The rules for multiplying and dividing signed numbers are easier to use than the ones for adding and subtracting.

When the signs are the same (alike) the answer is positive (+).

When the signs are different the answer is negative (-).

The above rules apply to 2 numbers (or variables) whether multiplied or divided.

\[
\begin{align*}
+ \times + &= + \\
- \times - &= + \\
- \times + &= - \\
+ \times - &= - \\
\end{align*}
\]

\text{Positive answer} \quad \text{Negative answer}

\text{The order of the positive and negative doesn’t matter.}

Example
\((-2)(-3) = \) This is a multiplication problem.
\[+6 \]

\(-2 - 3 = \) Caution! This is subtraction. The answer is \(-5\)
\[-5\]

Example
\((2)(-3) = \) The signs are different so the answer is negative.
\[-6 \]

Example
\((-2)(3) = \) The signs are different so the answer is negative.
\[-6\]

Example
\((+2)(+3) = \) The signs are the same so the answer is positive.
\[+6\]
More than 2 numbers being multiplied -
Again, this subject is covered by section 1.9. The shortcut is this:

An **odd** number of negative signs being multiplied gives a **negative** answer.

An **even** number of negative signs being multiplied gives a **positive** answer.

**DIVISION** The rules for division are the same as the rules for multiplication.

\[
\frac{+}{+} = + \quad \frac{-}{-} = + \quad \text{The same (like) signs give a positive answer.}
\]

\[
\frac{-}{+} = - \quad \frac{+}{-} = - \quad \text{Different signs give a negative answer.}
\]

Example

\[
\frac{+8}{-2} = -4 \quad \text{The signs are different so the answer is negative.}
\]

Example

\[
\frac{+8}{2} = +4 \quad \text{The signs are the same so the answer is positive.}
\]

Example

\[
\frac{-8}{2} = +4 \quad \text{The signs are the same so the answer is positive.}
\]

Example

\[
\frac{-8}{2} = -4 \quad \text{The signs are different so the answer is negative.}
\]
NEGATIVE SIGNS IN FRACTIONS - Fractions and division are the same.
Negative signs in fractions can be moved around freely without changing the value of the fraction. The sign can be in the top (numerator), bottom (denominator) or out in front of the fraction.

CAUTION: One of the "made up" rules by mathematicians is that a negative sign will NOT be left in the denominator of a fraction.

DIVISION INVOLVING ZERO

\[
\frac{1}{0} = \text{undefined} \quad \text{memory aid}
\]

\[
\frac{N}{0} = \text{undefined}
\]

"No, you cannot divide by 0."

\[
\frac{0}{1} = 0 \quad \text{memory aid}
\]

\[
\frac{0}{K} = 0
\]

"Yes, zero on top is ok and it equals 0."

Why is it that division by 0 is undefined?

\[
\frac{8}{4} = \frac{4 \times 2}{4} = \frac{8}{4} \quad \text{so} \quad 4 \times 2 = 8 \quad \text{This works.}
\]

\[
\frac{8}{0} = \frac{0 \times 0}{0} = \frac{0}{8} \quad \text{so} \quad 0 \times 0 \neq 8 \quad \text{This doesn't work.}
\]

What is the difference between dividing by and dividing into?

Example

\[
\frac{8}{4} \quad \text{Reading from the top down it is 8 divided by 4.}
\]

\[
\frac{8}{4} \quad \text{Reading from the bottom up it is 4 divided into 8.}
\]

The words "by" and "into" are not interchangeable.

CAUTION - Don't confuse subtraction and multiplication with a negative:

\[
3 - 5 \quad \text{is not the same as } \quad 3(-5)
\]

\[\text{subtraction} \quad \text{multiplication}\]
SUMMARY OF RULES FOR SIGNED NUMBERS

Adding

- Same Add
- Common

Different Subtract
- Bigger (absolute value)

Serve All Customers
Don't Sock Bullies

Subtracting

Change subtraction problems to addition problems and use the addition rules.

\[
\begin{align*}
-7 - (+3) & \quad \quad -7 - (-3) \\
\downarrow \quad \downarrow \quad \downarrow & \quad \downarrow \quad \downarrow \quad \downarrow \\
\text{Some change} & \quad \text{change to opposite} & \quad \text{some change} & \quad \text{change to opposite} \\
-7 + (-3) & \quad -7 + (+3) \\
& \quad = -10 & \quad = -4
\end{align*}
\]

Multiplying and Dividing

- Same A + C
- Different S - B

\text{add symbol}
\text{subtract symbol}