Multiplying and Dividing Integers

Grades 5-7
5 AF 1.5; 6 NS 2.3; 7.NS.2

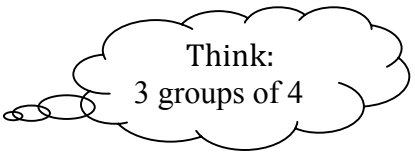
This lesson is intended to deepen student understanding of multiplication and division of integers. Students will build on prior knowledge of repeated addition and the concept of reciprocals.

Multiplying Integers:

Ask: When we multiply with integers, what combinations of positive, negative, and zero can you list? [pos × pos, pos × neg, pos × 0, neg × neg, neg × pos, neg × 0, 0 × 0]

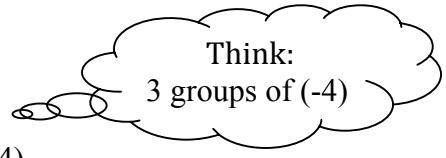
Tell your neighbor what you know about multiplying by zero [$n \times 0=0$]
How do you know? [The Zero Property of Multiplication]

<u>Positive × Positive</u>
3×4



3×4
$= 4+4+4$
$=12$

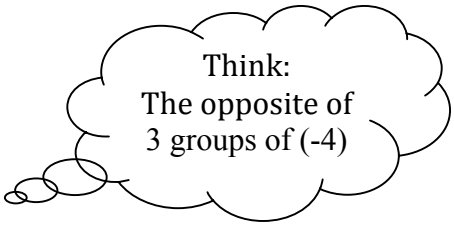
<u>Positive × Negative</u>
$3 \times (-4)$



$3 \times (-4)$
$= (-4)+(-4)+(-4)$
$= -12$

When we have $(-4) \times 3$, can we change the order of the factors to have $3 \times (-4)$? [yes]
Which property allows us to do this? [Commutative Property of Multiplication]

<u>Negative × Negative</u>
$-3 \times (-4)$



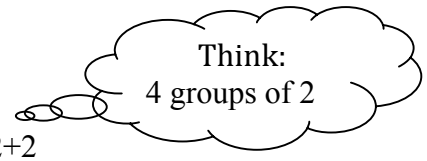
$-3 \times (-4)$
$=$ the opposite of $[3 \times (-4)]$
$=$ the opposite of $[(-4)+(-4)+(-4)]$
$=$ the opposite of $[-12]$
$=12$

You Try:
Identify and evaluate each expression.

4×2; $4 \times (-2)$; $-4 \times (-2)$

Positive × Positive

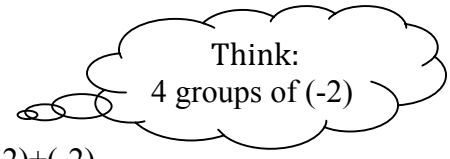
4×2



4×2
$= 2+2+2+2$
$=8$

Positive × Negative

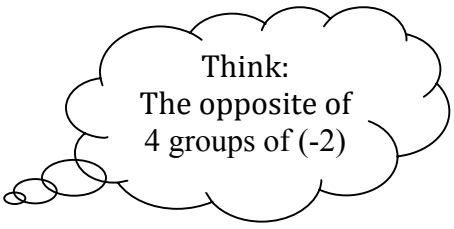
$4 \times (-2)$



$4 \times (-2)$
$= (-2)+(-2)+(-2)+(-2)$
$= -8$

Negative × Negative

$-4 \times (-2)$



$= \text{the opposite of } [4 \times (-2)]$
$= \text{the opposite of } [(-2)+(-2)+(-2)+(-2)]$
$= \text{the opposite of } [-8]$
$=8$

Dividing Integers:

What is a reciprocal? [the number by which you multiply a given number to get a product of one]
What are some examples of numbers and their reciprocals?

List and ask, "How do you know?"

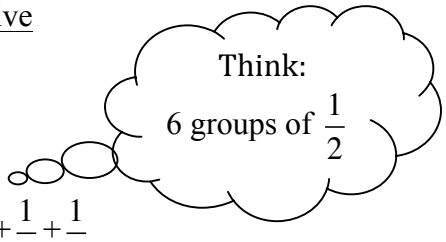
$\frac{2}{3}$ and $\frac{3}{2}$	$\frac{1}{5}$ and $\frac{5}{1}$
$\frac{3}{2} \bullet \frac{2}{3}$	$\frac{1}{5} \bullet \frac{5}{1}$
$= \frac{6}{6}$	$= \frac{5}{5}$
$= 1$	$= 1$

What is the reciprocal of -8? $\left[-\frac{1}{8}\right]$

$$\frac{-8}{1}\bullet\frac{1}{-8}$$
$$=\frac{-8}{-8}$$
$$=1$$

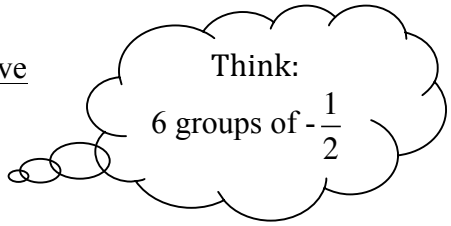
Remember you can divide by multiplying by the reciprocal of the divisor.

Positive ÷ Positive



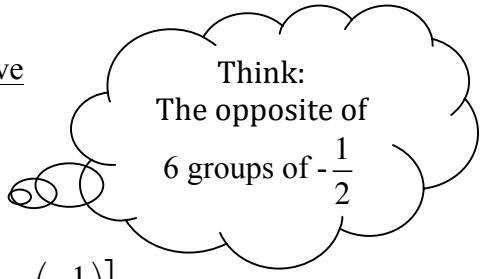
$6 \div 2$
$=6 \bullet \frac{1}{2}$
$=\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$
$=3$

Positive ÷ Negative



$6 \div (-2)$
$=6 \bullet (-\frac{1}{2})$
$=\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)$
$=-3$

Negative ÷ Negative

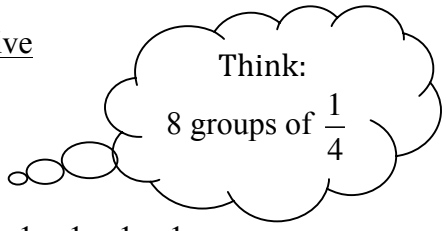


$-6 \div (-2)$
$=-6 \bullet \left(-\frac{1}{2}\right)$
$= \text{the opposite of } \left[6 \bullet \left(-\frac{1}{2}\right)\right]$
$= \text{the opposite of } \left[\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)+\left(-\frac{1}{2}\right)\right]$
$= \text{the opposite of } -3$
$=3$

You Try:
Identify and evaluate each expression.

$8 \div 4$; $8 \div (-4)$; $-8 \div (-4)$

Positive ÷ Positive



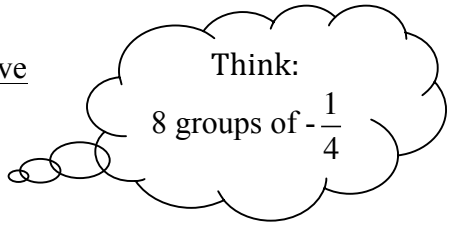
$8 \div 4$

$= 8 \bullet \frac{1}{4}$

$= \frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}$

$=2$

Positive ÷ Negative



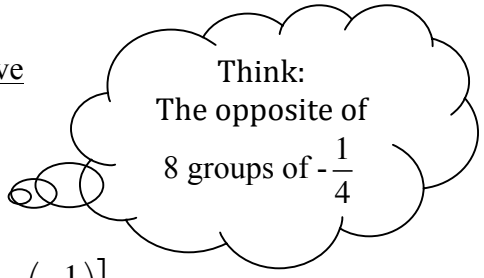
$8 \div (-4)$

$= 8 \bullet \left(-\frac{1}{4}\right)$

$= \left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)$

$=-2$

Negative ÷ Negative



$-8 \div (-4)$

$= -8 \bullet \left(-\frac{1}{4}\right)$

$=$ the opposite of $\left[8 \cdot \left(-\frac{1}{4}\right)\right]$

$=$ the opposite of $\left[\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)+\left(-\frac{1}{4}\right)\right]$

$=$ the opposite of -2

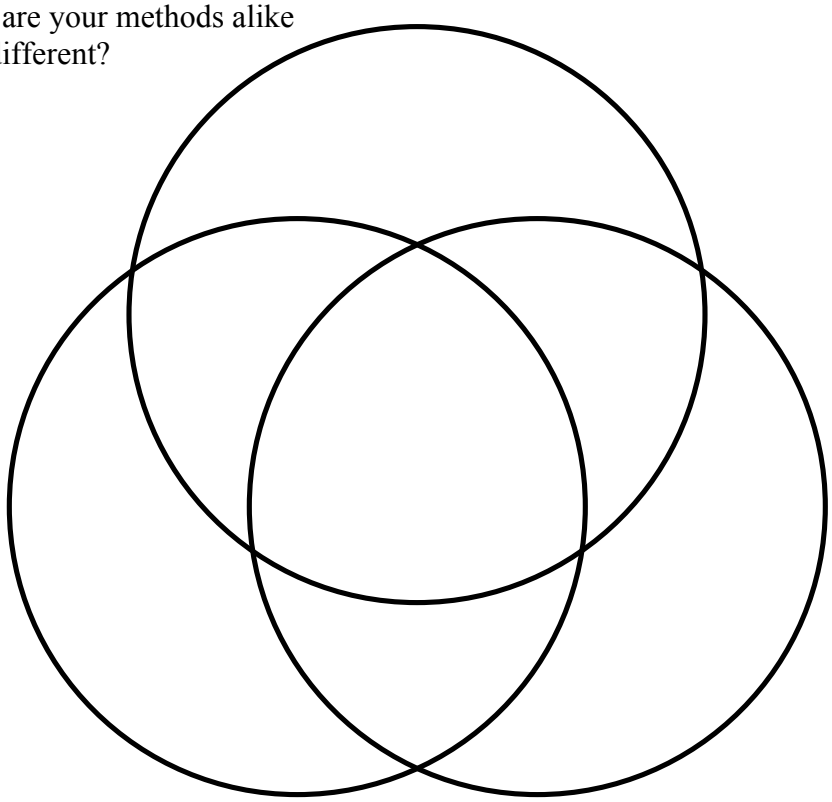
$=2$

Warm Up 6.NS.7.1d

- Evaluate the expression: -4 + -5 + -6
- Find two classmates who used other ways to evaluate the expression and record their methods.

My Method	Method 2 by	Method 3 by

How are your methods alike and different?



What is something new or different that you learned?