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Section 2.1/System of Equations

1. The tickets for a trip were purchased yesterday for both students and instructors. Children tickets cost \$7 each ,and adult tickets cost \$10 each. The number of children tickets purchased was two more than three times the number of adult tickets purchased. How many of each were purchased if all of the tickets cost a total of \$138.

introduce and define a variable:  $a$ =number of adult tickets

$c$ =number of children tickets= $2+3a$  (two more than 3 times the # of adult tickets)

total money from adult tickets= $10a$  ( price per ticket · number of tickets)

total money from children tickets= $7(2+3a)$  (price per ticket · number of children tickets)

how to incorporate the \$138? (total money)

$7(2+3a)+10a=138$  (money from kid tickets+money from adult tickets=total money)

distribute 7:  $7 \cdot 2 + 7 \cdot 3a + 10a = 138$

multiply out:  $14 + 21a + 10a = 138$

combine the terms with  $a$ :  $14 + 31a = 138$

subtract 14 from both sides:  $14 - 14 + 31a = 138 - 14$   
 $0 + 31a = 124$

$$31a = 124$$

$$\frac{31}{31} a = \frac{124}{31}$$

$$a = 4 \leftarrow 4 \text{ adult tickets}$$

Now that we know  $a=4$ ,

we find  $c$ :

$$c = 2 + 3a$$

$$c = 2 + 3(4) \text{ (replace } a \text{ with } 4)$$

$$c = 2 + 12$$

$$c = 14 \text{ children tickets}$$

Question 2: Jolene invests her savings in two bank accounts. One pays 6% and the other pays 12% simple interest per year. She puts twice as much in the lower-yielding account because it is less risky. Her annual interest is 9384 dollars. How much is invested at each rate?

introduce and define a variable:  $h$ =higher,  $l$ =lower Interest=  $P \cdot r$

$l$ = how to relate this to  $h$ ?  $l = 2h$  ( $h=100$ ,  $l=200$ )

How do we incorporate the rates and the total interest earned?

interest from one +interest from second=total interest

right or wrong?  $l + h = 9384$ ? wrong..why? because no 6% and 12% has been incorporated

interest from the higher rate amount=  $0.12h$  (rate of interest · amount)

interest from the second one:  $.06 \cdot 2h$  (rate of interest · amount)

now the equation:  $0.12h + 0.06 \cdot 2h = 9384$

$$0.12h + .12h = 9384$$

$$0.24h = 9384$$

$$h = 9384 / 0.24 = 39100$$

What now?

amount from the lower-yielding account

$$l = 2 \cdot 39100 = 78200$$

Q3: At a farmer's market, Fred buys 3 pounds of apples and 9 pounds of cherries for 25.11. At the same market, Willa buys 6 pounds of apples and 8 pounds of cherries for 25.02. Determine the price per pound of apples and cherries at the farmer's market.

introduce and define a variable:  $a$  = price per pound of apples

Above we had specific relationships between the variable, but here do we have this? We don't have a relationship between the variables worked into the statement of the question.

$c$  = price per pound for cherries

$$3 \cdot a + 9 \cdot c = 25.11 \quad (\text{Fred: money for apples} + \text{money for cherries} = \text{total money spent})$$

$$6a + 8c = 25.02 \quad (\text{Willa: money for apples} + \text{money for cherries} = \text{total money spent})$$

$$\begin{cases} 3a + 9c = 25.11 \\ 6a + 8c = 25.02 \end{cases} \xrightarrow{\text{must find } a \text{ and } c}$$

$$\text{multiply } 3a + 9c = 25.11 \text{ by (cancel } a\text{): } -2(3a + 9c = 25.11) \xrightarrow{\text{simplify}} -6a - 18c = -50.22$$

add corresponding sides:

$$\cancel{6a} + 8c - \cancel{6a} - 18c = 25.02 - 50.22$$

$$8c - 18c = -25.2$$

$$-10c = -25.2$$

$$c = -25.2 / -10 = 2.52 \text{ dollars per pound of cherries!}$$

*why is this okay?*

$$2 + 4 = 6 \quad T$$

$$3 + 5 = 8 \quad T$$

$$2 + 3 + 4 + 5 = 6 + 8 \quad T?$$

$$14 = 14 \quad T$$

Last part: find the price per pound for the apples:

$$6a + 8(2.52) = 25.02 \leftarrow \text{only } a \text{ remains!}$$

$$6a + 20.16 = 25.02$$

$$6a = 25.02 - 20.16$$

$$6a = 4.86$$

$$a = 4.86 / 6 = 0.81 \text{ cents per pound of apples!}$$

