$(3+2)+5=10$
$3+(2+5)=10$

Basic Algebra 1.3

Use the commutative and associative properties

Commute = change location

+ x commutative property not $3+5=5+3$

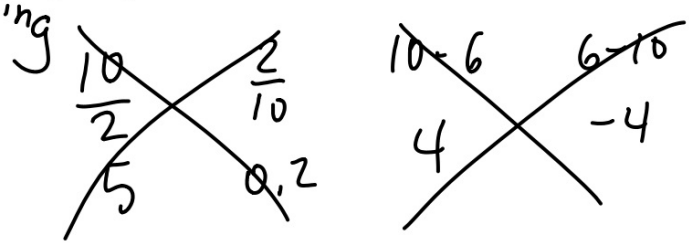
associative property grouping $2\cdot 3=3\cdot 2$

simplify

whole number

closure property

counterexample



matching activ.

Alg tiles

$x = 3$ $3 = x$

Commutative Property of Addition + X		
	Words:	The order in which two numbers are added does not change their sum.
	Symbols:	For any numbers a and b, $a + b = b + a$.
	Numbers:	$5 + 7 = 7 + 5$

Commutative Property of Multiplication + X		
	Words:	The order in which two numbers are multiplied does not change their product.
	Symbols:	For any numbers a and b, $a \cdot b = b \cdot a$.
	Numbers:	$3 \cdot 10 = 10 \cdot 3$

Mental math...

Associative Property of Addition		
	Words:	The way in which three numbers are grouped when they are added does not change their sum.
	Symbols:	For any numbers a, b, and c, $(a + b) + c = a + (b + c)$.
	Numbers:	$(24 + 8) + 2 = 24 + (8 + 2)$

3 4 3 4

11

Associative Property of Multiplication + X		
	Words:	The way in which three numbers are grouped when they are multiplied does not change their product.
	Symbols:	For any numbers a, b, and c, $(a \cdot b) \cdot c = a \cdot (b \cdot c)$.
	Numbers:	$(9 \cdot 4) \cdot 25 = 9 \cdot (4 \cdot 25)$

$(5 \cdot 3) 2 = 30$

$5 \cdot (3 \cdot 2) = 30$

Mental math... Gemma

$2 + (3 \cdot 5) = 17$

$(2 + 3) \cdot 5 = 25$

Examples

Name the property shown

1. $4 \cdot 11 \cdot 2 = 11 \cdot 4 \cdot 2$ Comm.

2. $(n + 12) + 5 = n + (12 + 5)$ assoc.

Your Turn

a. $(5 \cdot 4) \cdot 3 = 5 \cdot (4 \cdot 3)$ = 60

assoc

b. $16 + t + 1 = 16 + 1 + t$

Comm

17 + t

Matching activ.

$15 + 8 + 3x$

$(15 + 8) + 3x$

$23 + 3x$

Example 3 Simplify the expression $15 + (3x + 8)$. Identify the properties used in each step.

$15 + 8 + 3x$ Comm

$23 + 3x$ Subs

$7+2a+6+9$
$2a+7+6+9$ Comm
$2a+22$ Subs

Your Turn

Simplify each expression. Identify the properties used in each step.

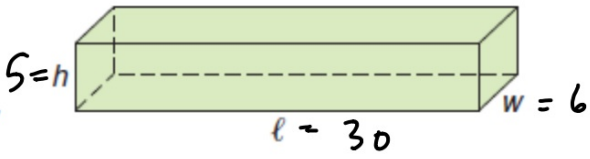
c. $7 + 2a + (6 + 9)$

$7+2a+15$ Subs
$2a+7+15$ Comm
$2a+22$ Subs

d. $(x \cdot 5) \cdot 20$

$x(5 \cdot 20)$ assoc
$x \cdot 100$ subs.
$100x$ comm
~~$100xx$~~
$100 \cdot x$
$100x$

4 The volume of a box can be found using the expression $\ell \times w \times h$, where ℓ is the length, w is the width, and h is the height. Find the volume of a box whose length is 30 inches, width is 6 inches, and height is 5 inches.



$5 \cdot 30 \cdot 6$ ← 3

900 in

900 cu. in.

0, 1, 2, 3, 4 . . .

Closure Property of Whole Numbers		
	Words:	Because the sum or product of two whole numbers is also a whole number, the set of whole numbers is closed under addition and multiplication.
	Numbers:	$2 + 5 = 7$, and 7 is a whole number. $2 \cdot 5 = 10$, and 10 is a whole number.

whole + whole = whole — Closed to addition

whole − whole = (maybe) — not " subtr.

whole · whole = whole — Closed to mult

$\frac{\text{whole}}{\text{whole}}$ = (maybe) — not " to division

Example 5 State whether the statement *Division of whole numbers is commutative* is *true* or *false*. If false, provide a counterexample.

False

ex: $\frac{2}{10} = 0.2$ $\frac{10}{2} = 5$

↑ Your exception