Geometry: 2.4 Algebraic Reasoning

---

is 4 + (5 + 6) = (4 + 5) + 6 yes

4 + 11 = 9 + 6

What is this property called?

Associative Property

is 6 + 5 = 5 + 6 ?

11 = 11

What is this property called?

Commutative Property

Does this property hold for subtraction?

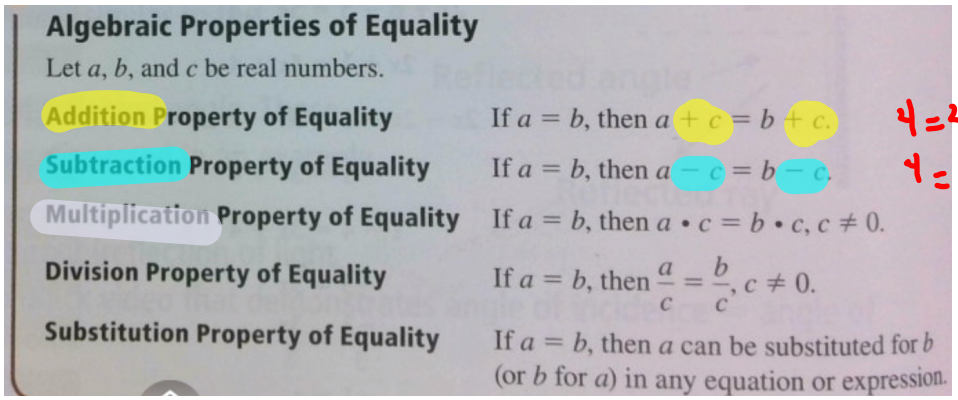
6 - 5 ≠ 5 - 6

1 -1

No.

Lesson 2.4 Algebraic Reasoning

When solving equations, you are constantly using properties of equality. Here's a list of some of them.



Algebraic Properties of Equality

Let a, b, and c be real numbers.

Addition Property of Equality	If $a = b$, then $a + c = b + c$.
Subtraction Property of Equality	If $a = b$, then $a - c = b - c$.
Multiplication Property of Equality	If $a = b$, then $a \cdot c = b \cdot c, c \neq 0$.
Division Property of Equality	If $a = b$, then $\frac{a}{c} = \frac{b}{c}, c \neq 0$.
Substitution Property of Equality	If $a = b$, then a can be substituted for b (or b for a) in any equation or expression.

$4 = 4$ $\quad 4+7 = 4+7$

$4 = 4$ $\quad 4-7 = 4-7$

Examples that use the properties to solve:

Using Properties of Equality

Addition: $x - 8 = 10$

adding same # keeps it equal

$+8 \quad +8$

$x = 18$

Subtraction: $m + 5 = 11$

$-5 \quad -5$

$x = 6$

- Multiplication: $\frac{x}{3} \cdot 3 = -7 \cdot 3$

$x = -21$

$\frac{3x}{3} = 1x = x$

Division: $-4x = 9$

$\frac{}{-4} \quad \frac{}{-4}$

$x = -\frac{9}{4}$

Side note about negatives...

$\frac{9}{-4} \overset{\checkmark}{=} \frac{-9}{4} \overset{\checkmark}{=} -\frac{9}{4} \neq \frac{-9}{-4}$

Ex: Solve the equations, Justify your steps.

P.o.E : property of Equality

$6x - 11 = -35$

$+11 \quad +11$ Addition Prop. of Equality

$\frac{6x}{6} = \frac{-24}{6}$ Division P.o.E

$x = -4$

$-2p - 9 = 10p - 17$

$+2p$ Addition P.o.E

$-9 = 12p - 17$

$+17 \quad +17$ Addition P.o.E

$\frac{8}{12} = \frac{12p}{12}$ Division P.o.E

$p = \frac{8}{12}$ simplify

$p = \frac{2}{3}$

Another "simplify" Example

$3x - 6x - 4 = 8$

$-3x - 4 = 8$

Solve & Justify Steps.

Ex: Solve for r. $p(r + 1) = n$

$\frac{p(r+1)}{p} = \frac{n}{p}$ Division POE

$r + 1 = \frac{n}{p}$

$-1 \quad -1$ Subtraction POE

$r = \frac{n}{p} - 1$

Ex: Solve for b. $A = \frac{1}{2} b h$

$\cdot 2 \quad \cdot 2$

$2A = bh$

$\frac{2A}{h} = \frac{bh}{h}$ division POE

$b = \frac{2A}{h}$

mult. POE

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

$= 1$

Homework:

Page 88-89

Numbers 7-9, 16, 17, 19, 20, 22, 23