Application problems involving distance, rate & time

150 mpr

1. A motorboat can travel 20 mi/h in still water. If the boat can travel 3 mi downstream on a river in the same time it takes to travel 2 mi upstream, what is the rate of the river's current?

| | D | 75 | J | 2 2 |
|-------|----|------|------|---|
| Down | 3. | X+20 | X+20 | 2 = - |
| up | 2 | 20-X | 20-X | 20+x $20-x3(20-x) = 2(20+x)$ |
| Total | | X | 1 | (20-x) = 2(20-x) $(20-3) = 40 + 2x$ $20 = 5x$ |

2. A small jet has an airspeed (the rate in still air) of 300 mi/h. During one day's flights, the pilot noted that the plane could fly 85 mi with a tailwind in the same time it took to fly 65 mi against that same wind. What was the rate of the wind? = 65 30-x ()=65(300+x)

| was the rate of the winds | | | | 85 65 |
|---------------------------|-----|--------|--------|-----------------------|
| | D | Fb | 1 | 30+X = 30-X |
| with | 85 | 350 +X | 300-tX | 85 (300-x)= 65(300+x) |
| against | 165 | 300×X | 300-X | 25500-85x= 19500+65x |
| 0 | 1 | 1 | 1 | 6000 = 150x |
| | 1 | IX | 1 | 40 = X |
| ". C | | N N N | | |

3. A plane flew 720 mi with a steady 30-mi/h tailwind. The pilot then returned to the starting point, flying against that same wind. If the round-trip flight took 10 h, what was the plane's airspeed?

$$\frac{720}{x+30} + \frac{720}{x-30} = \frac{10}{1}$$

$$720(x-30) + 720(x+30) = 10(x-30)(x+30)$$

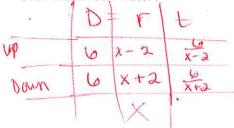
$$720x - 2100 + 720x + 2100 = 10(x^2-900)$$

$$= 10x^2-9000$$

$$+720x + 2100 = 10 (x^2 - 900)$$

 $1440x = 10x^2 - 9000$
 $0 = 10x^2 - 1440x - 9000$
 $0 = 10(x^2 - 144x - 900)$

4. Janet and Michael took a canoeing trip, traveling 6 mi upstream along a river, against a 2 mi/h current. They then returned downstream to the starting point of their trip. If their entire trip took 4 h, what was their rate in still water?



$$\frac{6}{x-2} + \frac{6}{x+2} = \frac{4}{1}$$

$$6(x+2) + 6(x-2) = 4(x-2)(x+2)$$

$$6x + 12 + 6x - 12 = 4(x^2-4)$$

 $12x = 4x^{2} - 16$ $0 = 4x^{2} - 12x - 16$ $0 = 4(x^{2} - 12x - 16)$ $0 = 4(x^{2} - 12x - 16)$ 5. Po Ling can bicycle 75 mi in the same time it takes her to drive 165 mi. If her driving rate is 30 mi/h faster

than her rate on the bicycle, find each rate.

| | D= | r | o t |
|-------|-----|------|------------------|
| BiKe | 75 | X | 7 <u>\$</u> X |
| Drive | 165 | X+30 | 165 X+30 |
| | | | |

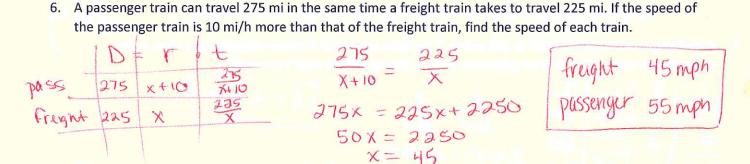
$$\frac{75}{X} = \frac{165}{X+30}$$

$$75(x+30) = 165X$$

$$75x + 2250 = 165X$$

$$2250 = 90X$$

$$25 = X$$



7. A light plane took 1 h longer to fly 540 mi on the first portion of a trip than to fly 360 mi on the second. If the rate was the same for each portion, what was the flying time for each leg of the trip?

| | 1D= | ~ | • t |
|--------|-----|------------|-----|
| first | 540 | 540 X+1 | X+1 |
| Second | 360 | 360 X | X |
| | | | |

$$\frac{540}{x+1} = \frac{360}{x}$$

$$540x = 360(x+1)$$

$$540x = 360x + 360$$

$$180x = 360$$

$$x = 2$$

3 hrs

8. Gilbert took 2 h longer to drive 240 mi on the first day of a business trip than to drive 144 mi on the second day. If his rate was the same both days, what was his driving time for each day?

first
$$240$$
 $\frac{240}{x+2}$ $x+2$
Second 144 $\frac{144}{x}$ x

$$\frac{240 \times = 144 \times + 288}{240 \times = 144 \times + 288}$$

$$\frac{240 \times = 144 \times + 288}{96 \times = 288}$$

$$\frac{240 \times = 288}{144 \times + 288}$$

9. An express train and a passenger bus leave the same city, at the same time, for a destination 350 mi away. The rate of the train is 20 mi/h faster than the rate of the bus. If the train arrives at its destination 2 h ahead of the bus, find each rate.

| aneda or cr | rieda or erie sasy mia easir rater | | | |
|-------------|------------------------------------|------|----------|--|
| | D = | ~ | t | |
| frain | 350 | x+20 | 350 | |
| BUS | 350 | X | 350 X | |
| - | | | | |

$$\frac{350}{x+20} + \frac{2}{x} = \frac{350}{x}$$

$$\frac{350(x) + 2x(x+20)}{x} = \frac{350(x+20)}{x}$$

$$\frac{350(x) + 2x^2 + 40x = 350x + 7000}{2(x^2 + 40x - 3500) = 0}$$

$$\frac{2x^2 + 40x - 7000 = 0}{2(x^2 + 20x - 3500) = 0}$$

$$\frac{2(x^2 + 20x - 3500) = 0}{2(x^2 - 50)(x + 70) = 0}$$

$$\frac{350}{x}$$

$$\frac{350$$

10. A private plane and a commercial plane take off from an airport at the same time for a city 720 mi away. The rate of the private plane is 180 mi/h less than that of the commercial plane. If the commercial plane arrives 2 h ahead of the private plane, find each plane's rate.

$$\frac{720}{X} + 2 = \frac{720}{x-180}$$

$$720(x-180) + 2(x)(x-180) = 720(x)$$

$$720x - (x-180) + 2x^2 - 360x = 720x$$

$$2x^2 - 360x - (x-180) = 0$$

$$2(x^2 - 180x - (x-180) = 0$$

$$2(x-360)(x+180) = 0$$

$$x = -180$$