IM 9–12 MATH v.1

Unit 2

Polynomials and Rational Functions

ALGEBRA 2

Lesson 22

Solving Rational Equations

Illustrative Mathematics®

Kendall Hunt

Learning Goal

Let's think about how to solve rational equations strategically.

Algebra 2

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Thoughtful Multiplication

Warm-up: Notice and Wonder

What do you notice? What do you wonder?

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

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

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

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

Rational Solving

Jada is working to find values of x that make this equation true:

$$\frac{5x+5}{x+1} = \frac{5}{x}$$

She says, "If I multiply both sides by $x(x+1)$, I find that the solutions are $x = 1$ and $x = -1$, but when I substitute in $x = -1$, the equation does not make any sense."

1. Is Jada's work correct? Explain or show your reasoning.
2. Why does Jada's method produce an x value that does not solve the equation?

More Rational Solving

1. Here are a lot of equations. For each one, use what you know about division to identify values of x that cannot be solutions to the equation.

   a. $\frac{(x^2+x-6)}{x-2} = 5$

   b. $\frac{2x+1}{x} = \frac{1}{x-2}$

   c. $\frac{10}{x+8} = \frac{5}{x-8}$

   d. $\frac{x^2+x+1}{13} = \frac{2}{x-1}$

   e. $\frac{x+1}{4x} = \frac{x-1}{3x}$

   f. $\frac{1}{x} = \frac{1}{x(x+1)}$

   g. $\frac{x+2}{x} = \frac{3}{x-2}$

   h. $\frac{1}{x-3} = \frac{1}{x(x-3)}$

   i. $\frac{(x+1)(x+2)}{x+1} = \frac{x+2}{x+1}$

2. Without solving, identify three of the equations that you think would be least difficult to solve and three that you think would be most difficult to solve. Be prepared to explain your reasoning.

3. Choose three equations to solve. At least one should be from your "least difficult" list and one should be from your "most difficult" list.

Solving Rational Equations

Lesson Synthesis

How can extra solutions arise in the process of solving an equation?

I know how to check for extraneous solutions to rational equations.

Learning Targets

Algebra 2

Find Rational Solutions

Cool-down

Identify all values of x that make the equation true:

$$\frac{x-3}{x} - \frac{8}{x+3}$$