* Online Homwork 2 and Written Homwork 2 are due next Friday (9/10) at 1 pm.

* MLC : Monday - Friday, 10 am - 4 pm at Swain East 340.
  ASC : Sunday - Thursday, 7 pm - 11 pm
  both online (Zoom) and offline (at the Briscoe, Forest, and Teter ASC locations)

My Office Hour : Monday 2:45 pm - 3:45 pm Wednesday 11 am - 12 pm at Rawless Hall 338.

* We have a grader : please email her only if you have questions about written homework grading.

* If you have not bought WebAssign Homework Package ($60) yet, please buy it before next Monday.
  (2-week free trial ends next Monday!)

* No class on Next Monday! (Labor Day) ✓

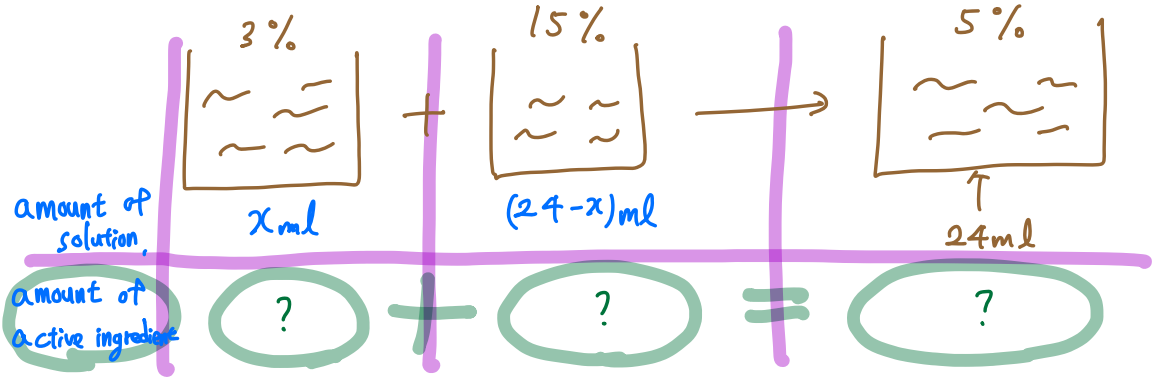
Section 2.2. Continued

Ex (Preparing eye drops)

A pharmacist is to prepare 24 ml of special eye drops for a glaucoma patient. The eye-drop solution must have a 5 % ← Goal! active ingredient, but the pharmacist only have 15 % solution and 3 % solution in stock. How much of each type of solution should be used to fill the prescription.

* Mass percent formula

$$(\text{Mass percent of chemical}) = \frac{\text{mass of chemical}}{\text{Total mass of compound}} \times 100$$



Step 1 Let x (ml) be the amount of 3% solution that we use.

Then $(24-x)$ (ml) is the amount of 15% solution that we should use.

Step 2 We drew the pictures in the previous page.

Step 3 We want to construct an equation about the amount of active ingredient. (mass)

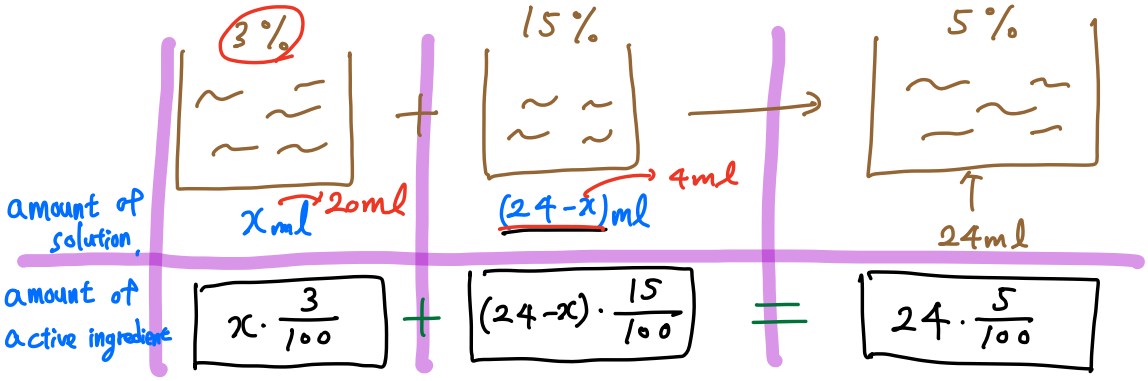
To do that we solved the formula

$$(\text{Mass percent of chemical}) = \frac{\text{mass of chemical}}{\text{Total mass of compound}} \times 100$$

for the mass of chemical!

We finished the class by getting

$$(\text{Mass of chemical}) = (\text{Total mass of compound}) \times \frac{(\text{Mass percent of chemical})}{100}$$



Equation: $x \cdot \frac{3}{100} + (24-x) \cdot \frac{15}{100} = 24 \cdot \frac{5}{100}$

↓ multiply 100

Step 4

$x \cdot 3 + (24-x) \cdot 15 = 24 \cdot 5$ $\quad \left(100 \cdot \left(x \cdot \frac{3}{100} + (24-x) \cdot \frac{15}{100}\right) = 24 \cdot \frac{5}{100} \cdot 100\right)$

$100 \cdot x \cdot \frac{3}{100} + 100 \cdot (24-x) \cdot \frac{15}{100}$

$3x + 360 - 15x = 120$

$-12x = 120 - 360 = -240$

$\frac{-12x}{-12} = \frac{-240}{-12} \Rightarrow \boxed{x = 20}$, $\Rightarrow$ 20 ml of 3% sol and 4 ml of 15% solution!

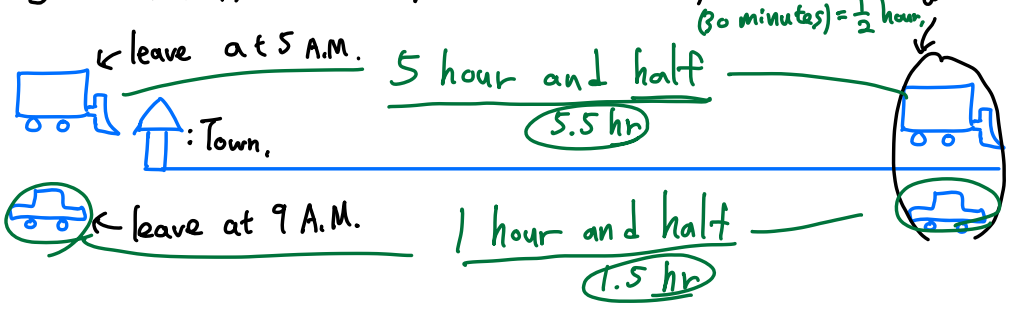
Ex (Snowplow Speed)

At 5 A.M. a snowplow, traveling at a constant speed, begins to clean a highway leading out of town. At 9 A.M. an automobile begins traveling the highway at a speed of 22 mi/hr and reach the plow 1 hour and 30 minutes later. Find the speed of the snowplow. ?

* Distance formula : (Distance) = (Speed) × (Time) (when speed is constant (unchanged))

Step 1 Let s (mi/hr) be the speed of the snowplow.

Step 2



Step 3 (distance that the plow has move) = (distance that the automobile has move)

$$s \times 5.5 = 22 \text{ mi/hr} \times 1.5$$

Step 4

$$5.5s = 33. \quad \frac{5.5 \cdot s}{5.5} = \frac{33}{5.5}. \quad \boxed{s = 6}$$

$$\Rightarrow \boxed{6 \text{ mi/hr}}.$$

Ex (Filling a swimming pool)

With water from one hose, a swimming pool can be filled in 9 hours. A second, larger hose used alone can fill the pool in 3 hours. How long would it take to fill the pool if both hoses were used simultaneously?

Step 1 Let t(hr) be the amount of time that we need fill the pool.

Step 2

filled : 9 hours!

$\frac{1}{9}$ of the pool : an hours, will be filled.

3 hours!

$\frac{1}{3}$ of the pool : an hour will be filled.

t hours!

$\frac{4}{9} = (\frac{1}{9} + \frac{1}{3})$ of the pool : an hour will be filled.

Step 3 $(\frac{4}{9}) \times t = 1$.

Step 4 $\Rightarrow \frac{9}{4} \times (\frac{4}{9}) \times t = \frac{9}{4}$, $t = \frac{9}{4}$

$\Rightarrow \frac{9}{4}$ hours! or $2\frac{1}{4}$ hours!

Section 2.3. Quadratic Equations.

$ax+b=0$.

- identity: an equation that is always true. $\frac{1}{x-1}=\frac{1}{x-1} \rightarrow (x-1)\cdot\frac{1}{x-1}=(x-1)\cdot\frac{1}{x-1} \rightarrow 1=1$. : All real numbers except $x=1$
- contradiction: an equation that is always false.

General form of the quadratic equation: $ax^2+bx+c=0,\ a\neq 0$.

To solve the quadratic equation, we need to use the Zero Factor Theorem (Z.F.T.)

If p and q are algebraic expressions, then

$$pq=0 \iff p=0 \text{ or } q=0.$$

If we can factor the given quadratic equation, we can easily solve the equation using Z.F.T.

Ex Solve: $6x^2-7x=3$

$-3 \quad -3$

$6x^2-7x-3=0$.

factor $\hookrightarrow (2x-3)(3x+1)=0. \Rightarrow 2x-3=0$ or $3x+1=0$.

$\Rightarrow \boxed{x=\frac{3}{2} \text{ or } x=-\frac{1}{3}}$

Ex Solve : $2x^2 = 3 + x$

Pf $2x^2 = 3 + x$

$2x^2 - (3+x) = 3 + x - (3+x)$

$2x^2 - x - 3 = 0$

$(2x - 3)(x + 1) = 0$ → By ZFT,

$2x - 3 = 0$ or $x + 1 = 0$

$\Rightarrow \boxed{x = \frac{3}{2} \text{ or } x = -1}$

When $d \geq 0$, the equation $x^2 - d = 0$ can be easily solved, using the formula $x^2 - y^2 = (x+y)(x-y)$

$x^2 - d = 0 \Rightarrow x^2 - (\sqrt{d})^2 = 0 \Rightarrow (x + \sqrt{d})(x - \sqrt{d}) = 0.$

$\Rightarrow x + \sqrt{d} = 0$ or $x - \sqrt{d} = 0$

$\Rightarrow x = -\sqrt{d}$ or $x = \sqrt{d}$: We also write $x = \pm\sqrt{d}$

$x^2 - d = 0$ or $x^2 = d$

$\Downarrow$

$x = \pm\sqrt{d}$

Ex Solve : $x^2 - 3 = 0$

$\Rightarrow x^2 = 3$

$\Rightarrow x = \pm\sqrt{3}$

$x = \sqrt{3}$ or $x = -\sqrt{3}$

Ex : $(x+2)^2 = 7$

$x + 2 = \pm\sqrt{7}$

$x = -2 \pm \sqrt{7}$

$x = -2 + \sqrt{7}$ or $x = -2 - \sqrt{7}$