

Feb 16 | 2011

Applications of Linear Systems: Percent/Mixture Problems (Chapter 1)

Assigned Work:

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- p. 39 # 11
- p. 55# 10, 12

Applications of Linear Systems: Percent/Mixture Problems

1. Percentages can be expressed as a fraction or a decimal.
$$25\% = \frac{25}{100} = 0.25$$
2. Use the wording of the question to help you choose your unknowns (variables).
3. Make sure your units are consistent.

Ex. 1) One type of granola is 30% fruit, and another type is 15% fruit. What mass of each type of granola should be mixed to make 600 g of granola that is 21% fruit?

Let x be the mass of 30% mix (in grams)

Let y be the mass of 15% mix (in grams)

$$x + y = 600 \quad ① \quad 0.30x + 0.15y = (0.21)600 \quad (\times 100)$$

$$x = 600 - y \quad ③ \quad 30x + 15y = 12600 \quad ②$$

Sub ③ into ②

$$30(600 - y) + 15y = 12600$$

$$18000 - 30y + 15y = 12600$$

$$18000 - 15y = 12600$$

$$\frac{5400}{15} = \frac{15y}{15}$$

$$y = 360$$

Sub $y = 360$ into ③

$$x = 600 - 360$$

$$x = 240$$

\therefore mix 240g of 30%
with 360g of 15%

Ex. 2) A chemistry teacher needs to make 10 L of 42% sulphuric acid solution. The acid solutions available are 30% sulphuric acid and 50% sulphuric acid, by volume. How many litres of each solution must be mixed to make the 42% solution?

Let x be the volume of 30% solution

Let y be the volume of 50% solution.

$$x + y = 10 \quad ① \quad 0.30x + 0.50y = 0.42(10) \quad \checkmark 100$$

$$\frac{30x}{10} + \frac{50y}{10} = \frac{420}{10}$$

$$3x + 5y = 42 \quad ②$$

$$\textcircled{1} \times 3: \quad \underline{3x + 3y = 30}$$

$$\text{Subtract } \underline{\quad 2y = 12 \quad}$$

$$y = 6$$

Sub $y = 6$ into ①

$$\begin{aligned} x + 6 &= 10 \\ x &= 4 \end{aligned}$$

\therefore we need 4L of 30% and 6L of 50%

Ex. 3) A candy store is preparing a mixture of chocolate raisins and chocolate peanuts. The raisins sell for \$2.22/kg and the peanuts for \$1.75/kg. How much of each type must be mixed to make 20 kg of a mixture that will sell for \$41?

Let x be the mass of raisins
Let y be the mass of peanuts.

$$x+y=20 \quad ① \quad 2.22x + 1.75y = 41 \quad ②$$

$\frac{\text{cost of}}{\text{raisins}}$ $\frac{\text{cost of}}{\text{peanuts}}$

* we are not given the cost/kg of the final mix.

$$\frac{41}{20\text{kg}} = 2.05/\text{kg} \leftarrow \begin{matrix} \text{calculated} \\ \text{cost/kg} \end{matrix}$$

$$2.22x + 1.75y = 2.05(20) \quad ③$$

$$x+y=20 \quad ① \quad 2.22x + 1.75y = 41 \quad ② \quad \times 100$$

$$y=20-x \quad ③ \quad 222x + 175y = 4100 \quad ④$$

Sub ③ into ④

$$222x + 175(20-x) = 4100$$

$$222x + 3500 - 175x = 4100$$

$$47x = 600$$

$$x = \frac{600}{47}$$

$$\text{Sub } x = 12.766 \text{ into } ③ \quad x = 12.766$$

$$y = 20 - 12.766$$

$$y = 7.234$$

∴ mix 12.766 kg of raisins
and 7.234 kg of peanuts.

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P. 27 #7.

Let x represent Brazilian ($\$/12/\text{kg}$)
let y " Ethiopian ($\$/17/\text{kg}$)

$$x + y = 200 \quad 12x + 17y = 15(200)$$
$$12x + 17y = 3000$$

P. 55 #12

Let x be # grams of M.O.

Let y be # grams of T.

	<u>Vit C</u>	<u>Vit A</u>
1g M.O. \rightarrow	0.26mg	0.13mg
x g M.O. \rightarrow	$0.26x$	$0.13x$
1g Tom. \rightarrow	0.13 mg	0.42 mg
y Tom \rightarrow	$0.13y$	$0.42y$
total	<u>13 mg</u>	<u>20.7 mg</u>

$$\text{Vit C: } 0.26x + 0.13y = 13$$
$$26x + 13y = 1300 \quad ①$$

$$\text{Vit A: } 0.13x + 0.42y = 20.7$$
$$13x + 42y = 2070 \quad ②$$

$$\begin{array}{r} ② \times 2: 26x + 84y = 4140 \\ ①: 26x + 13y = 1300 \\ \hline \text{Subtract} \quad 71y = 2840 \\ \qquad \qquad \qquad y = 40 \end{array}$$

$$\begin{array}{l} \text{Sub } y = 40 \text{ into } ① \\ 26x + 13(40) = 1300 \\ 26x = 1300 - 520 \\ 26x = 780 \\ x = 30 \\ \therefore \text{We need 30 g of M.O.} \\ \text{and 40 g of T} \end{array}$$