

Application problems involving distance, rate & time

Key

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	r	t
Down	3	$x+20$	$\frac{3}{x+20}$
up	2	$20-x$	$\frac{2}{20-x}$
Total		x	

$$\frac{3}{20+x} = \frac{2}{20-x}$$

$$3(20-x) = 2(20+x)$$

$$60 - 3x = 40 + 2x$$

$$20 = 5x$$

$$x = 4 \text{ mph}$$

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?

	D	r	t
with	85	$300+x$	$\frac{85}{300+x}$
against	65	$300-x$	$\frac{65}{300-x}$
		x	

$$\frac{85}{300+x} = \frac{65}{300-x}$$

$$85(300-x) = 65(300+x)$$

$$25500 - 85x = 19500 + 65x$$

$$6000 = 150x$$

$$40 = x$$

$$40 \text{ mph}$$

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?

	D	r	t
with	720	$x+30$	$\frac{720}{x+30}$
against	720	$x-30$	$\frac{720}{x-30}$
		x	10

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

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

$$720x - 2160 + 720x + 2160 = 10(x^2 - 900)$$

$$1440x = 10x^2 - 9000$$

$$0 = 10x^2 - 1440x - 9000$$

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

$$150 \text{ mph}$$

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?

	D	r	t
up	6	$x-2$	$\frac{6}{x-2}$
Down	6	$x+2$	$\frac{6}{x+2}$
		x	

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

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

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

$$12x = 4x^2 - 16$$

$$4 \text{ mph}$$

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	t
Bike	75	x	$\frac{75}{x}$
Drive	165	$x+30$	$\frac{165}{x+30}$

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

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

$$75x + 2250 = 165x$$

$$2250 = 90x$$

$$25 = x$$

$$\begin{array}{l} \text{Bike } 25 \text{ mph} \\ \text{Drive } 55 \text{ mph} \end{array}$$

6. A passenger train can travel 275 mi in the same time a freight train takes to travel 225 mi. If the speed of the passenger train is 10 mi/h more than that of the freight train, find the speed of each train.

	D	r	t
pass	275	$x+10$	$\frac{275}{x+10}$
freight	225	x	$\frac{225}{x}$

$$\frac{275}{x+10} = \frac{225}{x}$$

$$275x = 225x + 2250$$

$$50x = 2250$$

$$x = 45$$

freight 45 mph
passenger 55 mph

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?

	D	r	t
first	540	$\frac{540}{x+1}$	$x+1$
second	360	$\frac{360}{x}$	x

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

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

$$540x = 360x + 360$$

$$180x = 360$$

$$x = 2$$

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?

	D	r	t
first	240	$\frac{240}{x+2}$	$x+2$
second	144	$\frac{144}{x}$	x

$$\frac{240}{x+2} = \frac{144}{x}$$

$$240x = 144(x+2)$$

$$240x = 144x + 288$$

$$96x = 288$$

$$x = 3$$

3 & 5 hrs

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.

	D	r	t
train	350	$x+20$	$\frac{350}{x+20}$
BUS	350	x	$\frac{350}{x}$

$$\frac{350}{x+20} + \frac{2}{1} = \frac{350}{x}$$

$$350(x) + 2x(x+20) = 350(x+20)$$

$$350x + 2x^2 + 40x = 350x + 7000$$

$$2x^2 + 40x - 7000 = 0$$

$$2(x^2 + 20x - 3500) = 0$$

$$2(x-50)(x+70) = 0$$

BUS 50 mph
Train 70 mph

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.

	D	r	t
private plane	720	$x-180$	$\frac{720}{x-180}$
commercial plane	720	x	$\frac{720}{x}$

$$\frac{720}{x} + \frac{2}{1} = \frac{720}{x-180}$$

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

$$720x - 129600 + 2x^2 - 360x = 720x$$

$$2x^2 - 360x - 129600 = 0$$

$$2(x^2 - 180x - 64800) = 0$$

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

private plane 180 mph
commercial plane 360 mph