

Rational Expressions: Simplifying, Multiplying, and Dividing

A **rational expression** is a _____ divided by a _____.

ex: $\frac{50x}{10-x}$ $\frac{3x+1}{x^2-3x+2}$ $\frac{x^2+3xy-10y^2}{3x^2-7xy+2y^2}$

Note: Rational expressions are undefined when the denominator is equal to 0.

Ex 1.

Find any values of the variable for which each rational expression is undefined.

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

$$\frac{9x^2}{x^2-5x+6}$$

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

Simplifying Rational Expressions

Note: Just like any fraction, a rational expression is in **lowest terms** if the GCF of the numerator and denominator is 1 (that is, if there aren't any common factors on top and bottom).

Ex 2.

Write the following rational expression in lowest terms.

$$\frac{3x-12}{5x-20}$$

Ex 3.

Write the following rational expression in lowest terms.

$$\frac{x^2+2x-8}{2x^2-x-6}$$

Ex 4.

Write the following rational expression in lowest terms.

$$\frac{x-y}{y-x}$$

Ex 5.

Write the following rational expression in lowest terms.

$$\frac{4x^2-9}{6-4x}$$

Multiplying and Dividing Rational Expressions

Rational expressions work just like regular fractions when it comes to multiplication and division.

Ex 6.

Multiply. Write your answer in lowest terms.

$$\frac{x+y}{2x} \cdot \frac{x^2}{(x+y)^2}$$

Ex 7.

Multiply. Write your answer in lowest terms.

$$\frac{x^2+3x}{x^2-3x-4} \cdot \frac{x^2-5x+4}{x^2+2x-3}$$

Ex 8.

Divide. Write your answer in lowest terms.

$$\frac{x^2-4}{x^2-x-6} \div \frac{x^2+5x+6}{-2x}$$

Practice

1. Find any values of the variable for which the following rational expression is undefined.

$$\frac{3x}{x^2+6x+8}$$

2. Write the following rational expressions in lowest terms.

a) $\frac{x^2-y^2}{x^2+2xy+y^2}$

b) $\frac{2x^3+7x^2-30x}{2x^3-11x^2+15x}$

c) $\frac{ac-bc-ad+bd}{ac-ad-bd+bc}$

d) $\frac{x^2-1}{1-x}$

3. Multiply. Write the answer in lowest terms.

$$\frac{x^2-x-6}{x^2-2x-8} \cdot \frac{x^2+7x+12}{x^2-9}$$

4. Divide. Write the answer in lowest terms.

$$\frac{x^2-3x+2}{x^2+4x+3} \div \frac{x-1}{x+1}$$

Q: There is a word in the English language in which the first two letters signify a male, the first three letters signify a female, the first four signify a great man, and the whole word, a great woman. What is the word?