Pre-Calculus 11
7.6 Applications of Rational Expressions
Name: _____

Rational equations can be used to solve a variety of real-world problems, including those involving __motion, work, proportion__.

Example 1: *Solving Problems Involving Motion*   Recall $time = \dfrac{distance}{speed}$

A boat travels at an average speed of 15 km/h in still water. The boat travels 12 km downstream in the same time as it travels 8 km upstream. Determine the average speed of the current.   *use a chart*

let x = speed of the current

- down stream (faster speed)
  up   "   (slower)

	downstream	upstream.
Distance (km)	12	8
avg. speed (km/h)	$15 + x$	$15 - x$
time $\left(\dfrac{d}{s}\right)$	$\dfrac{12}{15+x}$	$\dfrac{8}{15-x}$

times are equal ∴ down = up.

$$\therefore \frac{12}{15+x} = \frac{8}{15-x}$$

$$12(15-x) = 8(15+x)$$

$$180 - 12x = 120 + 8x$$

$$\frac{60}{20} = \frac{20x}{20}$$

answer in a sentence please.

$$3 = x$$

the speed of the current is 3 km/h

Example 2: *Solving problems Involving Work*

Example 2: *Solving problems Involving Work*

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

let t = the hours of time it takes Graham to paint on his own.

time	amount Paul can paint	amount G can paint	painting together
1 hour	$\frac{1}{3}$	$\frac{1}{t}$	$\frac{3}{3}$ 1

common denominator
$3t$

$\frac{1}{3} + \frac{1}{t} = 1$

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

$t + 3 = 3t$

$3 = 2t$

$t = \frac{3}{2} = 1.5$

Graham can paint the door in 1.5 hours.

Example 3: *Solving problems Involving Proportion*

How much lemon juice must be added to 2 L of water to make a lemonade solution that contains 20% lemon juice?

let v = the volume of lemon juice added (L)
↳ total volume of the solution $(v+2)$

(20%)

$\dfrac{\text{volume lemon juice}}{\text{total volume.}} = \dfrac{20}{100}$

$\dfrac{v}{v+2} = \dfrac{20}{100}$

$100v = 20(v+2)$

$100v = 20v + 40$

$80v = 40$

$v = \frac{1}{2}$ no 0.5

∴ $\frac{1}{2}$ a Litre of lemon juice must be added to make a lemonade solution of 20% juice

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