TOPIC: SIMPLIFYING RATIONAL EXPRESSIONS

Intro to Rational Expressions and Functions

New $\frac{P}{Q}$

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

► A **rational function** is defined by a rational expression.

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

◆ Since the denominator of the rational function ≠ 0, the domain excludes any x-value that makes the denom 0.

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

(A) Find the domain. *Hint: Set the denom = 0 & solve for x.*

Set builder: { | x is a real number, _____ }

Interval: _____

(B) Evaluate at $x = 2$.

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PRACTICE Determine the domain of the function below. Write in interval notation.

(A)

$$f(x) = \frac{5}{x}$$

(B)

$$f(x) = \frac{7}{x-3}$$

(C)

$$f(x) = \frac{x+1}{x^2-9}$$

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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PRACTICE Determine the domain of the function $h(x)$.

$$h(x) = \frac{x^2 - 2x - 8}{x^2 - 5x + 4}$$

PRACTICE Given the function below, evaluate $f(2)$.

$$f(x) = \frac{3}{11 - x}$$

PRACTICE Given the function below, evaluate $f(2)$.

$$f(x) = \frac{3x + 4}{x^2 + 7x + 20}$$

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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) $\dfrac{(x+2)(x-2)}{(x+6)(x+2)}$

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

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PRACTICE Simplify the rational expression by factoring.

$(\boldsymbol{A})$

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

$(\boldsymbol{B})$

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

$(\boldsymbol{C})$

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

PRACTICE Simplify each expression.

$(\boldsymbol{A})$

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

$(\boldsymbol{B})$

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

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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?

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

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

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

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

PRACTICE Simplify the rational expression below:

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