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Mr. Rogove Date:_____

Learning Objective:

We will solve linear equations involving proportions, fractions, and variables in the denominator (G8M4L7).

Concept Development:

Sometimes, linear equations are in disguise.

Example:

$$\frac{5}{x} = \frac{6}{12}$$

What kind of problem is this?

PROPORTION!

How can we make this a linear equation?

CROSS MULTIPLY $\frac{5}{x} \times \frac{6}{12}$ $6x = 60$

Remember this theorem regarding proportions:

if $\frac{A}{B} \times \frac{C}{D}$, then $AD = BC$

provided $B \neq 0$ *and* $D \neq 0$

Can we apply this theorem to the following problem to create a linear equation?

$$\frac{x-1}{2} \times \frac{x+\frac{1}{3}}{4}$$

$4(x-1) = 2\left(x+\frac{1}{3}\right)$

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Guided Practice:

Steps for Solving More Complicated Linear Equations

1. Multiply each numerator by the other fraction's denominator.
2. Place expressions that contained more than one term in parentheses as a reminder to apply the distributive property.
3. Gather all variable terms on one side of the equation.
4. Use the properties of equality to isolate the variable.
5. Check your solution.

$$\frac{7}{3x+9} = \frac{1}{8}$$

$1(3x+9) = 8 \cdot 7$

$3x + 9 = 56$

$-9 \quad -9$

$\frac{3x}{3} = \frac{47}{3}$

$x = \frac{47}{3}$

CHECK

$\frac{7}{3x+9} = \frac{1}{8}$

$\frac{7}{3(\frac{47}{3})+9} \stackrel{?}{=} \frac{1}{8}$

$\frac{7}{47+9} \stackrel{?}{=} \frac{1}{8}$

$\frac{7}{56} \stackrel{?}{=} \frac{1}{8}$

$\frac{1}{8} \stackrel{\checkmark}{=} \frac{1}{8}$

$$\frac{6}{7x+5} = \frac{1}{9}$$

$7x + 5 = 54$

$-5 \quad -5$

$\frac{7x}{7} = \frac{49}{7}$

$x = 7$

CHECK

$\frac{6}{7x+5} = \frac{1}{9}$

$\frac{6}{7(7)+5} \stackrel{?}{=} \frac{1}{9}$

$\frac{6}{49+5} \stackrel{?}{=} \frac{1}{9}$

$\frac{6}{54} \stackrel{?}{=} \frac{1}{9}$

$\frac{1}{9} \stackrel{\checkmark}{=} \frac{1}{9}$

$$\frac{\frac{1}{5} - x}{7} = \frac{2x+11}{5}$$

$7(2x+11) = 5(\frac{1}{5} - x)$

$14x + 77 = 1 - 5x$

$+5x \quad +5x$

$19x + 77 = 1$

$-77 \quad -77$

$\frac{19x}{19} = \frac{-76}{19}$

$x = -4$

CHECK

$\frac{\frac{1}{5} - x}{7} = \frac{2x+11}{5}$

$\frac{\frac{1}{5} - (-4)}{7} \stackrel{?}{=} \frac{2(-4)+11}{5}$

$\frac{\frac{5}{5} \cdot \frac{21}{5}}{7} \stackrel{?}{=} \frac{3}{5} \cdot \frac{7}{7}$

$\frac{21}{35} \stackrel{\checkmark}{=} \frac{21}{35}$

$$\frac{2x+1}{9} = \frac{1-x}{6}$$

$6(2x+1) = 9(1-x)$

$12x + 6 = 9 - 9x$

$+9x \quad +9x$

$21x + 6 = 9$

$-6 \quad -6$

$\frac{21x}{21} = \frac{3}{21}$

$x = \frac{1}{7}$

CHECK

$\frac{2x+1}{9} = \frac{1-x}{6}$

$\frac{2(\frac{1}{7})+1}{9} \stackrel{?}{=} \frac{1-(\frac{1}{7})}{6}$

$\frac{\frac{2}{7}+1}{9} = \frac{\frac{6}{7}}{6}$

$\frac{\frac{9}{7}}{9} = \frac{\frac{6}{7}}{6}$

$\frac{\frac{18}{7}}{18} \stackrel{\checkmark}{=} \frac{\frac{18}{7}}{18}$

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$$\frac{6+x}{7x+\frac{2}{3}} = \frac{3}{8}$$

$3(7x+\frac{2}{3}) = 8(6+x)$

$21x + 2 = 48 + 8x$

$-8x \quad -8x$

$13x + 2 = 48$

$-2 \quad -2$

$\frac{13x}{13} = \frac{46}{13}$

$x = \frac{46}{13}$

CHECK

$\frac{6+\frac{46}{13}}{7(\frac{46}{13})+\frac{2}{3}} = \frac{3}{8}$

$$\frac{5+2x}{3x-1} = \frac{6}{7}$$

$7(5+2x) = 6(3x-1)$

$35 + 14x = 18x - 6$

$-14x \quad -14x$

$35 = 4x - 6$

$+6 \quad +6$

$\frac{41}{4} = \frac{4x}{4}$

$x = \frac{41}{4}$

$$\frac{8}{3-4x} = \frac{5}{2x+\frac{1}{4}}$$

$5(3-4x) = 8(2x+\frac{1}{4})$

$15 - 20x = 16x + 2$

$+20x \quad +20x$

$15 = 36x + 2$

$-2 \quad -2$

$\frac{13}{36} = \frac{36x}{36}$

$x = \frac{13}{36}$

$$\frac{12}{x+9} = \frac{3}{-2x-\frac{1}{2}}$$

$3(x+9) = 12(-2x-\frac{1}{2})$

$3x + 27 = -24x - 6$

$-27 \quad -27$

$3x = -24x - 33$

$+24x \quad +24x$

$\frac{27x}{27} = \frac{-33}{27}$

$x = -\frac{11}{9}$

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Independent Practice:

$\frac{x+4}{2x-5}=\frac{3}{5}$	$\frac{5x-8}{3}=\frac{11x-9}{5}$
$\frac{7}{x+11}=\frac{-8}{2x+1}$	$\frac{-x-2}{-4}=\frac{3x+6}{2}$

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Activating Prior Knowledge:

We know how to solve proportions

$\frac{7}{12} \times \frac{x}{42}$ 24.5 $12x = 7 \cdot 42$ $\frac{12x}{12} = \frac{294}{12}$ $x = 24.5$	$\frac{x}{10} = \frac{14}{35}$ $x = 4$

Closure:

Is this a linear equation? Why or why not?

NON LINEAR ✓✓✓✓

LINEAR ✓✓

$\frac{x-2}{2} \times \frac{3}{5-3x}$

$(x-2)(5-3x) = 6$

$-3x^2$

Teacher Notes:

Lesson 8 from ENY

HW handout from ENY, choose 6 of 10.