

Solving Linear Systems - I've Got Bigger Problems!

In groups of 4, complete the following tasks.

Task 1:

Newmarket has two competing car rental companies.

- For a compact car, Aurora High's Wrecks charges a daily rate of \$30 plus 25¢ per km driven.
- For the same size of car, G.W. William's Motors simply charges 40¢ per km driven.

1. Write an equation for the fees charged by each car rental company. Define the variables (provide 'let' statements)

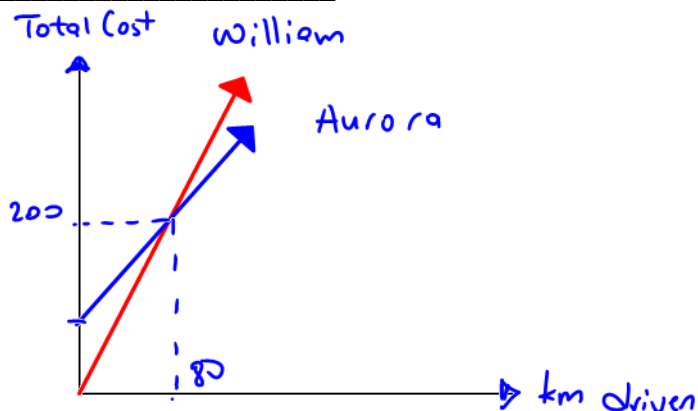
Let x represent cost per km

Let y represent total rental cost

Aurora High's Wrecks: ① $y = 0.25x + 30$

G.W. William's Motors: ② $y = 0.40x$

2. Sketch a graph to model the scenario & label the equations.



3. Solve the linear system algebraically.

sub ① into ② $-0.25x$ $-0.25x$ sub

$$0.25x + 30 = 0.40x$$

$$\frac{30}{0.15} = \frac{0.15x}{0.15}$$

$x = 200$

$$y = 0.40x$$

$$= 0.40(200)$$

$y = 80$

$\therefore \text{POI } (200, 80)$

4. What does the point of intersection represent in this scenario?

When you drive 200 km, no matter which company you choose, the total cost is \$80. (BREAK-EVEN)

5. What does the graph indicate about which company you should rent from?

km driven > 80 , go with Aurora
 km driven < 80 , " " William
 km driven $= 80$, no difference

$>$ bigger than
 $<$ less than

Task 2:

Wylie's Sporting Goods sells footballs and soccer balls. Mr. Peres bought 3 footballs and 4 soccer balls and spent \$126. Mr. Bulut bought 5 footballs and 2 soccer balls and spent \$140. How much do footballs and soccer balls cost?

- Write an equation for Mr. Peres' and Mr. Bulut's purchases. Define the variables (provide 'let' statements)

Let f represent the cost per one football

Let s represent the cost per one soccer ball

Mr. Peres: ① $126 = 3f + 4s$ Mr. Bulut: ② $140 = 5f + 2s$

- Solve your system of equations above in order to determine how much the balls cost.

Action 1

$$\begin{array}{r} 126 = 3f + 4s \\ \boxed{-} \quad 280 = 10f + 4s \\ \hline -154 = -7f \\ \frac{-154}{-7} = \frac{-7f}{-7} \\ \boxed{f = 22} \end{array}$$

Action 2

$$\begin{array}{r} 126 = 3f + 4s \\ 126 = 3(22) + 4s \\ \frac{60}{4} = \frac{4s}{4} \\ \boxed{s = 15} \end{array}$$

\therefore Football \$22
Soccer \$15

multiply by 2 to eliminate 's'

Task 3:

When Billy Bob rented a car for 4 days and drove 200 km, the charge was \$136. When he rented the same car for 7 days and drove 600 km the charge was \$288. What were the charge per day and the charge per km?

- Write an equation for each of Billy Bob's cases. Define the variables (provide 'let' statements)

Let d represent charge per day

Let k represent charge per km

Case #1: $136 = 4d + 200k$ Case #2: $288 = 7d + 600k$

- Solve your system of equations above in order to determine each charge.

Plan

Action 1

$$\begin{array}{r} 408 = 12d + 600k \\ \boxed{-} \quad 288 = 7d + 600k \\ \hline 120 = 5d \\ \frac{120}{5} = \frac{5d}{5} \\ \boxed{24 = d} \end{array}$$

Action 2

$$\begin{array}{r} 136 = 4d + 200k \\ 136 = 4(24) + 200k \\ \frac{-96}{136} = \frac{96}{200k} \\ \frac{40}{200} = \frac{200k}{200} \\ \boxed{0.20 = k} \end{array}$$

Conclusion

\therefore Charge/day = \$24
Charge/km = \$0.20 or 20¢

Task 4:

James looks in his TV cabinet and finds some old Beta and VHS tapes. He has 17 tapes in all. He finds that he has 3 more Beta tapes than VHS tapes. How many of each type does he have?

- Write an equation for each set of given information. Define the variables (provide 'let' statements)

Let b represent the number of Beta tapes

Let v represent the number of VHS tapes

#1: $b + v = 17$ #2: $b = v + 3$

- Solve your system of equations above in order to determine how many of each he has.

PLAN

Action 1

sub ② into ①

$$b + v = 17$$

$$(v+3) + v = 17$$

$$\frac{2v}{2} = \frac{10}{2}$$

$$v = 5$$

Action 2

$$b = v + 3$$

$$b = 5 + 3$$

$$b = 8$$

CONCLUSION

∴ James has 3 Beta and 5 VHS tapes.

Task 5:

The sum of two numbers is 7. Three times one of the numbers is 15 more than the other number. Find the numbers.

- Write an equation for each set of given information. Define the variables (provide 'let' statements)

Let m represent the first number

Let n represent the second number

#1: $m + n = 7$ #2: $3m = n + 15$

- Solve your system of equations above in order to determine each number.

Plan

Action 1

Rearrange ① to isolate m then sub into ②

$$m + n = 7$$

$$m = 7 - n$$

Action 2

$$3m = n + 15$$

$$3(7 - n) = n + 15$$

$$21 - 3n = n + 15$$

$$21 - 15 = 4n + 15 - 15$$

$$\frac{6}{4} = \frac{4n}{4} \Rightarrow n = 1.5$$

Action 3

$$m + n = 7$$

$$1.5 + n = 7$$

$$n = 5.5$$

CONCLUSION

∴ The numbers are 1.5 and 5.5

Task 6:

Rehman invests his summer earnings of \$3050. He invests part of the money at 8%/year and the rest at 7.5%/year. After 1 year, these investments earn \$242 in interest. How much did he invest at each rate?

Plan
 Let e represent the amount of money invested @ 8%/year
 Let s represent the amount of money invested @ 7.5%/year

#1: $3050 = e + s$ Multiply #1 by 0.08 to eli. e #2: $242 = 0.08e + 0.075s$

Action 1

$$\begin{array}{r} 244 = 0.08e + 0.08s \\ \boxed{-} \quad 242 = 0.08e + 0.075s \\ \hline 2 = 0.005s \\ \frac{2}{0.005} = \frac{0.005s}{0.005} \end{array}$$

Action 2

$$\begin{array}{r} 3050 = e + s \\ \quad \quad \quad -400 \\ \hline 3050 = e + 400 \\ \boxed{-400} \\ \hline 2650 = e \end{array}$$

Conclusion
 $s = 400$
 ∴ Rehman invested \$400 @ 7.5%/year and \$2650 @ 8%/year.

Task 7:

One type of granola has 30% nuts, by mass. A second type of granola has 15% nuts. What mass of each type needs to be mixed to make 600 g of granola that will have 21% nuts?

PLAN
 Let x represent the amount of 30% nut TYPE
 Let y represent the amount of 15% nut TYPE

Total g #1: $x + y = 600$ Mult #1 by 0.15 #2: $0.30x + 0.15y = 0.21(600)$

ACTION 1

$$\begin{array}{r} 0.15x + 0.15y = 90 \\ \boxed{-} \quad 0.30x + 0.15y = 126 \\ \hline -0.15x = -36 \\ \frac{-0.15x}{-0.15} = \frac{-36}{-0.15} \\ \boxed{x = 240} \end{array}$$

ACTION 2

$$\begin{array}{r} x + y = 600 \\ 240 + y = 600 \\ \hline y = 600 - 240 \\ \boxed{y = 360} \end{array}$$

CONC
 240g of 30% nut type needs to be mixed with 360g of 15% nut type of granola.

Task 8:

Ken has \$3.80 in nickels and dimes. If there are 50 coins altogether, how many dimes are there?

Plan let "d" be the number of dimes
 let "n" be the number of nickels

① $d + n = 50$ ← multiply by 0.05 to eliminate n

② $0.10d + 0.05n = 3.80$

Action 1

$$\begin{array}{r} 0.05d + 0.05n = 2.50 \\ - \quad 0.10d + 0.05n = 3.80 \\ \hline -0.05d = -0.70 \\ \underline{-0.05} \quad \underline{-0.05} \\ d = 14 \end{array}$$

Conclusion There are 14 dimes.

Task 9:

Mariam canoed 2 km downstream to her friend's cottage, and it took her one hour. The return (upstream) trip took 90 minutes. Find the paddling rate and the speed of the current.

Plan let "p" be the paddling rate
 let "c" be the current

	Distance	Speed	Time
Down	2	$p + c$	1
UP	2	$p - c$	2 → 120min

① $2 = p + c$
 ② $2 = 2(p - c)$

} $2 = p + c$
 $2 = 2p - 2c$ ← Multiply by 2 to eliminate c

Action 2

$$\begin{array}{r} 4 = 2p + 2c \\ + \quad 2 = 2p - 2c \\ \hline 6 = 4p \\ \frac{6}{4} = \frac{4p}{4} \\ 1.5 = p \end{array}$$

$2 = p + c$
 $2 = 1.5 + c$
 $c = 0.5$

Conclusion ∴ The paddling rate is 1.5 km/h and the speed of the current is 0.5 km/h