L3 - Rational Equations & Inequalities

November-26-15
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Equations & Inequalities
Lesson 3: Rational Equations & Inequalities

Solving Rational Equations!

1. Factor ~~each denominator~~ everything. (Simplify if possible)
2. Identify the non-permissible values
3. Multiply both sides of the equation by the lowest common denominator → cancel denominators!
4. Solve by isolating the variable on one side of the equation
5. * Check your answers (n.p.v.'s)

Ex.1: Solve each of the following equations.

a) $\left(\frac{x}{4}-\frac{7}{x}\right)=(3)4x$, $x\neq 0$

LCD = $4x$

$4x\left(\frac{x}{4}-\frac{7}{x}\right)=(3)4x$

$x^2-28=12x$

$x^2-12x-28=0$

$(x-14)(x+2)=0$

$x=14,-2$, $x\neq 0$

b) $\frac{2}{z^2-4}+\frac{10}{6z+12}=\frac{1}{z-2}$

Your Turn Solve. What are the non-permissible values?

$$\frac{3x}{x+2}-\frac{5}{x-3}=\frac{-25}{x^2-x-6}$$

$(x+2)(x-3)\left(\frac{3x}{x+2}-\frac{5}{x-3}=\frac{-25}{(x-3)(x+2)}\right)$

$x\neq -2,3$

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

$3x(x-3)-5(x+2)=-25$

$3x^2-9x-5x-10=-25$

$3x^2-14x+15=0$

$(3x-9)(3x-5)$

$(x-3)(3x-5)=0$

$x=3, 5/3$

reject (extraneous root)

Check:

$x=5/3$

Rational equations will often have applications with rates. These problems will often use the fact that any rate is in general: $RATE = \frac{JOB}{TIME}$

Ex. 3: Two friends share a paper route. Sheena can deliver the papers in 40 min. Jeff can cover the same route in 50 min. How long, to the nearest minute, does the paper route take if they work together?

(Sheena) $R_S = \frac{1}{40}$

(Jeff) $R_J = \frac{1}{50}$

Combined: $R = \frac{1}{40} + \frac{1}{50} = \frac{5}{200} + \frac{4}{200} = \frac{9}{200}$ ← paper routes / ← minutes

$200x\left(\frac{9}{200} = \frac{1}{x}\right) \rightarrow 9x = 200$

$x = \frac{200}{9}$

$x = 22.2$ min.

$x \neq 0$

Ex. 4: A group of friends go on a 3-h bike ride together. They ride 15 km with the wind at their backs, and then 15 km straight into the wind. The wind adds or subtracts 3 km/h from their speed. What is the average speed of the group of friends with no wind?

$S = \frac{D}{T}$

	Distance (km)	Speed	Time
with wind	15	$x+3$	$\frac{15}{x+3}$
against wind	15	$x-3$	$\frac{15}{x-3}$

$= 3 \rightarrow T = \frac{D}{S}$

Let x = average speed w/ no wind

$(x+3)(x-3)\left(\frac{15}{x+3} + \frac{15}{x-3} = 3\right)$ $x \neq -3, 3$

$15(x-3) + 15(x+3) = 3(x+3)(x-3)$

$15x - 45 + 15x + 45 = 3x^2 - 27$

$0 = 3x^2 - 30x - 27$

$0 = x^2 - 10x - 9$

Not Factorable...

$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(-9)}}{2(1)}$

$= \frac{10 \pm \sqrt{136}}{2}$

$= 10.8, -0.831$

Average speed: 10.8 km/h

PRACTICE: Rational Equations Worksheet