^2 = 8 \times 8 = 64$$
$$3^2 = 3 \times 3 = 9 \qquad 9^2 = 9 \times 9 = 81$$
$$4^2 = 4 \times 4 = 16 \qquad 10^2 = 10 \times 10 = 100$$
$$5^2 = 5 \times 5 = 25 \qquad 11^2 = 11 \times 11 = 121$$
$$6^2 = 6 \times 6 = 36 \qquad 12^2 = 12 \times 12 = 144$$

The first 12 perfect squares are:

$$\{1, 4, 9, 25, 36, 49, 64, 81, 100, 121, 144...\}$$

Perfect squares are used often in math. Try to memorize these familiar numbers so that you can recognize them as they are used in many math problems.

The first five squares of the negative integers are shown below. Remember that a negative integer times a negative integer equals a positive integer.

Square Notation	**Perfect Square**
$(-1)^2 = (-1 \times -1)$	**1**
$(-2)^2 = (-2 \times -2)$	**4**
$(-3)^2 = (-3 \times -3)$	**9**
$(-4)^2 = (-4 \times -4)$	**16**
$(-5)^2 = (-5 \times -5)$	**25**

Square Roots of Perfect Squares

The **square root** operation is the reverse operation of squaring a number. In other words, to find the square root of a number, determine what number times itself equals the given number.

Finding a square root of a perfect square can be as easy as guessing the solution to the following algebraic equation:

$$x^2 = 49$$

If we understand the meaning of the exponent “2”, we know that a solution for *x* is 7 because we are finding a number that when multiplied times itself equals 49.

$$7(7) = 49$$

We must also remember that if we include negative values, there is another solution, –7.

$$-7(-7) = 49$$

This guess and check system for finding values of this type is fine and will work for perfect square numbers like 49, 64 , 81, 144, or even the value 1.

Actually, the set of values $\{1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144...\}$ all have relatively easy “guessable” square root solutions. This set of values is called the “perfect squares” because the numbers that are used as double factors are **integral** values…**perfect**.

The square root of 25 is 5 or –5.

The symbol for the square root operation is $\sqrt{\ }$ **.**

To indicate which root is desired, we will use the following notation:

$$\sqrt{25} = 5 \qquad -\sqrt{25} = -5$$

Examples:

a. $\sqrt{81} = 9$

b. $-\sqrt{81} = -9$

c. $\sqrt{0.49} = 0.7$

d. $\sqrt{\dfrac{25}{64}} = \dfrac{\sqrt{25}}{\sqrt{64}} = \dfrac{5}{8}$

Try these!

On paper list the answers to the following problems. Look below for the correct answers.

Perfect Squares
1. List the perfect squares of the counting numbers 13 through 20.

2. What is the square of 30?

3. What is the square of 0.09?

Square Roots
4. What is $-\sqrt{144}$ **?**

5. What is $\sqrt{1.21}$?

6. What is $\sqrt{\frac{9}{100}}$?

Solutions

1. 169, 196, 225, 256, 289, 324, 361, 400

2. 900

3. 0.0081

4. –12

5. 1.1

6. $\frac{3}{10}$