Examples of time, rate, and distance problems:

A) Problems on land:

1) A freight train starts from Los Angeles and heads for Chicago at 40 mph. Two hours later a passenger train leaves the same station for Chicago traveling at 60 mph. How long will it be before the passenger train overtakes the freight train?

	Rate	x Time	= Distance
F	40	$x+2$	$40x+80$
P	60	x	$60x$

$40x+80=60x$
$-40x \quad -40x$
$\frac{80}{20}=\frac{20x}{20}$
$40=x$
4 hrs

2) A car leaves San Francisco for Los Angeles traveling an average of 70 mph. At the same time, another car leaves Los Angeles for San Francisco traveling 60 mph. If it is 520 miles between San Francisco and Los Angeles, how long before the two cars meet, assuming that each maintains its average speed?

SF ← 70x 60x → LA
520

	Rate	x Time	= Distance
to LA	70	x	$70x$
to SF	60	x	$60x$

4 hours!

$520=70x+60x$
$\frac{520}{130}=\frac{130x}{130}$
$4=x$

3) Two planes leave New York at 10 am, one heading for Europe at 600 mph and one heading in the opposite direction at 150 mph. (So it isn't a jet!) At what time will they be 900 miles apart? How far has each traveled?

Calif. ← 150x NY 600x → E
900 miles

	Rate	x Time	= Distance
to Europe	600	x	$600x$
Opp.	150	x	$150x$

$900=150x+600x$
$\frac{900}{750}=\frac{750x}{750}$
$1.2=x$
hours
$1\frac{1}{5}$ hrs
$\frac{6}{5}$ hr

$\frac{1}{5}\times 60=12$ mins

The trip takes 1 hr. 12 mins.

Distance of fast plane
$600x$
$=600(1.2)=$
720 miles

Slow plane's distance
$150(x)=150(1.2)$
$=180$ miles

4) Mr. Derbyshire makes a business trip from his house to Loganville in 2 hours. One hour later, he returns home in traffic at a rate ~~20 mph less than his rate going~~. If Mr. D is gone a total of 6 hours, how fast did he travel on each leg of the trip?

	Rate	x	Time	=	Distance
to L	X		2		2X
home	X-20		3		3X-60

$2X = 3X - 60$
$-3X \quad -3X$
$-X = -60$
$X = 60$

60 mph out, 40 mph return home.

5) Jake and Jerry went on a camping trip with their motorcycles. One day Jerry left camp on his motorcycle to go to the village. Ten minutes later Jake decided to go too. If Jerry was traveling 30 mph and Jake traveled 35 mph, how long was it before Jake caught up with Jerry?

Jerry → town
Jake → town

	Rate	x	Time	=	Distance
Jerry	30		$X+\frac{1}{6}$		$30X+5$
Jake	35		X		35X

$30X + 5 = 35X$
$-30X \quad -30X$
$5 = 5X$
$\frac{5}{5} = \frac{5X}{5}$
$1 = X$

Jake takes 1 hr. to catch up.

6) John drove 318 miles. He drove 34 mph for the first 3 hours and 54 mph for the rest of his drive. How long did he drive at 54 mph?

	Rate	x	Time	=	Distance
	34		3		102
	54		X		54x

start 102 + 54X end
318 miles
$102 + 54X = 318$
$\frac{54X}{54} = \frac{216}{54} = 4$
$X = 4$

John traveled 4 hrs at 54 mph.

B) Problems involving moving air (wind) or moving water (current):

1) A plane takes 5 hours to fly from Los Angeles to Honolulu and 4 1/11 hours to return from Honolulu to Los Angeles. If the wind velocity is 50 mph from the west on both trips, what is the airspeed of the plane? (Airspeed is the speed of the plane in still air.)

Rate	x	Time	=	Distance

2) In his motorboat, a man can go downstream in 1 hour less time than he can go upstream the same distance. If the current is 5 mph, how fast can he travel in still water if it takes him 2 hours to travel upstream the given distance?

Rate	x	Time	=	Distance