Math-2A

Lesson 1-2

Solving Single-Unknown Linear Equations

Vocabulary

Linear Equation: an equation where all of the letters (either variables or unknown values) have NO EXPONENTS.

$4x – 2 = 6$ $2x + 3y = 6$

Previous Vocabulary

Solution to an equation: the value of the variables or unknown value that makes the equation “true”.

Equivalent equation: has the same solution as the original equation:

$4x + 2 = 10$ $4x = 8$

The solution to both equations is $x = 2$.

They are equivalent equations.

Properties of Equality Only apply to equations!!!

Addition Property of Equality

Subtraction Property of Equality

Multiplication Property of Equality

Division Property of Equality

“+, -, x, ÷” by the same number on both sides of the equal sign and you are guaranteed that the next equation is an equivalent equation.

Solving a single-unknown equation: to use properties to rewrite the equation as a more simplified equivalent equation to help us more easily identify the solution.

$x \enclose{circle}{+3} = 7$ Turn addends that are constants into zeroes.

What property can we use to can we turn 3 into a zero?

What are the names of the 4 properties we learned yesterday?

Identity Property of Multiplication?

Inverse Property of Multiplication?

Identity Property of Addition?

Inverse Property of Addition?

Any number added to its opposite (sign +/-) becomes a zero.

$x \enclose{circle}{+3} = 7$ We want to take advantage of the inverse property of addition to turn the 3 into a zero but we must also obey the subtraction property of equality.

Subtract the same number from both sides of the equal sign and you are guaranteed that the next equation is an equivalent equation.

$$\begin{array}{rcl} x+3 & = & 7 \\ -3 & & -3 \\ \hline x+0 & = & 4 \\ x & = & 4 \end{array}$$

Are the two equations equivalent?

Are the two equations equivalent?

What property says that: x + 0 = x ?

Identity Property of Addition.

"Math"

Justification why the math results in an equivalent equation

$$\begin{array}{rcl} x+3 & = & 7 \\ -3 & & -3 \\ \hline x+0 & = & 4 \\ x & = & 4 \end{array}$$

(1) Subtraction Property of Equality and (2) Inverse Property of Addition.

(3) Identity Property of Addition.

One operation → rewrite and give your justification.

Your turn: solve the following equations using "one step—rewrite—justify"

$$\begin{array}{rcl} -5+x & = & 13 \\ +5 & & +5 \\ \hline 0+x & = & 18 \\ x & = & 18 \end{array}$$

(1) Addition Property of Equality and (2) Inverse Property of Addition.

(3) Identity Property of Addition.

$$\begin{array}{rcl} -9 & = & x+4 \\ -4 & & -4 \\ \hline -13 & = & x+0 \\ -13 & = & x \end{array}$$

(1) Subtraction Property of Equality and (2) Inverse Property of Addition.

(3) Identity Property of Addition.

Your turn: solve the following equations using "one step—rewrite—justify"

Hint: gather x's to one side of the equal sign.

$2x = x + 5$

-x | -x

x = 0 + 5

x = 5

(1) Addition Property of Equality and
(2) Inverse Property of Addition.

(3) Identity Property of Addition.

$2x - 6 = x + 4$

-x | -x

x – 6 = 0 + 4

x – 6 = 4

+6 | +6

x = 10

(1) Subtraction Property of Equality and (2) Inverse Property of Addition.

(3) Identity Property of Addition.

(5) Addition Property of Equality and
(6) Inverse Property of Addition.

(7) Identity Property of Addition.

$\textcircled{2}x = 12$ What property would we use here?

Inverse property of multiplication: turn the 2 into a one but we must also obey the properties of equality.

Divide both sides of the equal sign by the same number and you are guaranteed that the next equation is an equivalent equation.

$2x = 6$

$\div 2 \mid \div 2$

$1x = 3$

$x = 3$

Are the two equations equivalent?

Are the two equations equivalent?

What property says that: 1x = x ?

Identity Property of Multiplication.

Your turn: solve the following equations using "one step—rewrite—justify"

$5x + 2 = 17$

-2 | -2

5x = 15

÷ 5 | ÷ 5

x = 3

(1) Subtraction Property of Equality
(2) inverse property of addition,
(3) Identity property of addition

(4) Division property of equality
(5) Inverse Property of Multiplication
(6) Identity Property of Multiplication.

Turn coefficients into ones and addends into zeroes so that they disappear!

Could we have used the division property of equality first?

YES…but….

Your turn: solve the following equations using "one step—rewrite—justify"

$5x + 2 = 17$

÷ 5 | ÷ 5

$1x + \frac{2}{5} = \frac{17}{5}$

$x + \frac{2}{5} = \frac{17}{5}$

$-\frac{2}{5} \mid -\frac{2}{5}$

$x = \frac{15}{5}$

x = 3

(1) division Property of Equality
(2) inverse property of multiplication,

(3) Identity property of multiplication

(4) Subtraction Property of equality
(5) Inverse Property of addition
(6) Identity Property of addition.

(7) Equivalent values of the "3"

Why did both methods give the same solution?

Using properties guarantees equivalent equations.

Which "path" was easier?

Turn constant addends into zeroes 1st
Then
Turn coefficients into ones.

Let's make it faster → only identify the specific property of equality only.

$$\begin{array}{rcl} 2x-3 & = & 21 \\ +3 & & +3 \\ \hline 2x & = & 24 \\ \div 2 & & \div 2 \\ \hline x & = & 12 \end{array}$$

Addition Property of Equality

Division Property of Equality

Equivalent equation to the both equations above.

Turn coefficients into ones and addends into zeroes so that they disappear!

Your turn: solve using "1 step—rewrite—justify" (but you only have to identify the correct property of equality to make it quicker)

1. 2 = 3 + x

2. 12 – x = 3x

3. -27 = 2x – 3 + 2x

Your turn:

4. $\frac{x}{3} = -2$

5. $\frac{2x}{5} - 4 = -8$

6. $3x - 8 = 1$