

Section 0 – 2: Operations on Rational Numbers

Rules for the **Multiplication and Division** of Two Signed Numbers

1. The **symbol** tells you if you should multiply or divide.

A **pair of parentheses** () is the symbol used to show multiplication. A **fraction bar** like $\frac{4}{2}$ is the symbol used to show division.

2. The signs of the two numbers determines if the answer is positive or negative.

When Multiplying or Dividing

If the **signs of the two numbers are the same**, both + or both –, **the answer is positive +**

If the **signs of the two numbers are different**, one + and one –, **the answer is negative –**

Multiply Examples

Example 1

$2(-3)$
means 2 times – 3

the signs are different
the answer is negative

$$2(-3) = -6$$

Example 2

$-2(4)$
means – 2 times 4

the signs are different
the answer is negative

$$-2(4) = -8$$

Example 3

$(-2)(-5)$
means – 2 times – 5

the signs are the same
the answer is positive

$$(-2)(-5) = 10$$

Example 4

$-(-5)$
means – 1 times – 5

the signs are the same
the answer is positive

$$-(-5) = 5$$

Divide Examples

Example 5

$-(-4)$
means – 1 times 4

the signs are different
the answer is negative

$$-(-4) = -4$$

Example 6

$\frac{-10}{2}$
means – 10 divided by 2

the signs are different
the answer is negative

$$\frac{-10}{2} = -5$$

Example 7

$\frac{12}{-4}$
means 12 divided by – 4

the signs are different
the answer is negative

$$\frac{12}{-4} = -3$$

Example 8

$\frac{-15}{-5}$
means – 15 divided by – 5

the signs are the same
the answer is positive

$$\frac{-15}{-5} = 3$$

Rules for the **Addition or Subtraction** of Two Signed Numbers

How you know when to **ADD** or **SUBTRACT** two numbers.

You have an addition or subtraction problem when you have **2 numbers that are separated by + or – signs.**

$$5 - 3 \quad \text{or} \quad 4 + 5 \quad \text{or} \quad -4 - 6 \quad \text{or} \quad -5 + 2$$

Note: + or – signs are never right next to each other like $5 + - 6$.

A single + sign or the – sign **does not** determine addition or subtraction.

The signs of both of the numbers together tells you if you should add or subtract the two numbers.

Rule for the Addition of Two Signed Numbers

If two numbers have the **same signs**, both + or both –
you **add** the two numbers
and give the answer the **sign that was common** to both numbers.

Examples for addition: The **signs** of the two numbers **are the same**, both + or both –

$$-3 - 9 = -12 \quad \text{add 3 and 9 to get 12 and give the answer the common – sign to get –12}$$

$$5 + 6 = 11 \quad \text{add 5 and 6 to get 11 and give the answer the common + sign to get +11}$$

$$-5 - 8 = -13 \quad \text{add 5 and 8 to get 13 and give the answer the common – sign to get –13}$$

Rule for the Subtraction of Two Signed Numbers

If two numbers have **different signs**, one + and one –
you **subtract** the smallest of the two numbers from the largest without using their signs
and give the answer the **sign of the number farthest from zero.**

Examples for subtraction: The **signs** of the two numbers **are different**, one + and one –

$$3 - 9 = -6 \quad \text{subtract 9 and 3 to get 6 and give the answer a negative sign to get –6}$$

$$-2 + 6 = 4 \quad \text{subtract 6 and 2 to get 4 and give the answer a positive sign to get +4}$$

$$12 - 9 = 3 \quad \text{subtract 12 and 9 to get 3 and give the answer a positive sign to get +3}$$

$$-10 + 2 = -8 \quad \text{subtract 10 and 2 to get 8 and give the answer a negative sign to get –8}$$

Adding or Subtracting 3 or more Signed Numbers

If there are more than 2 signed numbers in one problem, one way to combine them all is to **combine them from left to right**. Combine the first two numbers and then combine that answer with the next number and continue until finished.

Example 1

$$\begin{aligned}8 - 12 + 1 \\= -4 + 1 \\= -3\end{aligned}$$

Example 2

$$\begin{aligned}-8 + 12 - 7 + 8 \\= 4 - 7 + 8 \\= -3 + 8 \\= 5\end{aligned}$$

Example 3

$$\begin{aligned}8 - 2 - 4 - 7 \\= 6 - 4 - 7 \\= 2 - 7 \\= -5\end{aligned}$$

Example 4

$$\begin{aligned}-3 + 5 - 4 + 6 \\= 2 - 4 + 6 \\= -2 + 6 \\= 4\end{aligned}$$

A second way to combine several numbers is to **combine all the positive numbers** by adding and getting a positive total, then **combining all the negative numbers** by adding and getting a negative total. Then combine the positive total and the negative total by subtracting and using the sign of the number farthest from zero.

Example 5

$$\begin{aligned}-8 + 2 + 4 - 6 \\= 6 - 14 \\= -8\end{aligned}$$

Example 6

$$\begin{aligned}8 - 2 + 1 - 4 \\= 9 - 6 \\= 3\end{aligned}$$

Example 7

$$\begin{aligned}8 - 2 - 4 - 5 \\= 8 - 11 \\= -3\end{aligned}$$

Example 8

$$\begin{aligned}3 - 2 + 4 - 7 \\= 7 - 9 \\= -2\end{aligned}$$

Multiply or Divide 3 or more Signed Numbers

If there are **three** signed numbers multiplied together, multiply the first two numbers together and then multiply that answer times the third number.

Example 9

$$\begin{aligned}3(2)(-4) \\= 6(-4) \\= -24\end{aligned}$$

Example 10

$$\begin{aligned}-(-2)(-3) \\= 2(-3) \\= -6\end{aligned}$$

Example 11

$$\begin{aligned}(-4)(-2)(5) \\= (8)(5) \\= 40\end{aligned}$$

Example 12

$$\begin{aligned}(-2)(4)(3) \\= (-8)(3) \\= -24\end{aligned}$$