# Multiplication and Division

## Multiplication:

### Multiplication by zero:

\[
3 \cdot 0 = 0 \\
x \cdot 0 = 0 \\
0 \cdot 0 = 0
\]

### Signed multiplication:

\[
(\text{positive value}) \times (\text{negative value}) = \text{negative value} \\
(\text{negative value}) \times (\text{negative value}) = \text{positive value} \\
(\text{positive value}) \times (\text{positive value}) = \text{positive value}
\]

*the table above can be applied to Division.*

### Reciprocals:

The reciprocal of \( \frac{3}{4} \) is \( \frac{4}{3} \)

The reciprocal of \( -\frac{2}{3} \) is \( -\frac{3}{2} \)

**NOTE:** Multiplying reciprocals always produces 1.
Example 1:

a) \( \frac{3 \cdot 4}{4 \cdot 3} = \)

b) \( -\frac{2}{3} \cdot -\frac{3}{2} = \)

c) \( 3 \cdot \frac{1}{3} = \)

**Division:**

Recall: \( \frac{x}{y} \) means \( x \div y \)

Zero & Division:

Example 2:

a) \( \frac{0}{2} = 0 \) because \( 0 \cdot 2 = 0 \)

b) \( \frac{2}{0} \) is undefined because there is no value that you can multiply by \( 0 \) to get \( 2 \).

Signed Division:

\( (\text{negative value}) \div (\text{positive value}) = \text{negative value} \)
\( (\text{positive value}) \div (\text{negative value}) = \text{negative value} \)
\( (\text{negative value}) \div (\text{negative value}) = \text{positive value} \)
Example 3:

a) \( 8 \div 2 = 4 \) because \( 4 \cdot 2 = 8 \)
b) \( 8 \div (-2) = -4 \) because \( \underline{\phantom{0}} \cdot (-2) = 8 \)
c) \(-8 \div 2 = -4 \) because \( \underline{\phantom{0}} \cdot (2) = -8 \)
d) \(-8 \div (-2) = \underline{\phantom{0}} \) because \( \underline{\phantom{0}} \cdot (\underline{\phantom{0}}) = (\underline{\phantom{0}}) \)

Recall: The word **product** always indicates **multiplication** and the symbol used for multiplication are \((\cdot)\) and \((\times)\). The words **quotient** always indicates **division** and the symbols used for division are \((\div)\) and \((\frac{3}{4})\).

Example 4:

Write a numerical expression for each phrase, and simplify.

a) The product of \(9\) and \(-2\) added to \(7\).

\[
7 + 9 \cdot (-2)
\]

\[
= 7 + (-18)
\]

\[
= 7 - 18
\]

\[
= \boxed{-11}
\]

b) the quotient of \(-20\) and \(4\) subtracted from \(7\)

\[
7 - (-20 \div 4)
\]

\[
= 7 + (-5)
\]

\[
= 7 + 5
\]

\[
= \boxed{12}
\]
1. The reciprocal of $-\frac{2}{5}$ is _____.

2. Evaluate the following:
   
   a) $\frac{5}{3} \cdot \frac{3}{5} = _____$
   
   b) $\frac{0}{52} = _____$
   
   c) $\frac{52}{0} = _____$

3. Write a numerical expression for each phrase and simplify:

   a) The product of $-4$ and $3$ added to $-10$

   b) The quotient of $42$ and $-7$ subtracted from $-3$