

Signed Numbers (Positives and Negatives)

Double Signs: If two signs appear directly in front of a number, they should be combined into a single sign. Two matching signs will result in addition (a single plus sign). Two different signs will be subtraction.

$$\text{Matching} \rightarrow \text{Addition: } 2 + (+1) = 2 + 1 \quad 2 - (-1) = 2 + 1$$

$$\text{Different} \rightarrow \text{Subtraction: } 2 - (+1) = 2 - 1 \quad 2 + (-1) = 2 - 1$$

Addition and Subtraction: When *combining* two numbers by adding or subtracting, there are two sign rules to follow, but remember to first follow the **Double Signs** rule.

If the numbers have the **same sign**, **add** the numbers without the signs, and then the result (sum) will always have the **same sign as the original numbers**.

$$\text{Same signs: } \quad 5 + 3 = 8 \quad \quad 3 + 5 = 8 \quad \quad -5 - 3 = -8 \quad \quad -3 - 5 = -8$$

All results have the same sign as the original numbers.

If the numbers have **opposite signs**, first forget the signs. Then find the **difference** between the numbers. Give the result the **same sign as the larger** of the original numbers.

$$\text{Opposite signs: } \quad 5 - 3 = 2 \quad \quad -3 + 5 = 2 \quad \quad -5 + 3 = -2 \quad \quad 3 - 5 = -2$$

All results are the same sign as the larger number 5.

Multiplication and Division: When *multiplying or dividing* two numbers, there are also two rules to follow:

If the numbers have the **same sign**, the result (product or quotient) is always **positive**.

$$\text{Same signs: } \quad 12 \cdot 3 = 36 \quad \quad -12 \cdot -3 = 36 \quad \quad 12 \div 3 = 4 \quad \quad -12 \div -3 = 4$$

All results are positive.

If the numbers have **opposite signs**, the result (product or quotient) is always **negative**.

$$\text{Opposite signs: } \quad -12 \cdot 3 = -36 \quad \quad 12 \cdot -3 = -36 \quad \quad -12 \div 3 = -4 \quad \quad 12 \div -3 = -4$$

All results are negative.

Order of Operations

When *simplifying* an expression, the operations must be done in a specific order. The order is:

Parentheses \rightarrow Exponents \rightarrow Multiplication/Division \rightarrow Addition/Subtraction

The mnemonic "PEMDAS" is commonly used to help you remember the order.

Important things to note: Inside a set of *parentheses*, order of operations must also be followed.

Multiplication and division happen at the same time, so they are performed from *left to right*. *Addition and subtraction* also happen at the same time and are therefore performed from *left to right*. A more illustrative version of PEMDAS might be:

\rightarrow \rightarrow
P E M/D A/S

$$\text{Examples: } 9 - 3 + 5 = 6 + 5 = 11 \quad \quad 9 - (3 + 5) = 9 - 8 = 1 \quad \quad 4 \cdot 3 - 7 = 12 - 7 = 5$$

$$16 \div 2 \cdot 4 = 8 \cdot 4 = 32 \quad \quad 16 \div (2 \cdot 4) = 16 \div 8 = 2 \quad \quad -3^2 \cdot 2 = -9 \cdot 2 = -18$$

$$21 - ((-3)^2 + 5 \cdot 2) = 21 - (9 + 5 \cdot 2) = 21 - (9 + 10) = 21 - 19 = 2$$