

Your Name

Mrs. T

2/1/21

Notes

Lessons 5.2-5.4

Applying Systems of Equations

Objective: To be able to create a system of equations from a word problem and decide determine how to solve it either with graphing, substitution, or with elimination.

Virtue: If a solution works for you and it works for some one else then it works for both of you and is THE solution to your problem.

Skill: This method is why standard form is really important.

Many real world problems can be solved by a system of equations and if you are good at them then you can bust it out to easily find the solution. The more variables that you must solve for the more equations you need to solve them with, and they can be linear, quadratic, cubic, or anything.

How to apply
systems of
equations

How to Write the System

Step 1: Define the variables, they should be what we are looking to find. x : # of y : cost of \$

Step 2: Look for two totals, these will be the two constants on the other side of the equal sign.

Object Equation: $x + y = \text{Total objects}$

Money Equations: $\text{price} \cdot x + \text{price} \cdot y = \text{Total Money}$

Step 3: Look for a relationship, write an expression that equals one of the variables

Ask: Which is bigger? that will be alone

ex. The age of the teacher is twice that of the student's

x : Teacher age y : Student age Teacher is older, so $x = 2y$

ex. There are three times as many dolphins as whales

d : # of dolphins w : # of whales more dolphins, so $d = 3w$

Tip: Totals: add the variables

Differences: subtract the variables.

A Payless sold 200 shoes in a day, they sold boots and regular shoes. If they made \$2700, and boots sold for \$30 and regular shoes sold for \$15 (how many of each type of shoe did they sell?)

Step 1: Define Variables

x : # of boots

y : # of reg. shoes

Step 2: Look for Totals

Total shoes $200 = x + y \rightarrow x = (200 - y)$ (Substitution Method) (Step 1)

Total money $2700 = 30x + 15y$

Step 2 $2700 = 30(200 - y) + 15y$

Step 3 $2700 = 6000 - 30y + 15y$

$$\begin{array}{r} 2700 = 6000 - 15y \\ -6000 \quad -6000 \\ \hline -3300 = -15y \\ \quad -15 \quad \quad -15 \\ \hline 220 = y \end{array}$$

Sold 220 regular shoes

Step 4

$$x = 200 - y$$

$$x = 200 - 220$$

$$x = -20 \quad \text{negative?}$$

20 boots were returned

Tia and Ken each sold snack bars and magazine subscriptions for a school fund-raiser. Tia sold 16 snack bars and 4 magazine subscriptions. Ken sold 20 snack bars and 6 magazine subscriptions. Tia earned \$132 and Ken earned \$190. What was the cost of a snack bar and what was the cost of a magazine subscription?

Step 1: Define variables

x : Price/cost of a snack bar
 y : Price/cost of a mag. Subs.

$$\begin{aligned} -3 \cdot (16x + 4y) &= (132) \cdot -3 \\ 2 \cdot (20x + 6y) &= (190) \cdot 2 \\ \hline 48x - 12y &= -396 \\ + 40x + 12y &= 380 \\ \hline -8x &= -16 \\ \hline x &= \frac{-16}{-8} \\ x &= \$2 \text{ per snack bar} \end{aligned}$$

$$\begin{aligned} 16(2) + 4y &= 132 \\ 32 + 4y &= 132 \\ 4y &= 100 \\ y &= 25 \text{ per mag. subs.} \end{aligned}$$

Step 2: Totals = equations

\$ Tia's Total $132 = 16x + 4y$
 \$ Ken's Total $190 = 20x + 6y$

A library contains 2000 books. There are 3 times as many non-fiction books as fiction books. Write and solve a system of equations to determine the number of non fiction and fiction books?

Step 1: Define Variables (look at question)

x : # of non fiction books
 y : # of fiction books

~~$3x = y$~~
 which do you have more of?
 non-fiction
 $x > y$
 $3y = x$

Use substitution
 $x + y = 2000$
 $3y + y = 2000$
 $4y = 2000$
 $y = 500$ fiction books
 $x + 500 = 2000$
 $x = 1500$ non-fiction books

Step 2: Write Equations Totals?

$$2000 = x + y$$

Total books #NF books #F books

Step 3: Write Equation Relationship

more non fiction books

$$x = 3 \cdot y$$

non fiction fiction

A T-shirt printing company sells T-shirts for \$15 each. The cost of a printing machine is \$3000, a blank t-shirt costs \$5. The company has a fixed cost for the machine used to print the T-shirts and an additional cost per T-shirt. What is the number of T-shirts the company must sell in order for the income to equal the expenses.

Step 1: Define variables

x : # of T-shirts

y : Money in \$

Step 2: Write 2 equations

expenses Cost Equation: $y = 5x + 3000$

Total spent on shirts *spent on machine*

Income Profit Equation: $y = 15x$

Total made from shirts

$$15x = 5x + 3000$$

$$\begin{array}{r} -5x \\ -5x \end{array}$$

$$\frac{10x = 3000}{10 \quad 10}$$

$$x = 300$$

They need to sell 300 shirts to break even

The chess club has 15 members and gains a new member every month. the film club has 5 members and gains 3 new members every month. Write and solve a system of equations to find when the number of members in both clubs will be equal.

Step 1:

x : # of months

y : Total members

Chess: $y = 15 + 1x$

Film: $y = 5 + 3x$

$$15 + x = 5 + 3x$$

⑦ x : # of pumpkins
 y : # of squash

$$\begin{array}{r} \boxed{y = 6 + x} \\ \boxed{5x + 3y = 98} \\ \$ \quad \$ - \$ \\ \hline 5x + y = 98 \\ \$ \quad \$ \quad \$ \\ \quad \quad \quad \text{pumpkin} \end{array}$$

⑧ x : # hours on weekend
 y : # hrs during week

$$y = 5x$$

$$\begin{array}{r} \underline{30}x + \underline{20}y = 650 \\ \$ \text{ for } \$ \text{ for } \\ \text{Weekend} \quad \text{week} \end{array}$$

How many liters of 25% acid and 40% acid should be mixed to make 30 liters of 35% acid solution.

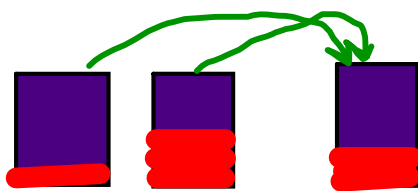
$$\begin{aligned} x &: \# \text{ of liters (25\% acid)} \\ y &: \# \text{ of liters (40\% acid)} \end{aligned} \quad \begin{aligned} 0.25x + 0.4y &= 0.35(30) \\ x + y &= 30 \end{aligned}$$

How many liters of 14% acid and 80% acid should be mixed to make 10 liters of 60% acid solution.

$$\begin{aligned} x &: \# \text{ liters (14\% acid)} \\ y &: \# \text{ liters (80\% acid)} \end{aligned} \quad \begin{aligned} 0.14x + 0.8y &= .6(10) \\ x + y &= 10 \end{aligned}$$

How many liters of 15% acid and 33% acid should be mixed to make 40 liters of 21% acid solution.

$$\begin{aligned} x &: \# \text{ liters of 15\% acid} \\ y &: \# \text{ liters of 33\% acid} \end{aligned}$$



Change! for next year

$$\begin{aligned} x + y &= 40 \text{ liters} \\ -x & \quad -x \\ \hline .15x + .33y &= .21(40) \\ & \rightarrow \text{Use substitution} \\ y &= 40 - x \\ .15x + .33(40 - x) &= .21(40) \\ .15x + 13.2 - .33x &= 8.4 \\ \underline{.15x} & \quad \underline{.33x} \\ -.18x + 13.2 &= 8.4 \\ -.18x &= -4.8 \\ x &= 26\frac{2}{3} \text{ of 1st solution} \end{aligned}$$

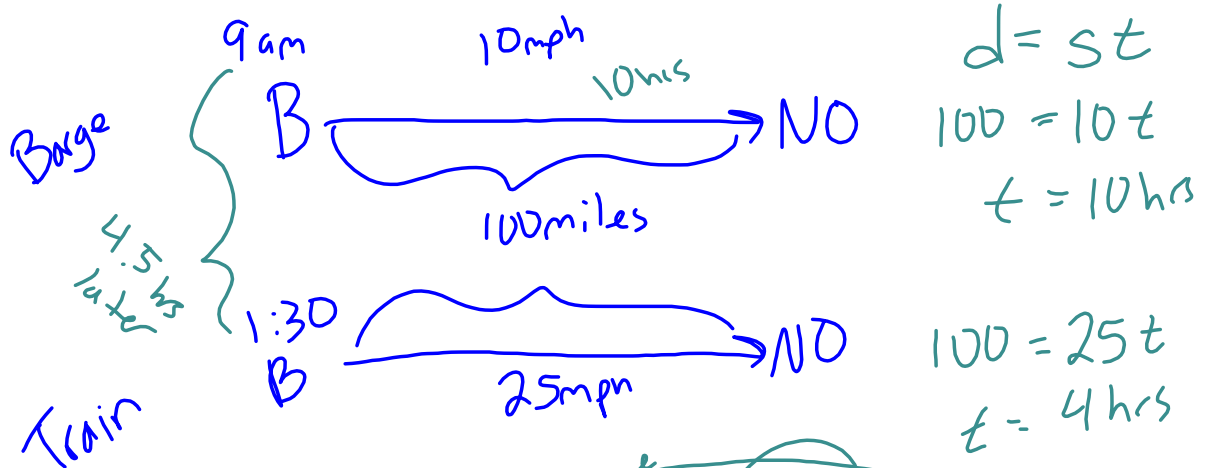
T shirts \$20 each

s : % discount at Store S

t : \$ discount at Store T

$$63 = [3(20) - s(60)] + [1(20) - 1t]$$

$$140 = [5(20) - s(100)] + [4(20) - 4t]$$



x : # of hrs
 y : # of miles traveled

Barge: $y = 10x$

Train: $y = 25(x - 4.5)$

~~$10x = 25(x - 4.5)$~~

Solve

Summary

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Assignment: Workbooks 5-5

Homework Answers 5-5 Skills Practice

- | | |
|-------------------------------|--------------------------|
| 1. Elimination by mult. (2,2) | 7. $y = 6 + x$ |
| 2. elimination by add. (4,1) | $5x + 3y = 98$ |
| 3. substitution (-8,-48) | 10 pumpkins, 16 squashes |
| 4. elimination by mult (3,-5) | 8. $20x + 30y = 650$ |
| 5. elimination by add (4,8) | $x = 5y$ 5 hours |
| 6. substitution (-22, 13) | 9. $x + y = 14$ |
| | $2x + 3y = 30$ |
| | 12 2-pointer baskets |

Homework Answers 5-5 Word Problem Practice:

1. 28 dimes, 66 quarters
2. 26.66 L of 15%; 13.33 L of 33%
3. 1450 ft
4. Apples: \$1.49 per lb; Potatoes: \$0.99 per lb
5. Store S: 20%; Store T: \$5
6. 75 miles
7. The train will arrive first. It will arrive in New Orleans at 5:30 pm of the same day.
8. At 10:30 pm the same day