PRINCIPLES - LESSON 1E
PROPERTIES OF REAL NUMBERS

Having an understanding of the properties of real numbers will help you perform arithmetic and algebraic calculations. Most of these you are already aware of.

Simplify. Do NOT use a calculator. Look for shortcuts.

ex1) $6 + 137 + 4$

$= \underbrace{6 + 4}_{10} + 137 = 147$

ex2) $5 \cdot 13 \cdot 2$

$= \underbrace{5 \cdot 2}_{10} \cdot 13 = 130$

ex3) $25 \cdot 5 \cdot 4 \cdot 2$

$= \underbrace{25 \cdot 4}_{100} \cdot 5 \cdot 2 = 1000$

What is the name of the property that allows you to switch the order of numbers when adding or multiplying?

COMMUTATIVE PROPERTY

to commute = to go back and forth

The Commutative Property states that the order of numbers doesn't matter.

ex4) Is addition commutative? That is, does $3 + 4 = 4 + 3$?

yes $\quad 7 = 7$

ex5) Is subtraction commutative? That is, does $3 - 4 = 4 - 3$?

no $\quad -1 \neq 1$

ex6) Is multiplication commutative? That is, does $3 \cdot 4 = 4 \cdot 3$?

yes $\quad 12 = 12$

ex7) Is division commutative? That is, does $3 \div 4 = 4 \div 3$?

no $\quad \frac{3}{4} \neq \frac{4}{3}$

COMMUTATIVE PROPERTY

The Commutative Property of Addition

For all real numbers a and b, $a + b = b + a$

The Commutative Property of Multiplication

For all real numbers a and b, $a \cdot b = b \cdot a$

CHANGING GROUPING

Simplify. Do NOT use a calculator. Try to change the grouping.

ex8) $(13+2)+98$

$= 13+(2+98)$

$= 13+100$

$= 113$

ex9) $\frac{5}{7}\cdot\left(\frac{7}{5}\cdot\frac{2}{3}\right)$

$= \left(\frac{5}{7}\cdot\frac{7}{5}\right)\cdot\frac{2}{3}$

$\frac{35}{35}$

$= 1 \cdot \frac{2}{3} = \frac{2}{3}$

What is the name of the property that allows you to change the grouping of numbers when adding or multiplying?

ASSOCIATIVE PROPERTY

to <u>associate</u> = to keep company in a group

The Associative Property allows us to change grouping.

Addition and multiplication are associative. Subtraction and division are not.

The Associative Property of Addition

For all real numbers a, b, and c, $(a + b) + c = a + (b + c)$

The Associative Property of Multiplication

For all real numbers a, b, and c, $(a \cdot b) \cdot c = a \cdot (b \cdot c)$

DISTRIBUTIVE PROPERTY

to distribute = to deliver or pass out

The Distributive Property is a way to remove grouping symbols

We distribute a number outside of parenthesis to each number inside parenthesis. After we distribute, the parenthesis are gone.

ex10) Simplify by the order of operations:

$5(11+7)$

$= 5(18)$

$= 90$

ex11) Simplify by the distributive property:

$5(11+7)$

$= 55 + 35$

$= 90$

DISTRIBUTIVE PROPERTY

Distribute and then simplify.

Which property is responsible for #12 and #13 being exactly the same question?

The commutative property

ex12) $3(6-2)$

$= 18 - 6$

$= 12$

ex13) $(6-2)3$

$= 18 - 6$

$= 12$

Use the distributive property to make each calculation easier.

ex14) $4(15)$

$= 4(10+5)$

$= 40 + 20 = 60$

ex15) $6(128)$

$= 6(100+20+8)$

$= 600 + 120 + 48 = 768$

IDENTITY ELEMENTS

An identity element is a number that leaves other numbers unchanged when combined with them.

What is the identity element for addition?

In other words, what number leaves other numbers unchanged when added?

0

0 is the identity element under addition.

0 is called the additive identity.

What is the identity element for multiplication?

In other words, what number leaves other numbers unchanged when multiplied?

1

1 is the identity element under multiplication.

1 is called the multiplicative identity.

The Identity Property can be recognized when an identity element is combined with another number.

INVERSE PROPERTIES

Inverse Property of Addition

When I add a number and its **additive inverse**, I get the additive identity, 0.

$$5 + (-5) = 0$$

$$-3 + 3 = 0$$

$$\tfrac{1}{4} + (-\tfrac{1}{4}) = 0$$

Additive inverse is a fancy name for:

OPPOSITE

Inverse Property of Multiplication

When I multiply a number and its **multiplicative inverse**, I get the multiplicative identity, 1.

$$5 \cdot \frac{1}{5} = 1$$

$$-\frac{1}{3} \cdot (-3) = 1$$

$$\frac{3}{4} \cdot \frac{4}{3} = 1$$

Multiplicative inverse is a fancy name for:

RECIPROCAL

The Inverse Property can be recognized when two numbers are combined to get an identity element.