In exercises 1 to 8, solve each equation for the indicated variable.

1. $\frac{1}{x} = \frac{1}{a} - \frac{1}{b}$ for x $\frac{ab}{b-a} = x$

2. $\left(\frac{1}{x} = \frac{1}{a} + \frac{1}{b}\right)^{xab}$ for a $ab = xb + xa$
$ab - xa = xb$
$a(b-x) = xb \longrightarrow$ $\boxed{a = \frac{xb}{b-x}}$

3. $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ for R_1 $\frac{RR_2}{R_2 - R} = R_1$

4. $\frac{1}{F} = \frac{1}{D_1} + \frac{1}{D_2}$ for D_2 $D_1 D_2 = FD_2 + FD_1$ $\boxed{D_2 = \frac{FD_1}{D_1 - F}}$

5. $y = \frac{x+1}{x-1}$ for x $\frac{y+1}{y-1} = x$

6. $y = \frac{x-3}{x-2}$ for x $xy - 2y = x - 3$
$xy - x = 2y - 3$
$\boxed{x = \frac{2y-3}{y-1}}$

7. $t = \frac{A-P}{Pr}$ for P $P = \frac{A}{1+rt}$

8. $I = \frac{nE}{R+nr}$ for n $IR + Irn = nE$
$Irn - nE = -IR$ $\boxed{n = \frac{-IR}{Ir - E}}$ OR
$n = \frac{IR}{E - Ir}$

4 mph **9. Motion.** 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?

40 mph **10. Motion.** 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	$t = \frac{d}{r}$
head	65	300−r	$\frac{65}{300-r}$
tail	85	300+r	$\frac{85}{300+r}$

$\frac{65}{300-r} = \frac{85}{300+r} \longrightarrow \boxed{r = 40 \text{ mph}}$
$19500 + 65r = 25500 - 85r$
$150r = 6000$

150 mph **11. Motion.** 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?

4 mph **12. Motion.** 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	r−2	$\frac{6}{r-2}$
dn	6	r+2	$\frac{6}{r+2}$

$\frac{6}{r-2} + \frac{6}{r+2} = 4$ $6r + 12 + 6r - 12 = 4r^2 - 16$
$4r^2 - 12r - 16 = 4(r^2 - 3r - 4) = 4(r-4)(r+1) = 0$
$r = 4$

17. Motion. 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.
Bus = 50 mph   train = 70 mph

360 mph **18. Motion.** 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
pp	720	r−180	$\frac{720}{r-180}$
cp	720	r	$\frac{720}{r}$

$\frac{720}{r} - \frac{720}{r-180} = 2$ $720(r-180) - 720r = 2r(r-180)$
$2r^2 - 360r + 129600 = 2(r^2 - 180r + 64800)$
$= 2(r-360)(r+80)$
$r = 360$

6 h **19. Work.** One road crew can pave a section of highway in 15 h. A second crew, working with newer equipment, can do the same job in 10 h. How long would it take to pave that same section of highway if both crews worked together?

$\frac{1}{15} + \frac{1}{10} = \frac{1}{t}$

15 h **21. Work.** An inlet pipe can fill a tank in 10 h. An outlet pipe can drain that same tank in 30 h. The inlet valve is opened, but the outlet valve is accidentally left open. How long will it take to fill the tank with both valves open?

$\frac{1}{10} - \frac{1}{30} = \frac{1}{t}$