

2.6 Problem Solving

There are 2 types of problem solving questions we will look at: speed/distance/time, and rate of work.

Type 1: Speed/Distance/Time

Mario drove from Edmonton to Grande Prairie and back, a distance of about 360 km each way. Mario's average speed was 30 km/h greater on his return trip than on his trip out. His total driving time was 10 h. Determine Mario's average speed on each leg of his journey.

Complete the table below. Choose a variable to represent Mario's average speed for one leg of his journey. Write, then solve an equation to solve the problem. Verify the solution.

$t = \frac{d}{v}$


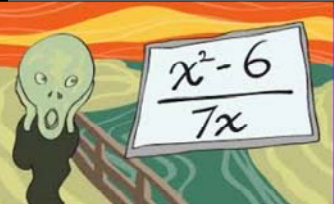
	Edmonton to Grande Prairie	Grande Prairie to Edmonton	
d	Distance (km)	360	360
v	Average speed (km/h)	x	x+30
t	Time (h)	$\frac{360}{x}$	$\frac{360}{(x+30)}$

= 10

$$\frac{360}{x} + \frac{360}{(x+30)} = \frac{10}{1}$$

LCM: $x(x+30)$

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Jerome rows his boat 24 km downstream and back to where he began. When the average speed of the current is 2 km/h, Jerome can complete the journey in 9 h. What is Jerome's average rowing speed in still water?

	downstream	upstream
d	24	24
v	x+2	x-2
t	$\frac{24}{(x+2)}$	$\frac{24}{x-2}$

$$\frac{24}{(x+2)} + \frac{24}{(x-2)} = 9$$

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3. On a canoe trip, Patan paddled upstream a distance of 10 km. On the return trip downstream, the average speed of the canoe was 5 km/h greater than its speed upstream. Write, then simplify an expression for Patan's total paddling time in terms of the average speed upstream.

	up	down
d	10	10
v	x	x+5
t	$\frac{10}{x}$	$\frac{10}{x+5}$

$$\frac{10}{x} + \frac{10}{(x+5)}$$

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A plane travels from Toronto to Vancouver and back, a distance of about 3400 km each way. The plane flies 100 km/h faster on the return trip than it does on the journey out. Write, then simplify an expression for the total flying time in terms of the average speed from Toronto to Vancouver.

	Tor-Van	Van-Tor
d	3400	3400
v	x	x+100
t	$\frac{3400}{x}$	$\frac{3400}{(x+100)}$

$$\frac{3400}{x} + \frac{3400}{(x+100)}$$

$$\text{LCM: } x(x+100)$$

$$= \frac{3400x + 340000 + 3400x}{x(x+100)}$$

$$= \frac{6800x + 340000}{x(x+100)}$$

$$\text{Restrictions: } x \neq 0, -100.$$


$$x > 0$$

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Type 2: Rate of Work

Kyra mows a lawn in 40 min. When Mark and Kyra work together, they can mow the lawn in 24 min. How long would it take Mark to mow the lawn on his own?

$$3m \cdot \frac{1}{40} + \frac{1 \cdot 120}{120m} = \frac{1 \cdot 5m}{24 \cdot 5m}$$

LCM: 120m

$$\frac{3m}{120m} = \frac{120}{120m} = \frac{5m}{120m}$$


$$\frac{3m}{120m} + 120 = \frac{5m}{120m}$$

$$-\frac{3m}{120m} \quad -\frac{3m}{120m}$$

$$\frac{120}{2} = \frac{2m}{2}$$

$M = 60 \text{ min}$

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3. Lyle can fill the bathtub using the cold water tap in 8 min. When both the hot and cold water taps are fully open, he can fill the bathtub in 6 min. How long would it take Lyle to fill the bathtub using only the hot water tap?

An equation that represents this situation is: $\frac{6}{8} + \frac{6}{t} = 1$, where t is the time in minutes required to fill the bathtub using only the hot water tap. Solve the equation to solve the problem.

$$t: \frac{6}{8} + \frac{6 \cdot 8}{t \cdot 8} = \frac{1 \cdot 8t}{1 \cdot 8t}$$

LCM: 8t

$$\frac{6t}{8t} = \frac{48}{8t} = \frac{8t}{8t}$$


$$\frac{6t}{8t} + 48 = \frac{8t}{8t}$$

$$-\frac{6t}{8t} \quad -\frac{6t}{8t}$$

$$\frac{48}{2} = \frac{2t}{2}$$

$t = 24 \text{ min}$

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2. Marissa can paint a garage door in 3 h. When Marissa and Roger work together, they can paint the same garage door in 1 h. How long would it take Roger to paint the garage door on his own?

$$\text{Marissa} + \text{Roger} = 1\text{h}$$

$$\frac{1 \cdot R}{3R} + \frac{3 \cdot 1}{3R} = \frac{1 \cdot 3R}{1 \cdot 3R}$$


LCM: 3R

$$\frac{R}{3R} + \frac{3}{3R} = \frac{3R}{3R}$$

$$\begin{array}{r} R + 3 = 3R \\ -R \quad -R \\ \hline 3 = 2R \\ \frac{3}{2} = \frac{2R}{2} \end{array}$$

$$\boxed{R = 1.5\text{h}}$$

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5. It takes a painter 3 h to spray paint a fence. When two people paint the fence, one using a sprayer and the other using a brush, they can paint the fence in 2 h. How long would it take one person to paint the fence using only a brush?

$$\begin{array}{l} 2B \cdot \frac{1}{3} + \frac{6 \cdot 1}{6B} = \frac{1 \cdot 3B}{2 \cdot 3B} \\ 2B \cdot \frac{1}{3} + \frac{6 \cdot 1}{6B} = \frac{1 \cdot 3B}{2 \cdot 3B} \end{array}$$

LCM: 6B

$$\frac{2B}{6B} + \frac{6}{6B} = \frac{3B}{6B}$$

$$\begin{array}{r} 2B + 6 = 3B \\ -2B \quad -2B \\ \hline 6 = B \end{array}$$

6 hours to brush only

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