

**Essential Question:** How do we solve equations with rational expressions?

**Do Now:** Solve the following equations.

$$(a) \quad 33 = \frac{8}{s} + 9$$

$$(b) \quad \frac{x}{x+4} = 2$$

## RATIONAL EXPRESSIONS

&

## RATIONAL EQUATIONS

**an expression that is the ratio of two polynomials**

$$\frac{3x}{2} \qquad \frac{x+5}{x-2}$$

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

**an equation with one or more rational expressions**

$$3x + \frac{x}{3} = 5$$

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

$$\frac{7}{x} + \frac{3}{4} = \frac{5}{x}$$

When solving rational equations, identify any values for the variable which make the denominator zero. These values are considered the **restrictions**.

What are the restrictions for the equations in today's Do Now?

$$33 = \frac{8}{s} + 9 \quad s \neq \underline{\hspace{2cm}}$$

$$\frac{x}{x+4} = 2 \quad x \neq \underline{\hspace{2cm}}$$

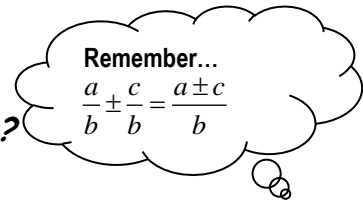
Determine whether the given value of  $x$  is a restricted value for the rational equation. Explain how you know.

$$a) \quad \frac{3x}{x+6} = 2; \quad x = 6$$

$$b) \quad \frac{x+4}{x-4} = -3; \quad x = 4$$

# SOLVING RATIONAL EQUATIONS

How do we solve an equation containing rational expressions?



(a) Consider the following equation...

$$\frac{5x}{4} + \frac{x}{4} = 12$$

- Is the equation a proportion?
- How would you solve this equation?



(b) Let's try another example.

$$\frac{2x}{5} + 1 = \frac{13}{5}$$

- Is the equation a proportion?
- How would you solve this equation?

(c) What about this equation?

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

- Is the equation a proportion?
- How would you solve this equation?

**In order to add and subtract fractions, the denominators must BE THE SAME!**

**If denominators are not the same,**

- you must find the **LCD**
- write an **equivalent fraction** with the LCD  
(multiply by a "*form of one*" - **FOO**)
- **add/subtract** rational expressions to create a proportion
- **cross multiply**
- **solve** the equation
- **CHECK** your answer!

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

Let's try solving a few more rational equations. Check your solution!

$$1) \frac{3x}{4} - \frac{x}{4} = -5$$

$$2) \frac{x}{6} - \frac{2}{3} = \frac{5}{6}$$

$$3) \frac{x+3}{5} - \frac{3x}{10} = 7$$

$$4) \frac{3x}{7} + 1 = \frac{2}{5}$$

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

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

### *The* **TAKEAWAY**

To solve rational equations, combine fractions and create a proportion. Combining fractions requires a common denominator. In order to create fractions with a common denominator, multiply each fraction by a FOO (\_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_). When a fraction is multiplied by a FOO, an equivalent fraction is created.