

Section 6.4 Rational Equations

Solving

$$16. \quad \frac{7}{8} - \frac{x}{4} = -\frac{11}{8}$$

clear the fractions
by multiplying by the
LCD

$$\frac{\cancel{8}}{1} \cdot \frac{7}{\cancel{8}} - \frac{\cancel{8}^2}{1} \cdot \frac{x}{4} = \frac{\cancel{8}}{1} \cdot \frac{-11}{8}$$

$$\text{LCD} = 8$$

$$\begin{array}{r} 7 - 2x = -11 \\ -7 \qquad -7 \end{array}$$

$$\frac{-2x}{-2} = \frac{-18}{-2}$$

$$x = 9$$

{9}

with x's in the denominators

18.

$$\frac{1}{3x} + \frac{1}{x} = \frac{4}{15}$$

$$\text{LCD} = 15x$$

$$\frac{\cancel{15x}^5}{1} \cdot \frac{1}{\cancel{3x}} + \frac{\cancel{15x}^3}{1} \cdot \frac{1}{\cancel{x}} = \frac{\cancel{15x}}{1} \cdot \frac{4}{15}$$

Clear the
fractions

$$\frac{5 + 15}{\cancel{x}} = 4x$$

$$\frac{20}{4} = \frac{4x}{4}$$

$$5 = x$$

{5}

$$30. \quad \frac{2}{z-1} - \frac{5}{z+1} = \frac{4}{z^2-1} \leftarrow \text{factor}$$

$$\frac{2}{z-1} - \frac{5}{z+1} = \frac{4}{(z+1)(z-1)} \quad \text{LCD} = (z+1)(z-1)$$

$$\frac{(z+1)(z-1)}{1} \cdot \frac{2}{z-1} - \frac{(z+1)(z-1)}{1} \cdot \frac{5}{z+1} = \frac{(z+1)(z-1)}{1} \cdot \frac{4}{(z+1)(z-1)}$$

$$2(z+1) - 5(z-1) = 4$$

$$2z + 2 - 5z + 5 = 4$$

Linear, isolate z

$$-3z + 7 = 4$$

$$-7 \quad -7$$

$$-3z = -3$$

$$z = 1$$

~~{1}~~

have to check
the domain

no solution

$$\frac{2}{z-1} - \frac{5}{z+1} = \frac{4}{z^2-1}$$

$\frac{2}{1-1}$
undefined

you may get a
quadratic equation

$$x^2 + 3x + 2 = 0$$

put in standard
form and solve

check both
solutions in the
domain

Section 6.4 Continued

Solving Rational Equations

48. $\frac{12}{x^2-9} + \frac{2}{x+3} = \frac{x}{3-x}$

with = sign multiply each term by the LCD

LCD = $(x-3)(x+3)$

~~#~~ $\frac{12}{(x-3)(x+3)} + \frac{2}{x+3} = -\frac{x}{x-3}$

Annotations: $-\frac{x+3}{1(x-3)}$, -1 , $+ \text{nick}$

Clear Fractions

$(x-3)(x+3) \cdot \frac{12}{(x-3)(x+3)} + (x-3)(x+3) \cdot \frac{2}{x+3} = (x+3)(x-3) \cdot -\frac{x}{x-3}$

Adding or subtracting expressions

$\frac{(x-2)x}{(x-2)x+3} + \frac{x}{x-2} \frac{(x+3)}{(x+3)}$ no sign

make them have a common denominator

$12 + 2(x-3) = -x(x+3)$

$+x^2 \quad 12 + 2x - 6 = -x^2 - 3x$
 $\quad \quad \quad +3x \quad \quad \quad +x^2 + 3x$

$x^2 + 5x + 6 = 0$

$(x+3)(x+2) = 0$

$x+3=0$ or $x+2=0$

$-3 -3$

~~$x = -3$~~ or $x = -2$

$\{-2\}$

check domain $x \neq -3$ or 3

Solve graphically

54. $\frac{1}{x-1} = \frac{2}{x}$

$\underbrace{\frac{1}{x-1}}_{y_1} = \underbrace{\frac{2}{x}}_{y_2}$

F5 math Intersection

Solve an equation for a Variable

76. $\frac{P}{V} = \frac{VI}{V}$, solve for T

$$\frac{P}{V} = T$$

74. $2\pi \cdot r = \frac{C \cdot 2\pi}{2\pi}$, for C

10:20

$$2\pi r = C$$

78. $\frac{d}{1} \cdot \frac{a}{b} = \frac{c}{d} \cdot \frac{d}{1}$ for d

$$\frac{b}{a} \cdot \frac{ad}{b} = c \cdot \frac{b}{a}$$

$$d = \frac{bc}{a}$$

LCD = bd

$$bd \cdot \frac{a}{b} = \frac{c}{d} \cdot bd$$

$$\frac{ad}{a} = \frac{bc}{a}$$

$$d = \frac{bc}{a}$$

86. $\frac{1}{t+1} = \frac{a}{a-b}$, for b LCD = $(t+1)(a-b)$

$$\frac{1}{t+1} \cdot \frac{(t+1)(a-b)}{(t+1)(a-b)} = \frac{a}{a-b} \cdot \frac{(t+1)(a-b)}{(t+1)(a-b)}$$

$$a - b = at + a$$

$$\frac{-b}{-1} = \frac{at}{-1}$$

$$b = -at$$

cross-multiply

$$\frac{1}{t+1} = \frac{a}{a-b}$$

$$1 \cdot (a-b) = a(t+1)$$

$$a-b = at+a$$

$$\frac{-b}{-1} = \frac{at}{-1}$$

$$b = -at$$

$$6.1 \quad \frac{(\quad)}{(\quad)} = \frac{(\quad)}{(\quad)}$$

multiply by LCD

$$6.4 \quad \frac{(\quad)}{(\quad)} = \frac{(\quad)}{(\quad)} + \frac{(\quad)}{(\quad)}$$

cross multiply

$$84. \quad \frac{R}{1} = \frac{R_1 R_2}{R_1 + R_2}, \text{ for } R_2$$

$$R(R_1 + R_2) = R_1 R_2$$

$$RR_1 + RR_2 = R_1 R_2$$

$$\frac{-RR_2}{RR_1} = \frac{-RR_2}{R_1 R_2 - RR_2}$$

$$\frac{RR_1}{R_1 - R} = \frac{R_2(R_1 - R)}{R_1 - R}$$

2 R_2 's

* Common Factor

$$\boxed{\frac{RR_1}{R_1 - R} = R_2}$$

Write a rational equation using the form $\frac{1}{A} + \frac{1}{B} = \frac{1}{T}$ and solve.

A is the time for the first person to complete the job alone, B is the time for the second person to complete the job alone and T is the time it takes with the people working together.

- It takes Jill 10 hours to put together a puzzle and it takes Jack 15 hours to put together the same puzzle. How long will it take them to complete the puzzle if they work together?

$\frac{1}{10} + \frac{1}{15} = \frac{1}{T}$ LCD = 30T
 $30T \cdot \frac{1}{10} + 30T \cdot \frac{1}{15} = 30T \cdot \frac{1}{T}$
 $3T + 2T = 30$
 $5T = 30$
 $T = 6$
 It will take them 6 hours together.

$\frac{3}{30} + \frac{2}{30} = \frac{1}{T}$
 $\frac{5}{30} = \frac{1}{T}$

$\frac{1}{6} = \frac{1}{T}$
 $T = 6$

$\frac{1}{10}$ each hour
 $+$ $\frac{1}{15}$ each hour

- Luke takes 6 hours to paint a room. Colby takes only 3 hours to paint the same room. How long would it take if they worked together?

$\frac{1}{6} + \frac{1}{3} = \frac{1}{T}$ LCD = 6T
 $6T \cdot \frac{1}{6} + 6T \cdot \frac{1}{3} = 6T \cdot \frac{1}{T}$
 $T + 2T = 6$
 $3T = 6$
 $T = 2$
 It would take them 2 hours working together.

- If George and Tom lay sod in a yard together, it takes them 12 hours. Alone, Tom can do the job in 18 hours. How long would it take for George to lay the sod by himself?

$\frac{1}{A} + \frac{1}{18} = \frac{1}{12}$ LCD = 36B
 $36B \cdot \frac{1}{18} + 36B \cdot \frac{1}{18} = 36B \cdot \frac{1}{12}$
 $2B + 36 = 36B$
 $-2B$ $-2B$
 $36 = B$
 It would take George 36 hours by himself.

Write a rational equation using the form $\frac{1}{A} + \frac{1}{B} = \frac{1}{T}$ and solve.

A is the time for the first person to complete the job alone, B is the time for the second person to complete the job alone and T is the time it takes with the people working together.

1. It takes Jill 10 hours to put together a puzzle and it takes Jack 15 hours to put together the same puzzle. How long will it take them to complete the puzzle if they work together?
2. Luke takes 6 hours to paint a room. Colby takes only 3 hours to paint the same room. How long would it take if they worked together?
3. If George and Tom lay sod in a yard together, it takes them 12 hours. Alone, Tom can do the job in 18 hours. How long would it take for George to lay the sod by himself?

Answers:

1. It would take them 6 hours working together.
2. It would take them 2 hours working together.
3. It would take 36 hours with George working alone.