TOPIC: SIMPLIFYING RATIONAL EXPRESSIONS

Intro to Rational Expressions

New $\frac{P}{Q}$

◆ A **rational expression** has a _____ in the numerator (P) & denominator (Q):

► Recall: The denominator of a fraction *cannot* be _____.

Recall **Rational Number**	New **Rational Expression**
Quotient of two **[INTEGERS | POLYNOMIALS]** $\frac{11}{35}$ $\neq 0$	Quotient of two **[INTEGERS | POLYNOMIALS]** $\frac{4x}{x-2}$ $\neq 0$; x cannot be ___

◆ To find where *any* rational expression is _____, set the denominator equal to zero and solve for x.

EXAMPLE For the expression $\frac{x-1}{2x-6}$, answer the following.

($\boldsymbol{A}$) Find the x-value(s) for which it is undefined.

($\boldsymbol{B}$) Evaluate at $x = 2$.

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PRACTICE For which value(s) of x is the rational expression undefined?

(A)

$$\frac{5}{x}$$

(B)

$$\frac{7}{x-3}$$

(C)

$$\frac{x+1}{x^2-9}$$

PRACTICE Evaluate the rational expression for the given value of x.

(A)

$$\frac{12}{x+3}, \quad x=-1$$

(B)

$$\frac{x^2-4}{x^2-x-6}, \quad x=2$$

(C)

$$\frac{3x}{x^2+x-6}, \quad x=-2$$

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Simplifying Rational Expressions

◆ To simplify a rational expression, _____ numerator & denominator completely and _____ common factors.

Recall: Simplify Rational #s	New: Simplify Rational Expressions
$\frac{28}{35}$	$\frac{28x^3}{35x^5}$
Factor completely: $\frac{7 \cdot 4}{7 \cdot 5}$	**Factor completely:**
Cancel common factors: $\frac{\cancel{7} \cdot 4}{\cancel{7} \cdot 5}$	**Cancel common factors:**
Simplified answer: $\frac{4}{5}$	**Simplified answer:**

EXAMPLE Simplify the following expressions.

(*A*) $\frac{(x+2)(x-2)}{(x+6)(x+2)}$

(*B*) $\frac{x-5}{3x^2-15x}$

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PRACTICE Simplify the rational expression by factoring.

(***A***)

$$\frac{6x}{12x}$$

(***B***)

$$\frac{x^2 - 9}{x^2 - 3x}$$

(***C***)

$$\frac{x^2 - 4x}{x^2 - 2x - 8x}$$

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EXAMPLE Write three equivalent expressions of the rational expression below:

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

EXAMPLE Which of the following rational expressions is equal to –5?

$(\boldsymbol{A})$ $\dfrac{\boldsymbol{10x}}{\boldsymbol{2x}}$

$(\boldsymbol{B})$ $\dfrac{\boldsymbol{25 - 5x}}{\boldsymbol{x}}$

$(\boldsymbol{C})$ $-\dfrac{\boldsymbol{15x}}{\boldsymbol{3(-x)}}$

$(\boldsymbol{D})$ $\dfrac{\boldsymbol{20 - 5x}}{\boldsymbol{(x - 4)}}$

PRACTICE Simplify the rational expression below:

$$\frac{x^2 + 5x + 6}{x^2 + 7x + 10}$$

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Simplifying Rational Expressions with Opposite Factors

◆ Recall: If you divide a *number* by its opposite, you will get –1 (ex. $\frac{7}{-7} = -1$ or $\frac{-9}{9} = -1$).

► If you divide an *expression* by its opposite (**ALL** _____ have opposite signs), you will also get –1.

EXAMPLE Write each rational expression in lowest terms.

(A) $\frac{x+4}{-x-4} = \frac{x+4}{-1(\quad)} =$

(B) $\frac{10-x}{x-10}$

(C) $\frac{(x+3)(3-x)}{x-3}$

◆ Note: The factors $a+b$ & $a-b$ are *conjugates*, NOT opposites.

PRACTICE Simplify each expression.

(A) $\frac{x-7}{7-x}$

(B) $\frac{x^2-16}{16-x^2}$

(C) $\frac{x^2-10x+24}{(4-x)(6-x)}$