

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] $\frac{11}{35}$ ≠ 0		Quotient of two [INTEGERS POLYNOMIALS] $\frac{4x}{x-2}$ ≠ 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.

(A) Find the x -value(s) for which it is undefined.

(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)

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

EXAMPLE

Write three equivalent expressions of the rational expression below:

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

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EXAMPLE

Which of the following rational expressions is equal to -5 ?

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

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

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

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

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.

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

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

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

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

PRACTICE

Simplify each expression.

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

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

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