Applications of Rational Equations

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Applications

Rational equations can be used to solve a variety of problems in real-world situations.

We will see how to use rational equations in multi-rate work problems, and distance-speed-time problems.

Applications

Here's a video showing the use of a rational equation to solve a simple multi-rate work problem:

click here

This is the problem described in the video:

Tom can wash a car in 45 minutes. Jerry can wash the same car in 30 minutes. How long will it take to wash the car if they work together?

Applications

To solve the problem, the instructor used the fact that the amount of work completed is equal to the rate of work multiplied by the time spent working: $W = rt$

This formula might also be used as $t = \frac{W}{r}$ or $r = \frac{W}{t}$ depending upon which quantity is unknown.

Applications

Example:

Underground pipes can fill a swimming pool in 4 hours. A regular garden hose can fill the pool in 16 hours. If both are used at the same time, how long will it take to fill the pool?

The unknown quantity is time, or *t*. Discuss the table entries for use in this solution.

	rate	time	work
pipes	$\frac{1}{4}$	t	$\frac{1}{4}t$
hose	$\frac{1}{16}$	t	$\frac{1}{16}t$

Example (continued):

	rate	time	work
pipes	$\frac{1}{4}$	t	$\frac{1}{4}t$
hose	$\frac{1}{16}$	t	$\frac{1}{16}t$

The total amount of work by the pipes and the hose should equal 1 job completed.

$$\frac{1}{4}t + \frac{1}{16}t = 1$$

$$16 \cdot \frac{1}{4}t + 16 \cdot \frac{1}{16}t = 16 \cdot 1$$

$$4t + t = 16$$

$$5t = 16$$

$$t = 3.2$$

With the pipes and hose working together, the pool will be filled in 3.2 hours.

Applications

Example:

Working alone, Tony's dad can complete the yard work in 3 hours. If Tony helps his dad, the yard work takes 2 hours. How long would it take Tony working alone to complete the yard work?

The unknown is the number of hours for Tony working alone. Discuss the table entries for use in this solution. Then write an equation and solve.

	rate	time	work
Dad	$\frac{1}{3}$	2	$\frac{2}{3}$
Tony	$\frac{1}{x}$	2	$\frac{2}{x}$

Teacher Notes

36 James can paint the office by himself in 7 hours. Manny paints the office in 10 hours. How long will it take them to paint the office working together?

Answer

37 Working together, it takes Sam, Jenna, and Francisco 2 hours to clean one house. When Sam is working alone, he can clean the house in 6 hours. When Jenna works alone, she can clean the house in 4 hours. Determine how long it would take Francisco to clean the house on his own.

Answer

38 Allison can complete a sales route by herself in 5 hours. Working with an associate, she completes the route in 3 hours. How long would it take her associate to complete the route by himself?

A 8 hours

B 6.5 hours

C 7.5 hours

D 5 hours

Answer

Applications

Another application of rational equations is solving distance-speed-time problems. Recall that distance traveled is equal to the speed (rate) multiplied by the time.

$$D = rt$$

This formula may also be used as $r = \dfrac{D}{t}$

or $t = \dfrac{D}{r}$ depending upon which quantity is unknown.

Applications

Example:

Marcie can walk 8 miles in the same amount of time as Ashley can walk 6 miles. If Marcie walks one mile per hour faster than Ashley, how fast does each person walk?

Use *r* to represent the smaller of the unknown quantities, which is Ashley's rate. Discuss the table entries for use in this solution.

	rate	time	distance
Ashley	r	$\frac{6}{r}$	6
Marcia	$r + 1$	$\frac{8}{r+1}$	8

Applications

Example:

	rate	time	distance
Ashley	r	$\frac{6}{r}$	6
Marcia	$r + 1$	$\frac{8}{r+1}$	8

The time spent walking is equal for the two girls.

$$\frac{6}{r} = \frac{8}{r+1}$$

$$6(r+1) = 8r$$

$$6r + 6 = 8$$

$$6 = 2r$$

$$3 = r$$

Ashley's rate is 3 mph

and

Marcia's rate is 4 mph

Applications

Example:

Paul drove 18 miles to the airport to pick up his father and then returned home. With no traffic on the return trip, he was able to average 15 miles per hour faster than he did on the trip there. If the total driving time was 1 hour, what was his average speed driving to the airport?

Use *r* to represent the smaller of the unknown quantities, which is Paul's rate to the airport. Discuss the table entries for use in this solution. Then write an equation and solve.

	rate	time	distance
to airport	r	$\frac{18}{r}$	18
return trip	$r + 15$	$\frac{18}{r+15}$	18

Teacher Notes

39 James can jog twice as fast as he can walk. He was able to jog the first 9 miles to his grandmother's house, but then he tired and walked the remaining 1.5 miles. If the total trip took 2 hours, then what was his average jogging speed?

A 3 mph

B 4.5 mph

C 2.5 hours

D 3 hours

Answer

40 A passenger car averages 16 miles per hour faster than a bus. If the bus travels 56 miles in the same time it takes the passenger car to travel 84 miles, then what is the speed of each?

(Hint: use r for the smaller unknown speed)

Answer