~~Thursday, February 13, 2020~~ Tuesday, February 18

Bell Work

Problem: The sum of Jim and Kim's ages is 53. Half of Jim's age is eight less than Kim's age.

Define Variables: Please identify your unknowns in this question.

Let j be Jim's age and k be Kim's age.

Equations: The equations to represent this situation are given below. Explain why they make sense, or write down some questions if they don't make sense to you

sum of ages is 53.

① Total Age: $j + k = 53$

② Relative Values: $\frac{1}{2} j = k - 8$

half of Jim's age is Kim's age minus 8

Solve: Find their ages by solving the system of equations.

From ①: $j = 53 - k$

Sub in to ②: $\frac{1}{2}(53 - k) = (k - 8)$

$53 - k = 2k - 16$

$\frac{69}{3} = \frac{3k}{3}$

$23 = k$

$j = 30$

1.4 Solving Linear Systems: Substitution (Continued)

Applications of Linear Systems: Word Problems

We can use linear systems to model many real life situations. For example, in economics you will often be asked to use linear systems to find break even points for companies. In order to be able to use our ability to solve linear systems, we first need to be able to turn words in to equations. You have already had a little bit of practice with this, but we are going to revisit it today!

Helpful Hints for Word Problems

- If there are percentages in a question, express them as decimals;
- If there are dollars and cents, express them in the same units (either all dollars or all cents);
- In most cases, your equations will look like the ones below if you have defined things properly.

$x + y = c$
$ax + by = d$

(where a, b, c, and d are just numbers)

Practice Problems: Solve each of the following using substitution by creating a linear system of equations.

1) You have $10 000 to invest and you want to earn $800 interest from it this year. Part will be invested in a savings account that earns interest at a rate of 6%/a and part will be invested in a GIC that collects interest at a rate of 10%/a. How much should you place in each account to earn your desired amount in interest?

Let x be the amount invested in the savings account.
Let y " " " " " " GIC.

① Total $: $x+y = 10\,000 \rightarrow x = 10000-y$ — Sub into ②:

② Total Interest: $0.06x+0.1y = 800$

$0.06(10000-y)+0.1y = 800$
$600-0.06y+0.1y = 800$
$0.04y = 200$
$y = 5000$

∴ I should invest $5000 in each account.

2) A health food company packs peanut butter in jars. Some jars hold 250 g and other jars hold 500g. On Tuesday, the company packed 225 kg of peanut butter into 605 jars. How many jars of each size did they pack?

Let x be the # of 250g jars packed.
Let y " " " " 500g " " .

1000g = 1kg

① Total mass: $0.25x+0.5y = 225$

② Total # of jars: $x+y = 605$

from ②: $x = 605-y$
Sub into ①

$0.25(605-y)+0.5y = 225$
$151.25-0.25y+0.5y = 225$
$\frac{0.25y}{0.25} = \frac{73.75}{0.75}$
$y = 295$

∴ They packed 310 250g jars and 295 500g jars.

3) Mixture Problem

In a chemistry lab there are stock solutions of 40% hydrochloric acid and solutions of 50% hydrochloric acid. An experiment requires 150 mL of 44% hydrochloric acid. How much of each stock solution should be used?

Let x be the amt of 40% acid.
Let y " " " " 50% acid.

① Total volume: $x+y = 150mL$

② Concentration: $0.40x+0.50y = 0.44(150)$ ← Multiply desired Concentration by total volume!

$0.4x+0.5y = 66$

From ①: $y = 150-x$
Sub into ②: $0.4x+0.5(150-x) = 66$
$0.4x+75-0.5x = 66$
$\frac{-0.1x}{-0.1} = \frac{-9}{-0.1}$
$x = 90mL$

∴ You need to use 90mL of 40% solution and 60 mL of 50% solution.