

The Addition Property

$$\text{IF } a=b, \text{ THEN } a+d=b+d$$

EXAMPLE:

$$6x - 5 = 13$$

GIVEN

$$6x - 5 + 5 = 13 + 5$$

ADDITION
PROPERTY

The Subtraction Property

$$\text{IF } a=b, \text{ THEN } a-d=b-d$$

EXAMPLE

$$6x + 5 = 11$$

GIVEN

$$6x + 5 - 5 = 11 - 5$$

SUBTRACTION
PROPERTY

The Multiplication Property

$$\text{IF } a=b, \text{ THEN } ad=bd$$

EXAMPLE

$$\frac{x}{4} = 10$$

GIVEN

$$4 \cdot \left(\frac{x}{4}\right) = 10 \cdot 4$$

MULTIPLICATION
PROPERTY

The Division Property

$$\text{IF } a=b, \text{ THEN } \frac{a}{d} = \frac{b}{d}$$

EXAMPLE

$$3x = 18$$

GIVEN

$$\frac{3x}{3} = \frac{18}{3}$$

DIVISION
PROPERTY

The Substitution Property

• IF $a=b$, THEN YOU CAN REPLACE a WITH b IN ANY SITUATION

• SUBSTITUTION IS WHAT WE DO WHEN WE COMBINE LIKE TERMS

EXAMPLE

$$3x + 5 = 13$$

GIVEN

$$3x - 5 + 5 = 13 + 5$$

ADDITION
PROPERTY

$$3x = 18$$

SUBSTITUTION
PROPERTY

NOTICE HOW THE $13+5=18$. THAT IS SUBSTITUTION

The Distributive Property

$$\text{GIVEN } a+bx \text{ THEN } d(a+bx) = da+dbx$$

EXAMPLE

$$4(2x+3)$$

GIVEN

$$8x + 12$$

DISTRIBUTIVE
PROPERTY

Example 1

Given: $\frac{4x+6}{2} = 9$

Prove: $x = 3$

Statements	Reasons
a. $\frac{4x+6}{2} = 9$	a. <u>GIVEN</u>
b. $2\left(\frac{4x+6}{2}\right) = 2(9)$	b. Mult. Prop.
c. $4x+6 = 18$	c. <u>SUBSTITUTION</u>
d. $4x+6-6 = 18-6$	d. <u>SUBSTITUTION</u>
e. $4x = 12$	e. Substitution
f. $\frac{4x}{4} = \frac{12}{4}$	f. Div. Prop.
g. $x = 3$	g. Substitution

Example 2

Given: $4x + 8 = x + 2$

Prove: $x = -2$

Statements	Reasons
a. $4x + 8 = x + 2$	a. <u>GIVEN</u>
b. $4x + 8 - x = x + 2 - x$	b. <u>SUBTRACTION</u>
c. $3x + 8 = 2$	c. Substitution
d. $3x + 8 - 8 = 2 - 8$	d. <u>SUBTRACTION</u>
e. $3x = -6$	e. Substitution
f. $\frac{3x}{3} = \frac{-6}{3}$	f. <u>DIVISION</u>
g. $x = -2$	g. Substitution

★ You MUST ALWAYS USE SUBSTITUTION IN BETWEEN EACH OTHER PROPERTY. FIRST OF THE SUBSTITUTION PROPERTY LIKE SIMPLIFICATION

Example 3

Given: $6x + 2(x-1) = 30$

Prove: $x = 4$

$6x + 2(x-1) = 30$	Given
$6x + 2x - 2 = 30$	DISTRIBUTIVE
$8x - 2 = 30$	SUBSTITUTION
$8x - 2 + 2 = 30 + 2$	ADDITION
$8x = 32$	SUBSTITUTION
$\frac{8x}{8} = \frac{32}{8}$	DIVISION
$x = 4$	SUBSTITUTION

Handwritten notes: "CONSTANT TERMS USE SUBSTITUTION" with an arrow pointing to the -2 terms in the steps above.

Example 4

$4(x-2) = 16$

$4x - 8 = 16$

$2x - 8 + 8 = 16 + 8$

$2x = 24$

$\frac{2x}{2} = \frac{24}{2}$

$x = 12$

a. Given
b. <u>DISTRIBUTIVE</u>
c. <u>ADDITION</u>
d. <u>SUBSTITUTION</u>
e. <u>DIVISION</u>
f. <u>SUBSTITUTION</u>