

HOMEWORK: Applications of Systems- Related Rates

- 1.) A fishing boat travels 10 miles downstream in 30 minutes. The return trip ^{against} takes the boat 40 minutes. Find the rate of the boat in still water

B = Boat Rate
C = Current rate

Up	B-C	40	10
Down	B+C	30	10

$$40(B-C) = 10 \quad 40B - 40C = 10$$

$$30(B+C) = 10 \quad 30B + 30C = 10$$

$$3(4B - 4C = 1) \quad 12B - 12C = 3$$

$$4(3B + 3C = 1) \quad 12B + 12C = 4$$

$$24B = 7$$

$$B = \frac{7}{24} \text{ miles/min OR } \frac{7}{24} \cdot 60 = 17.5 \text{ mph}$$

- 2.) A small airplane flies 600km in 5 hours against the wind. Returning with the wind requires only 4 hours. Find the speed of the plane in still air and the speed of the wind.

P = Plane Rate
W = Wind Rate

w/wind	P+W	4	600
Against	P-W	5	600

$$4(P+W) = 600$$

$$5(P-W) = 600$$

$$(4P + 4W = 600) \div 4$$

$$(5P - 5W = 600) \div 5$$

$$135 + W = 150$$

$$W = 15$$

$$P + W = 150$$

$$P - W = 120$$

$$2P = 270 \quad P = 135$$

135 km/hr plane speed
15 km/hr wind speed

- 3.) A swamp buggy goes 18 km downstream in 4 hours and it goes the same distance upstream in 6 hours. Find the speed of the swamp buggy in still water and the speed of the current.

B = Rate of Buggy
C = Rate of Current

Down	B+C	4	18
Up	B-C	6	18

$$3(4B + 4C = 18)$$

$$2(6B - 6C = 18)$$

$$12B + 12C = 54$$

$$12B - 12C = 36$$

$$4(3.75) + 4C = 18$$

$$15 + 4C = 18$$

$$4C = 3$$

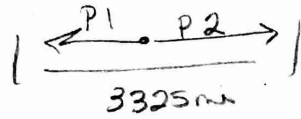
$$C = \frac{3}{4} = .75$$

$$24B = 90$$

$$B = 3.75$$

Buggy rate 3.75 km/hr
Current rate .75 km/hr

- 4.) Two planes left the same time and flew in opposite directions from the airport. One plane traveled at 500 mi/hr and the other plane traveled at 450 mi/hr. In how many hours were the planes 3325 miles apart? (Hint: You will only have one variable for this problem.)



$h = \text{hours}$

P1	500	h	$500h$
P2	450	h	$450h$
			<u>3325</u>

$$500h + 450h = 3325$$

$$950h = 3325$$

$$h = 3.5$$

After $3\frac{1}{2}$ hours
planes were 3325
miles
apart.

- 5.) Kellie and Megan paddled a canoe down the river at 4 mi/hr. 45 minutes later, Corey traveled down the river in a motorboat at 10 mi/hr from the same point. How long did it take Corey to pass them?

$K \rightarrow$ Kellie time
 $C \rightarrow$ Corey time

r	t	D
K	4	$4K$
C	10	$10C$

$$4K = 10C$$

$$C = K - \frac{3}{4}$$

\rightarrow (45 min)

$$4K = 10(K - \frac{3}{4})$$

$$4K = 10K - \frac{30}{4}$$

$$-6K = -\frac{30}{4}$$

$$-24K = -30$$

$$K = \frac{30}{24}$$

$$K = \frac{5}{4}$$

$$K = 1.25 \text{ hrs.}$$

$$C = 1.25 - .75$$

$$= .50$$

$\frac{1}{2}$ hour to pass

- 6.) A truck leaves the gasoline station and travels at an average rate of 70 km/hr. Two hours later, a bus leaves the same place, traveling the same route as the truck. If the bus averages 90 km/hr, how long will it take the bus to catch up to the truck?

$t =$ truck time

$b =$ bus time

Truck	70	t	$70t$
Bus	90	b	$90b$

$$70t = 90b$$

$$b = t - 2$$

$$70t = 90(t - 2)$$

$$70t = 90t - 180$$

$$-20t = -180$$

$$t = 9$$

$$b = 9 - 2$$

$$b = 7$$

7 hours for the bus
to take over the
truck