Math: Pre-Algebra Session #2

To multiply integers, you need to follow two steps:

1. **Ignore the signs and multiply**
2. **Figure out the sign of the answer using sign rules →**

Multiplying Integers Sign Rules
Positive • Positive = Positive
Negative • Negative = Positive
Positive • Negative = Negative
Negative • Positive = Negative

The two integers have the same sign:

$-3 \cdot -2 = 6$ OR $3 \cdot 2 = 6$

Answer will be positive.

The two integers have the opposite signs:

$-3 \cdot 2 = -6$ OR $3 \cdot -2 = -6$

Answer will be negative.

Let's practice integer multiplication with different notation.

Here are three ways to write the same multiplication problem.

Dot	Parentheses (1)	Parentheses (2)
$5 \cdot -7 = -35$	$5(-7) = -35$	$(5)(-7) = -35$

Commutative Property of Multiplication

Commutative Property of Multiplication

$$a \cdot b = b \cdot a$$

where a and b are integers

The commutative property of multiplication states that the product of two integers will be the same regardless of their order.

Associative Property of Multiplication

Associative Property of Multiplication
$(a \bullet b) \bullet c = a \bullet (b \bullet c)$
where a, b, and c are integers

The associative property of multiplication states that the product of more than two integers will be the same regardless of which integers are multiplied together first.

More Multiplication Properties

Identity Property of Multiplication

$a \cdot 1 = a$ OR $1 \cdot a = a$

where a is any integer

* The product of any integer and -1 equals the opposite of the integer.

Zero Property of Multiplication

$a \cdot 0 = 0$ OR $0 \cdot a = 0$

where a is any integer

* The product of any integer and 1 equals the integer.

Multiplicative Property of -1

$a \cdot -1 = -a$ OR $-1 \cdot a = -a$

where a is any integer

* The product of any integer and 0 equals 0.

Order of Operations tells us the correct order to evaluate a math expression.

P	Parentheses
E	Exponents
M	Multiplication & Division
D	
A	Addition & Subtraction
S	

1. Evaluate the parentheses.
2. (Skip exponents for now.)
3. Evaluate multiplication and/or division.
4. Evaluate addition and/or subtraction.

Distributive Property

Distributive Property

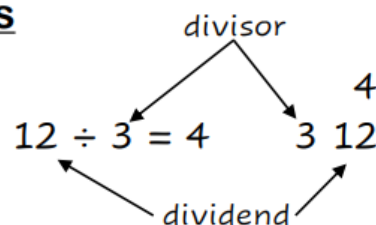$$a \cdot (b + c) = a \cdot b + a \cdot c$$

OR

$$(b + c) \cdot a = b \cdot a + c \cdot a$$

where a, b, and c are integers

The distributive property tells us that distributing the multiplier (a) to each addend (b & c) produces the same result as adding the addends first and then multiplying by the multiplier.

Dividing Integers

*Remember: The number we divide by is called the **divisor** and the number we divide into is called the **dividend**.

$$12 \div 3 = 4$$

To divide integers, you need to follow two steps:

1. Ignore the signs and divide the numbers
2. Figure out the sign of the answer using these sign rules →

Dividing Integers Sign Rules	
Positive ÷ Positive = Positive	The two integers have the same sign: $12 \div 3 = 4$ OR $-12 \div -3 = 4$ Answer will be positive.
Negative ÷ Negative = Positive	
Positive ÷ Negative = Negative	The two integers have the opposite signs: $-12 \div 3 = -4$ OR $12 \div -3 = -4$ Answer will be negative.
Negative ÷ Positive = Negative	

Multiplicative Property of -1	Commutative Property of Multiplication	Identity Property of Addition
Order of Operations	Associative Property of Multiplication	Distributive Property
Commutative Property of Addition	Integer Subtraction to Addition	Identity Property of Multiplication
Zero Principle	Zero Property of Multiplication	Associate Property of Addition

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To multiply integers, you need to follow two steps:

1. Ignore the signs and multiply
2. Figure out the sign of the answer using these sign rules →

Multiplying Integers Sign Rules	
Positive • Positive = Positive	**The two integers have the same sign:** -3 • -2 = 6 OR 3 • 2 = 6 Answer will be positive.
Negative • Negative = Positive	
Positive • Negative = Negative	**The two integers have the opposite signs:** -3 • 2 = -6 OR 3 • -2 = -6 Answer will be negative.
Negative • Positive = Negative	

$$5 \cdot 2 = 10$$
$$-5 \cdot -2 = +10$$
$$-5 \cdot 2 = -10$$
$$5 \cdot -2 = -10$$

$$6 \cdot 3 = 18$$
$$-6 \cdot -3 = +18$$
$$6 \cdot -3 = -18$$
$$-6 \cdot 3 = -18$$

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

$$(-3)(5) = -15$$

$$(-1)2 = -2$$

$$-4(11) = -44$$

$$12(-3) = -36$$

$$-3(0) = 0$$

Let's practice integer multiplication with different notation.

Here are three ways to write the same multiplication problem.

Dot	Parentheses (1)	Parentheses (2)
$5 \cdot -7 = -35$	$5(-7) = -35$	$(5)(-7) = -35$

Play Teacher vs Student

$$9 \cdot 11 = 99$$

$$-3 \cdot 10 = -30$$

$$(1) \, 0 = 0$$

$$-17 \cdot 1 = -17$$

$$(-8)(-8) = +64$$

$$(-9)(-9) = 81$$

$$(-7) \, 5 = -35$$

$$2 \cdot -12 = -12$$

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

means that changing order does not matter to result

Commutative Property of Multiplication

Commutative Property of Multiplication
$a \cdot b = b \cdot a$
where a and b are integers

The commutative property of multiplication states that the product of two integers will be the same regardless of their order.

$2 \cdot 3 = 6$

$3 \cdot 2 = 6$

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

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

$(-11)5 = -55$

$5(-11) = -55$

means "grouping"

Associative Property of Multiplication

Associative Property of Multiplication
$(a \cdot b) \cdot c = a \cdot (b \cdot c)$
where a, b, and c are integers

The associative property of multiplication states that the product of more than two integers will be the same regardless of which integers are multiplied together first.

$$2(3)(4) = 24$$
$$6 \times 4$$

$$2(3)(4) = 24$$
$$2 \times 12$$

$$(-1)(2)(3) = -6$$
$$-2 \times 3$$

$$-1(2)(3) = -6$$
$$-1 \times 6$$

$$(-4 \cdot 10)(2) = -80$$

$$(-4)(10 \cdot 2) = -80$$

$$7 \cdot (-1)(-9) = 63$$
$$7 \cdot 9$$

$$(7) \cdot -1 \cdot -9$$
$$-7 \times -9$$
$$= 63$$

More Multiplication Properties

Identity Property of Multiplication
$a \cdot 1 = a$ OR $1 \cdot a = a$
where a is any integer

* The product of any integer and -1 equals the opposite of the integer.

Zero Property of Multiplication
$a \cdot 0 = 0$ OR $0 \cdot a = 0$
where a is any integer

* The product of any integer and 1 equals the integer.

Multiplicative Property of -1
$a \cdot -1 = -a$ OR $-1 \cdot a = -a$
where a is any integer

* The product of any integer and 0 equals 0.

Identity
$$5 \cdot 1 = 5$$
$$1 \cdot (-3) = -3$$
$$1 \cdot -67 = -67$$

Zero mult.
$$5 \cdot 0 = 0$$
$$-5 \cdot 0 = 0$$
$$-500 \cdot 0 = 0$$

mult. Prop of -1 :
$$5 \cdot -1 = -5$$
$$300 \cdot -1 = -300$$
$$-1 \cdot -6 = 6$$
$$-1 \cdot 10 = -10$$

Order of Operations tells us the correct order to evaluate a math expression.

1. Evaluate the parentheses.
2. (Skip exponents for now.)
3. Evaluate multiplication and/or division.
4. Evaluate addition and/or subtraction.

P	Parentheses
E	Exponents
M	Multiplication &
D	Division
A	Addition &
S	Subtraction

$$-2(4--6)$$
$$\underbrace{4+6}$$
$$-2(10) = -\underline{\underline{20}}$$

$$9\cdot(-6--5)$$
$$\underbrace{-6+5}$$
$$9\cdot(-1) = -\underline{\underline{9}}$$

$$(-1+0)\cdot(3-2)+4$$
$$-1\cdot(1)+4$$
$$\underbrace{-1}+4 = \underline{\underline{3}}$$

$$-12+(-4\cdot-2)\cdot0$$
$$+8\cdot0$$
$$-12+0 \qquad = -\underline{\underline{12}}$$

Distributive Property

Distributive Property

$$a \cdot (b + c) = a \cdot b + a \cdot c$$

OR

$$(b + c) \cdot a = b \cdot a + c \cdot a$$

where a, b, and c are integers

The distributive property tells us that distributing the multiplier (a) to each addend (b & c) produces the same result as adding the addends first and then multiplying by the multiplier.

$$5(2 + 3) = \overset{2 \times 5}{10} + \overset{3 \times 5}{15} = \underline{\underline{25}}$$

$$3(-4 + 3) = -12 + 9 = \underline{\underline{-3}}$$

$$-2(6 + -3) = -12 + 6 = \underline{\underline{-6}}$$

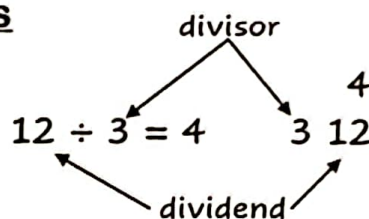$$-1(4 - 8) = -4 + 8 = \underline{\underline{-4}}$$

$$6(-2 - 3) = -12 - 18 = \underline{\underline{-30}}$$

$$\underbrace{}_{-5}$$

$$6 \cdot -5 = \underline{\underline{-30}}$$

Dividing Integers

divisor

*Remember: The number we divide by is called the **divisor** and the number we divide into is called the **dividend**.

$$12 \div 3 = 4$$

$$3 \overline{)12}^{\;4}$$

dividend

To divide integers, you need to follow two steps:

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Positive ÷ Positive = Positive	**The two integers have the same sign:** 12 + 3 = 4 OR -12 + -3 = 4 Answer will be positive.
Negative ÷ Negative = Positive	
Positive ÷ Negative = Negative	**The two integers have the opposite signs:** -12 + 3 = -4 OR 12 + -3 = -4 Answer will be negative.
Negative ÷ Positive = Negative	

$$60 \div 10 = 6$$

$$60 \div -10 = -6$$

$$-60 \div -10 = 6$$

$$-60 \div 10 = -6$$

$$7 \div -7 = -1$$

$$(7 - -9) \div (10 - 8)$$

$$16 \div 2$$

$$= 8$$

$$(-1 + 1) \div (1 - 3)$$

$$0 \qquad\qquad -2$$

$$0 \div 2 = 0$$

Multiplicative Property of -1	Commutative Property of Multiplication	Identity Property of Addition
$3 \cdot (-1) = -3$	$-4 \cdot 3 = 3 \cdot -4$	$0 + -6 = -6$
Order of Operations	**Associative Property of Multiplication**	**Distributive Property**
PEMDAS	$(-2 \cdot 3) \cdot +4$ $= -2 (3 \cdot +4)$	$4(-2+7) =$ $4(-2) + 4(7)$
Commutative Property of Addition	**Integer Subtraction to Addition**	**Identity Property of Multiplication**
$6 + 3 = 3 + 6$	$2 - 3 = 2 + -3$	$1 \cdot 17 = 17$
Zero Principle	**Zero Property of Multiplication**	**Associate Property of Addition**
$8 + -8 = 0$	$7 \cdot 0 = 0$	$(-4+3) + -2$ $= -4 + (3 + -2)$

Questions

Multiplicative Property of -1	Commutative Property of Multiplication	Identity Property of Addition
You borrowed $1 from me three times.	Tickets are $4, you need 3 tix. ⎯⎯⎯ You ordered 3 tix @ $4 each.	the temp did not increase. $(T = -6°C)$
Order of Operations	**Associative Property of Multiplication**	**Distributive Property**
Please excuse my dear aunt sally.) $\dfrac{(-3+4)2}{10}$	You spent $2 for snacks MTW for 4 weeks. ⎯⎯⎯ You buy snacks 3days a week for 4 wks @ $2 per snack	every week, you earn $7 but spend $2 for a month.
Commutative Property of Addition	**Integer Subtraction to Addition**	**Identity Property of Multiplication**
game #1 → I scored 6, you scored 3 goals. Then I scored Game #2 → 3 + you scored 6 goals. Total scores for each game?	I earned $2 + spent $3. ⎯⎯⎯ I spent $3 + earned $2.	Seventeen boxes fit into one shipping box.
Zero Principle	**Zero Property of Multiplication**	**Associate Property of Addition**
I made 8 cookies. you ate them all. How many are left?	You earn $7 per hour at your job. You went on vacation. How much did you earn?	the elevator starts at floor -4, goes up 3 + down 2. ⎯⎯⎯ the elevator starts at floor 3, goes down 2, + down 4 more.