

Pre-Calculus II

7.5

I can't wait to do my Math homework...



## Solving Equations with Rational Expressions

Investigation: Find the value of  $x$

a.)  $\left(\frac{x}{3} + \frac{5}{3} = \frac{9}{3}\right) \cdot 3$

$$x + 5 = 9$$

$$x = 4$$

b.)  $\frac{x}{7} + \frac{5}{7} = \frac{9}{7}$

$$x + 5 = 9$$

$$x = 4$$

Method for Solving equations with rational expressions.

1. Change all expressions so they have the same denominator
2. State any restrictions if there's an  $x$  in the denominator. THEN drop the denominator
3. Solve the equation:  
 $\rightarrow$  LHS numerator = RHS numerator  
(left hand side) ↑ (right hand side)

Examples

$$1. \frac{2x}{2} + \frac{3x}{5} - \frac{1x}{2} = \frac{3}{10}$$

LCD: 10

$$\frac{6x}{10} - \frac{5}{10} = \frac{3}{10}$$

1. Rewrite every term over 10

$$6x - 5 = 3$$

2. drop the denominator

$$6x = 8$$

3. solve equation.

$$x = \frac{8}{6} = \boxed{\frac{4}{3}}$$

$$2. \frac{1}{m-2} = \frac{5}{m-4} \quad \text{LCD: } (m-2)(m-4)$$

$$\frac{1}{m-2} \left( \frac{m-4}{m-4} \right) = \frac{5}{m-4} \left( \frac{m-2}{m-2} \right) \quad \textcircled{1} \text{ write each term over LCD}$$

② state NPVs:  $m \neq 4, m \neq 2$

$$\frac{m-4}{(m-2)(m-4)} = \frac{5(m-2)}{(m-2)(m-4)} \quad \textcircled{3} \text{ Drop denominator}$$

$$m-4 = 5m-10 \quad \textcircled{4} \text{ solve for } m.$$

$$-m + 10 = 4m \rightarrow m = \frac{10}{4} = \frac{5}{2}$$

☺ DON'T FORGET RESTRICTIONS when there is a variable in the denominator

$$3. \frac{1}{n} + 3 = \frac{3n}{n+4} \quad \text{LCD: } n(n+4)$$

$$\frac{1}{n} \left( \frac{n+4}{n+4} \right) + 3 \left( \frac{n(n+4)}{n(n+4)} \right) = \frac{3n}{n+4} \left( \frac{n}{n} \right)$$

$$\frac{n+4}{n(n+4)} + \frac{3n(n+4)}{n(n+4)} = \frac{3n^2}{n(n+4)} \quad \text{NPVs: } n \neq 0, n \neq -4$$

$$(n+4) + 3n(n+4) = 3n^2$$

$$n+4 + 3n^2 + 12n = 3n^2$$

$$13n + 4 = 0$$

$$13n = -4$$

$$n = \frac{-4}{13}$$

$$4. \frac{2}{x+2} + \frac{8}{x^2-4} = 1$$

① Factor denominator to find LCD

$$\frac{2}{x+2} + \frac{8}{(x+2)(x-2)} = 1 \quad \text{LCD: } (x+2)(x-2)$$

$$\frac{2}{x+2} \left( \frac{x-2}{x-2} \right) + \frac{8}{(x+2)(x-2)} = 1 \left( \frac{x-2}{x-2} \right) \left( \frac{x+2}{x+2} \right)$$

$$\frac{2(x-2)}{(x+2)(x-2)} + \frac{8}{(x+2)(x-2)} = \frac{(x+2)(x-2)}{(x+2)(x-2)} \quad \text{NPs: } x \neq -2, x \neq 2$$

$$2(x-2) + 8 = (x+2)(x-2) \quad \text{② drop denominator and solve}$$

$$2x - 4 + 8 = x^2 - 2x + 2x - 4$$

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

↑ make life easier  
by keeping "x<sup>2</sup>" positive

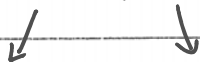
\* NOTICE WE HAVE AN  
x<sup>2</sup> and x  
- move everything to one  
side, set = 0, factor

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

$$-2x - 4 \quad -2x - 4$$

$$0 = x^2 - 2x - 8$$

$$0 = (x-4)(x+2)$$



$$x-4=0$$

$$x=4$$

$$x+2=0$$

$$x=-2$$

non-permissible value  
↳ reject!!

solution is  $x=4$