

LESSON #5: SOLVING RATIONAL EQUATIONS

Do Now: Solve for x.

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

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

$$2x^2 - 4x = x^2 + 2x$$

$$-x^2 - 2x - x^2 - 2x$$

$$x^2 - 6x = 0$$

$$x(x-6) = 0$$

| | |
|-------|-------|
| $x=0$ | $x=6$ |
|-------|-------|

| STEPS | EXAMPLE |
|---|---|
| <p>1. Find the <u>LCD</u> of the equation. (If needed <u>Factor</u> the denominators).</p> | $\frac{x}{x+2} = \frac{3}{x} + \frac{4}{x^2+2x} = x(x+2)$ |
| <p>2. <u>multiply</u> each fraction by the LCD to get rid of the <u>denominators</u></p> | $LCD = x(x+2)$ $x(x+2) \left(\frac{x}{x+2} = \frac{3}{x} + \frac{4}{x(x+2)} \right)$ |
| <p>3. Solve the equation for the variable. (Be careful when there is a subtraction sign that you have to <u>Distribute!</u> (keep, change, change))</p> | $\frac{x^2(x+2)}{(x+2)} = \frac{3(x+2)}{x} + \frac{4(x)(x+2)}{(x)(x+2)}$ $x^2 = 3(x+2) + 4$ $x^2 = 3x + 6 + 4$ $x^2 = 3x + 10$ $-3x - 10$ |
| <p>4. Check for <u>extraneous solutions</u>, a solution or an answer that makes the fraction undefined.</p> | $x^2 - 3x - 10 = 0$ $(x-5)(x+2)$ <p>5 or $-2 \rightarrow$ <u>reject!</u> ↳ make denominator undefined!</p> |

PRACTICE:

LCD = $(x+2)(x-2)$ **DO IT IN YOUR HEAD!**

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

$$1(x-2) + 1(x+2) = 4$$

$$2x = 4$$

$$x = 2 \rightarrow \text{reject}$$

NO REAL SOLUTIONS!

LCD = $(x+16)(x+2)$

$$(x+16)(x+2) \left(\frac{x}{x+2} - \frac{1}{x+16} = \frac{-38}{(x+16)(x+2)} \right)$$

$$x(x+16) - (x+2) = -38$$

$$x^2 + 16x - x - 2 = -38$$

$$x^2 + 15x - 2 = -38$$

$$+38 \quad +38$$

$$x^2 + 15x + 36 = 0$$

$$(x+9)(x+4) = 0$$

| | |
|-----------------|-----------------|
| $-9 \checkmark$ | $-4 \checkmark$ |
|-----------------|-----------------|

$$3) \frac{12}{x-4} + \frac{2x}{4-x} = \frac{10}{x-4}$$

Instead of $(x-4)(4-x)$ try multiplying $4-x$ by -1 ! saves you time!

$$\frac{12}{x-4} + \frac{-2x}{-1(4-x)} = \frac{10}{x-4}$$

$$\begin{array}{r} -4+x \\ \text{or} \\ x-4 \end{array}$$

$$\frac{12}{x-4} + \frac{-2x}{x-4} = \frac{10}{x-4}$$

$$\begin{array}{r} 12 - 2x = 10 \\ -12 \quad -12 \\ \hline \end{array}$$

$$-2x = -2$$

$$\boxed{x=1}$$

If all denom. are the same, cross out!!!

4) Carlos was given this problem from his teacher.

$$\frac{-2}{x-2} = \frac{x-4}{x^2-4}$$

Carlos did the following:

Is Carlos correct? Explain your answer.

$$-2(x^2-4) = (x-2)(x-4) \quad x^2 - 4x - 2x + 8$$

$$-2x^2 + 8 = x^2 - 6x + 8$$

$$+2x^2 \quad +2x^2$$

$$8 = 3x^2 - 6x + 8$$

$$-8 \quad -8$$

$$0 = 3x^2 - 6x$$

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

$$x=0, x=2$$

NO, he is not correct. you have to bring over every thing from one side to other. He did to on the left, he needs to do that on the right.

$$5) \frac{37}{x^2-64} + \frac{x}{x-8} = \frac{-2}{x+8}$$

$$37 + x(x+8) = -2(x-8)$$

$$37 + x^2 + 8x = -2x + 16$$

$$\begin{array}{r} -16 \quad +2x \quad +2x \quad -16 \\ \hline \end{array}$$

$$x^2 + 4x + 21 = 0$$

$$(x+7)(x+3) = 0$$

$$\boxed{-7} \quad \boxed{-3}$$