

LESSON #6: SOLVING "WORKING TOGETHER" WORD PROBLEMS

NOW: Solve the following rational equations:

<p>1.) <math>\frac{37}{x^2-64} + \frac{x}{x-8} = \frac{-2}{x+8}</math>    LCD = <math>(x+8)(x-8)</math></p> $37 + x(x+8) = -2(x-8)$ $37 + x^2 + 8x = -2x + 16$ $\begin{array}{r} 37 \\ +2x \\ \hline -16 \end{array} \quad \begin{array}{r} +2x \\ +2x \\ \hline -16 \end{array}$ $x^2 + 10x + 21 = 0$ $(x+7)(x+3) = 0$ <p><u>-7</u>    <u>-3</u></p>	<p>2.) <math>\frac{1}{4} + \frac{1}{6} = \frac{1}{x}</math>    LCD = <math>12x</math></p> $3 \frac{12x}{4} + 2 \frac{12x}{6} = \frac{12x}{x}$ $3x + 2x = 12$ $5x = 12$ $x = 2.4$
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**EXAMPLE PROBLEM:** It takes Caiden 4 hours to rake the leaves at his house. His younger brother Evan can rake the leaves at the house in 6 hours. How long will it take Caiden and Evan to rake the leaves if they work together? ?

• Working together

	Hours to do the job	Fraction of the job done in 1 hour
Caiden	4	$\frac{1}{4}$
Evan	6	$\frac{1}{6}$
<b>TOGETHER</b>	? x	$\frac{1}{x}$

1) a) Write and solve a rational equation that illustrates the Do-Now example.

$$\frac{1}{4} + \frac{1}{6} = \frac{1}{x} \quad (\text{see do now!})$$

$$x = 2.4 \text{ hours to do it together}$$

b) Let's change the scenario. If Caiden and Evan's younger sister Avery decides to help and it takes all three of them 1.5 hours to rake the leaves, how long would it take Avery to complete the job all by herself?

$$12x \left( \frac{1}{4} + \frac{1}{6} + \frac{1}{x} = \frac{1}{1.5} \right) \quad \text{LCD} = 12x$$

$$3x + 2x + 12 = 8x$$

$$5x + 12 = 8x$$

$$12 = 3x$$

$x = 4 \text{ hours for Avery to complete alone}$

2. Working together, Anya and Bill painted the wood of a swing set in 8 hours. Last year, Anya painted the swing set by herself and the year before that Bill painted it by himself, but took twice as long as Anya did. How long did Anya and Bill take, when each painted was painting alone.

$$\text{Anya} = x$$

$$\text{Bill} = 2x$$

$$\text{Together} = 8 \text{ hours}$$

$$8x \left( \overset{A}{\frac{1}{x}} + \overset{B}{\frac{1}{2x}} = \overset{\text{Total}}{\frac{1}{8}} \right) \quad \text{LCD} = 8x$$

$$8 + 4 = x$$

$$\boxed{\begin{array}{l} 12 = x \rightarrow \text{Anya} \\ 24 = 2x \rightarrow \text{Bill} \end{array}}$$

**PRACTICE:**

3. Suppose one painter can paint the entire house in twelve hours, and the second painter takes eight hours to paint a similarly-sized house. How long would it take the two painters together to paint the house?

$$24x \left( \frac{1}{12} + \frac{1}{8} = \frac{1}{x} \right)$$

$$\text{Key: Person 1 + Person 2 = Total}$$

$$\text{LCD} = 24x$$

$$2x + 3x = 24$$

$$5x = 24$$

$$x = \boxed{4.8 \text{ hours together}}$$

4. Jamie, Pria and Paul can paint a room together in 2 hours. If Pria does the job alone she can paint the room in 5 hours. If Paul works alone, he can paint the room in 6 hours. If Jamie works alone, how long would it take her to paint the room?

$$\text{LCD} = 30x$$

$$\text{Pria} + \text{Paul} + \text{Jamie} = \text{Total}$$

$$30x \left( \frac{1}{5} + \frac{1}{6} + \frac{1}{x} = \frac{1}{2} \right)$$

$$6x + 5x + 30 = 15x$$

$$11x + 30 = 15x$$

$$30 = 4x$$

$$\boxed{x = 7.5 \text{ hrs}}$$

5. One pipe can fill a pool 1.25 times as fast as a second pipe. When both pipes are opened, they fill the pool in five hours. How long would it take to fill the pool if only the slower pipe is used?

$$\text{PIPE 1} + \text{PIPE 2} = \text{TOTAL}$$

$$5x \left( \frac{1}{1.25x} + \frac{1}{x} = \frac{1}{5} \right) \quad \text{LCD} = 5x$$

$$4 + 5 = x$$

$$9 = x \rightarrow \text{PIPE 2}$$

$$\frac{11.25}{1.25} = 1.25x \rightarrow \text{PIPE 1}$$

↳ slower

$$\boxed{11.25 \text{ hrs}}$$

- ★ 6. Lindsey takes 2 hours to plant 500 flower bulbs. Francis takes 3 hours to plant 450 flower bulbs. Working together, how long should it take them to plant 1500 bulbs?

$$L + F = \text{TOGETHER ?}$$

convert to hourly:

$$L = \frac{500}{2} = 250 \text{ bulbs/hr} \rightarrow \frac{250}{1500} = \frac{1}{6}$$

$$F = \frac{450}{3} = 150 \text{ bulbs/hr} \rightarrow \frac{150}{1500} = \frac{1}{10}$$

$$\text{LCD} = 30x \left( \frac{1}{6} + \frac{1}{10} = \frac{1}{x} \right) \rightarrow x = \boxed{3.75 \text{ hours}}$$

A.C.T./S.A.T question

$$5x + 3x = 30$$

$$8x = 30$$

- ★ 7. Clarissa can complete spring-cleaning in a house in 5 hours. Ruth can complete the cleaning in the same house for 7 hours. If Clarissa works for 1 hour alone and then Ruth joins her to finish the cleaning, what is the total time it takes to complete the spring-cleaning?

- a) 2 hours, 30 minutes
- b) 2 hours, 20 minutes
- c) 3 hours, 20 minutes
- d) 3 hours
- e) 2 hours, 33 minutes

$$35x \left( \frac{1}{5} + \frac{1}{7} = \frac{1}{x} (.80) \right) \quad \text{LCD} = 35x$$

for 4 out of 5 hrs = 80% of job left

$$7x + 5x = 28$$

$$12x = 28$$

$$x = 2.3$$

$$.33 \times 60 = 19.8$$

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$$\rightarrow 2 \text{ hr } 20 \text{ min} + 1 \text{ hr (Clarissa did alone)}$$

$$\boxed{3 \text{ hr } 20 \text{ min total}}$$

