

A4: Rational Expressions

Domain: Set of real numbers in which an expression is defined (all of the numbers that DO NOT create something that does not exist). 'numbers' that do not exist include the square (or even root) of a negative number, a fraction with a denominator of 0, etc.

Find the domain of each.

a.) $2x^2 + 3x + 4$

b.) $\sqrt{x - 2}$

c.) $\frac{x+2}{x-3}$

** For a rational expression, numbers that would not be included in the domain would be those that make the denominator equal to zero. To find these numbers, we can set the denominator = to zero, and solve. **

Simplifying Rational Expressions

- 1.) Factor the numerator and denominator, if possible
- 2.) Cancel out common factors that are found in EVERY piece of both the numerator and denominator
 - The domain of a rational expression is found BEFORE simplifying (this domain remains when the rational expression is simplified because although the rational expression is simplified, both versions are equivalent)

Simplify each and state the domain.

d.) $\frac{x^2 4x - 12}{3x - 6}$

e.) $\frac{12 + x - x^2}{2x^2 - 9x + 4}$

Multiplying Rational Expressions

- 1.) Factor the numerator and denominator of both fractions
- 2.) "set up" to multiply (optional)
- 3.) Cancel out like terms
- 4.) Multiply straight across $\rightarrow$ numerator $\times$ numerator & denominator $\times$ denominator
- 5.) Simplify

Find each product and state the domain.

f.) $\frac{2x^2 + x - 6}{x^2 + 4x - 5} \cdot \frac{x^3 - 3x^2 + 2x}{4x^2 - 6x}$

Dividing Rational Expressions

- 1.) Keep the 1st fraction the same, change the $\div$ to $\times$, and flip the 2nd fraction
- 2.) Factor the numerator and the denominator of both fractions, if possible
- 3.) "set up" to multiply, if possible
- 4.) Multiply straight across $\rightarrow$ numerator $\times$ numerator & denominator $\times$ denominator
- 5.) Simplify

Find each quotient and state the domain.

$$g.) \frac{x^3-8}{x^2-4} \div \frac{x^2+2x+4}{x^3+8}$$

Adding and Subtracting Rational Expressions

We need to have the same denominators to add or subtract rational expressions, just like we need for basic fractions

1.) factor the denominators of each rational expression

2.) Find the LCD (least common denominator) by combining all of the different parts of the factored (or non factored) denominators in the given equation/expression

3.) What did you multiply each denominator by to get the new LCD? multiply each numerator by the same

4.) add/subtract the numerators, and the denominator stays the same

5.) Simplify

Perform the operations and simplify.

$$h.) \frac{x}{x-3} - \frac{2}{3x+4}$$

$$i.) \frac{3}{x-1} - \frac{2}{x} + \frac{x+3}{x^2-1}$$

Simplifying a Complex Fraction

$$j.) \frac{\left(\frac{2}{x} - 3\right)}{\left(1 - \frac{1}{x-1}\right)}$$