# Problem Solving With Linear Systems: Part 2 | MPM2D

Today we will look at two more types of linear systems problems: Mixture problems, and speed-distance-time problems.

Example 1: Solve a mixture problem

Ms. Warner has a bottle of 5% acetic acid and a bottle of 10% acetic acid. For a chemistry experiment, she needs a solution that is 8% acetic acid. This means she will have to mix the two together. If she needs 250 mL of 8% acetic acid, how much of each should she use?

Visual and Assigning Variables:
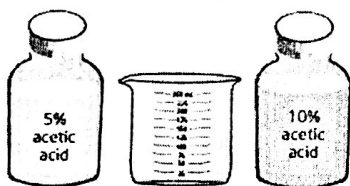
Let x represent the amount of 5% solution. (in mL)

Let y represent the amount of 10% solution (in mL)

Volume (mL)	5% Acid	10% Acid	8% Mixture
Solution	x	y	250
Pure Acid	$0.05x$	$0.1y$	20

"She needs 250 mL in total"	"There would be 8% of 250 = __20__ mL of pure acid in the final mixture."
Equation: $x + y = 250$ ①	Equation: $0.05x + 0.1y = 20$ ②

Solution: ① $y = -x + 250$

Sub in ②
$$0.05x + 0.1(-x + 250) = 20$$
$$0.05x - 0.1x + 25 = 20$$
$$-0.05x + 25 = 20$$
$$-0.05x = -5$$
$$\boxed{x = 100 \text{ mL}}$$

Sub in ①
$$y = -100 + 250$$
$$\boxed{y = 150 \text{ mL}}$$

Concluding Statement: She needs 100mL of 5% solution and 150mL of 10% solution

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Example 2: Solve a ~~mixture problem~~ speed-distance-time

Bort is on a canoe trip, and took 2 hours to travel 12km down a river. The return trip (against the current) took 3 hours. What was Bort's paddling speed, and what was the speed of the current?

Visual and Assigning Variables:

→ downstream

current
c kilometres per hour
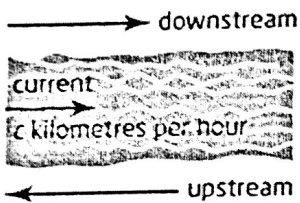
← upstream

Let p be the paddling speed
Let c be the current speed

Direction	Distance (km)	Speed (km/h)	Time (h)
Downstream	12	$p + c$	2
Upstream	12	$p - c$	3

Distance = Speed × Time (Downstream)	Distance = Speed × Time (Upstream)

Equation: $\dfrac{12}{2} = \dfrac{(p+c)(2)}{2}$ ①

Equation: $\dfrac{12}{3} = \dfrac{(p-c)(3)}{3}$

$$4 = p - c \quad ②$$

Solution:
$$6 = p + c \quad ①$$
$$4 = p - c \quad ②$$

① + ②: $10 = 2p$

$$\boxed{p = 5}$$

Sub $p = 5$ in ①
$$6 = 5 + c$$
$$\boxed{c = 1}$$

Concluding Statement: Bort paddles at 5km/h, the current is 1 km/h