

## Lesson 1: Solving Linear Inequalities and Word Problems

A. What is a linear equation?

- linear = line, as seen later, variable  $x$  is to the 1<sup>st</sup> degree
- equation  $\Rightarrow$  equal sign

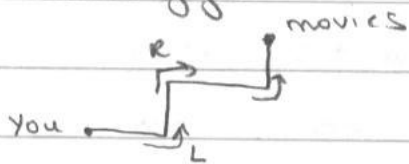
Ex: Are these linear equations?

- a)  $3x+5=8$  Yes,  $x^1 =$       c)  $5x^2+2=7$  No,  $x^2 \leftarrow 2^{\text{nd}} \text{ deg}$   
 b)  $4x-3$  No, no =      d)  $3x-19=2x$  Yes,  $x^1 =$

B. What is solving?  $\Rightarrow$  finding what the unknown variable is equal to (ie:  $x=?$ )

C. How do we solve?

• analogy:



going to movies

to go back

1) L

1) R

2) R

2) L

3) L

3) R

- to go back, we undo the forward operations backwards (undoing last, second to last, ... first)

what operations undo each other (inverses)

a) left, right    b) up, down    c) +, -    d)  $\times, \div$     e)  $x^2, \sqrt{x}$

• in an equation, imagine you are  $x$ , the operations being done are like left and right, and the movies is what it all equals. Thus, you undo the mathematical operations to get back to  $x$ .

\* because  $=$  says what's on one side is the same as what's on the other, we must perform operations on both sides of the  $=$  to balance the changes

②

ex:  $3x = 6$  ← what is being done to  $x$ ? It is being mult. by 3, thus to cancel that, we divide by 3 (on both sides!)

$$\frac{3x}{3} = \frac{6}{3}$$

$$x = 2$$

ex:  $x + 2 = 8$  ← 2 is being added to  $x$ , so to undo, we subtract 2 from both sides!

$$\underline{-2} \quad \underline{-2}$$

$$x = 6$$

ex:  $2x + 5 = 3x + 4$  ← Remember our solution is  $x = \#$ .  $x$ 's on one side, #'s on the other. Pick a side for each and cancel the ones that shouldn't be there

$$\underline{-2x} \quad \underline{-2x}$$

$$5 = x + 4$$

$$\underline{-4} \quad \underline{-4}$$

$$1 = x$$

cancelling  $x$ 's here, so I want #'s to be on this side

ex:  $3x + 2 - 5x = 9$  ← Here  $x$ 's are on one side.

$$\downarrow \checkmark$$

$$-2x + 2 = 9$$

$$\underline{-2} \quad \underline{-2}$$

$$-2x = 7$$

$$\underline{-2} \quad \underline{-2} \Rightarrow x = -\frac{7}{2}$$

cancelling brings them to other side, which we don't want. Here, we just combine like terms

ex  $3(x+2) = 9$  ←  $x$  is not free to move. Two ways

a) distribute and solve

b) undo  $\times 3$  first

$$3(x+2) = 9$$

$$3x + 6 = 9$$

$$\underline{-6} \quad \underline{-6}$$

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

$$x = 1$$

$$\frac{3(x+2)}{3} = \frac{9}{3}$$

$$x + 2 = 3$$

$$\underline{-2} \quad \underline{-2}$$

$$x = 1$$

\* Sometimes quicker, sometimes not

word Problems ★ read slowly !!

Phrases to consider:

a less than b  $\Rightarrow b - a$  (a is subtracted from b)

quotient of a and b  $\Rightarrow \frac{a}{b} \Rightarrow b \sqrt{a}$

difference between a and b  $\Rightarrow a - b$

product of a and b  $\Rightarrow (a)(b)$  (multiplication)

sum of a and b  $\Rightarrow a + b$  (addition)

Ex. five times a number is three less than seven times that number. what is the number?

★ easier →  
to solve  
using  
symbols

→  $5x = 7x - 3$

Solve:  $5x = 7x - 3 \rightarrow \begin{matrix} -7x & -7x \\ \hline -2x & = & -3 \end{matrix} \rightarrow \begin{matrix} -2x & = & -3 \\ \hline -2 & & -2 \end{matrix} \rightarrow x = \frac{3}{2}$

Ex: The difference between sixteen and nine times a number is three less than the quotient of that number and two.

$16 - 9x = \frac{x}{2} - 3$	can multiply both sides
$2(16 - 9x) = 2(\frac{x}{2} - 3)$	by 2 to cancel x's
$32 - 18x = x - 6$	denominator (since x
$\quad + 18x \quad + 18x$	is $\div$ by 2, $\times 2$ will
$32 = 19x - 6$	cancel the $\div 2$ , leaving
$\quad + 6 \quad \quad + 6$	just x)
$\frac{38}{19} = \frac{19x}{19} \Rightarrow 2 = x$	

Consecutive Integers: (consecutive = one after the other)

a) 1, 2, 3, 4, etc  $\Rightarrow$  to get from one to the next, add 1  
If we don't know 1<sup>st</sup> one, make that x, so  
next is  $x + 1, x + 2, x + 3, \text{ etc.}$

b) consecutive even (and odd) integers are 2 apart,  
so if x is the 1<sup>st</sup>, next is  $x + 2, x + 4, x + 6, \text{ etc.}$

4

ex. The sum of three consecutive even numbers is eighteen. Find the numbers.

$$\text{let } x = 1^{\text{st}} \#$$

$$x+2 = 2^{\text{nd}} \#$$

$$x+4 = 3^{\text{rd}} \#$$

$$\text{sum: } x + x+2 + x+4 = 18$$

$$3x + 6 = 18$$

$$\underline{-6} \quad \underline{-6}$$

$$\frac{3x}{3} = \frac{12}{3}$$

$$x = 4 \quad \star \text{ NOT DONE YET!}$$

need all

$$3 \#s \rightarrow x = 4, x+2 = 6, x+4 = 8$$