WS #A-7
Problem Solving

The steps for solving an applied problem are:

1. Read the problem thoroughly. Determine realistic possibilities for the answer.
2. Assign A variable, then express any remaining unknown quantities in terms of this variable.
3. Create mathematical expressions, equations, & possibly a table
4. Solve the equation for the variable, then answer the question
5. Check your answer to make sure you are correct

(5) In order to achieve her goal, Candy should INVEST $17,500 in bonds & $52,500 in certificates

1. Candy has $70,000 to invest and requires an overall rate of 9%. She can invest in a safe, governmental-insured certificate of deposit, but it only pays 8%. To obtain 9%, she agrees to invest some of her money in noninsured corporate bonds paying 12%. How much should be placed in each investment to achieve her goal?

(1) asks for 2 dollar amounts that must total 70,000

(2) x = the Amt invested in bonds

(3) $70,000 - x$ = amt inv in certificate

	Principal ($)	Interest ($)
Bonds	x	$0.12x$
Cert.	$70,000 - x$	$0.08(70,000 - x)$
Total	70,000	$0.09(70,000) = 6300$

(4) $.12x + 0.08(70,000 - x) = 6300$

$0.04x = 700$

$x = 17,500$ Bonds

$52,500$ Cert

2. The manager of a Starbucks store decides to experiment with a new blend of coffee. She will mix some B grade Colombian coffee that sells for $5 per pound with some A grade Arabic coffee that sells for $10 per pound to get 100 pounds of the new blend. The selling price of the new blend is to be $7 per pound, and there is to be no difference in revenue from the selling the new blend versus selling the other types. How many pounds of the B grade Colombian and A grade Arabic coffees are required?

3. Tanya, who is a long-distance runner, runs at an average velocity of 8 mph. Two hours after Tanya leaves her house, you leave in your Honda and follow the same route. If your average velocity is 40 mph, how long will it be before you catch up to Tanya? How far will each of you be from home?

4. A motorboat heads up stream a distance of 24 miles on the Illinois River, whose current is running at 3 mph. The trip up and back takes 6 hours. Assuming that the boat maintained a constant speed relative to the water, what was the speed?

5. At 10:00 AM Danny is asked by his father to weed the garden. From past experience, Danny knows that this will take him 4 hours, working alone. His older brother mike, when it is his turn to do the job requires 6 hours. Since Mike wants to go golfing with Danny and has a reservation at 1:00 PM, he agrees to help Danny. Assuming no gain or loss of efficiency, when will they finish if they work together? Can they make the golf date?

6. From each corner of a square piece of sheet metal, remove a square 9 centimeters. Turn up the edges and for an open box. If the box is to hold 144 cubic centimeters, what should be the dimensions of the piece of sheet metal?

WS A.7 (Problem Solving) - worked out solutions

2.) x = # of lbs of B grade Colombian coffee

$100 - x$ → # of lbs of A grade Arabic coffee

Price B grade: \$5 — lbs of B grade: x

Price A grade: \$10 — lbs of A grade: $(100 - x)$

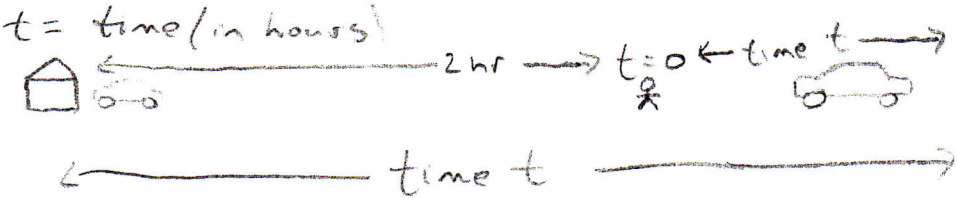
Price per lb of blend: \$7 — lbs of blend: (100)

$$5x + 1000 - 10x = 700$$

$$-5x + 1000 = 700 \rightarrow \frac{-5x}{-5} = \frac{-300}{-5} \rightarrow \boxed{x = 60}$$

- The manager should blend 60 lbs of B grade Colombian coffee w/ $100 - 60 = 40$ lbs of A grade Arabic coffee to get the desired blend.

3.) t = time (in hours)



	Velocity (mi/hr)	Time (hr)	Distance (mi)
Tanya	8	$t + 2$	$8(t+2)$
Honda	40	t	$40t$

$$8(t+2) = 40t$$

$$8t + 16 = 40t \rightarrow 32t = 16 \rightarrow \boxed{t = \frac{1}{2} \text{ hr}}$$

Distance = $40t = 40\left(\frac{1}{2}\right) = 20$

- It will take the Honda A ½ hr to catch up to Tanya. Each will have gone 20 miles.

4.) Time = $\frac{\text{Distance}}{\text{Velocity}}$ v = constant speed of the motor boat relative to water

true speed upstream = $(v-3)$ mi/hr

true speed downstream = $(v+3)$ mi/hr

Distance / Velocity

	Velocity (mi/hr)	Distance (mi)	Time (hr)
Upstream	$v-3$	24	$\frac{24}{v-3}$
Downstream	$v+3$	24	$\frac{24}{v+3}$

Total time up + back = 6 hrs

$$\frac{24}{v-3} + \frac{24}{v+3} = 6$$

$$\frac{24(v+3)+24(v-3)}{(v+3)(v-3)} = 6 \rightarrow \frac{(v^2-9)\,48v}{v^2-9} = 6\cdot(v^2-9)$$

$$48v = 6v^2 - 54$$

$$0 = 6v^2 - 48v - 54$$

$$0 = 6(v^2 - 8v - 9)$$

$$0 = 6(v-9)(v+1)$$

$v = 9$ mi/hr, ~~$v = -1$ mi/hr~~ can't have neg speed

- The speed of the motorboat relative to the water is 9 mi/hr

<Continued> A.7 (Problem Solving) - worked out solutions

5.)

	Hours to Do the job	Part of Job Done in one hour
Danny	4	$\frac{1}{4}$
Mike	6	$\frac{1}{6}$
Together	t	$\frac{1}{t}$

Part Done by Danny in 1 hr + Part Done by Mike in 1 hr = Part Done together in 1 hr

$$\frac{1}{4} + \frac{1}{6} = \frac{1}{t}$$

$$\frac{6+4}{24} = \frac{1}{t} \rightarrow \frac{10}{24} = \frac{1}{t}$$

$$\frac{10t}{10} = \frac{24}{10} \rightarrow \boxed{t = 2.4}$$

- Working together Danny + Mike can do the job in 2.4 hrs or [2 hours, 24 minutes]. Thus, they should make the golf date, since they will finish at 12:24 pm.

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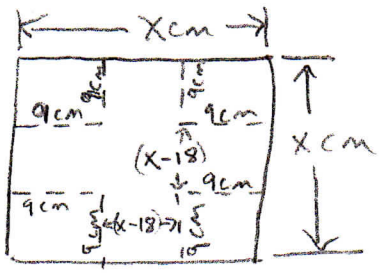
6.)



Length × width × height = volume

$(x-18)(x-18)(9) = 144$

$\frac{9(x-18)^2}{9} = \frac{144}{9}$

$(x-18)^2 = 16$

$\sqrt{(x-18)^2} = \pm\sqrt{16}$

$x - 18 = \pm 4$

$x = 18 + 4 = \boxed{22}$

$x = 18 - 4 = 14$ can't use 14 b/c if you sub into $(x-18)$, you'll have -4 as a side length

- The dimensions of the piece of sheet metal is

22 cm × 22 cm