

Chapter 6 section 1  
Rational Expressions and Functions: Multiplying and Dividing

Polynomial: single term or sum of two or more terms containing variables with whole-number exponents.

$$3x, 4x + 3y, 3x^2 - 5y^3$$

Rational Expression: polynomial divided by a nonzero polynomial.

$$\frac{120x}{100-x} \quad \frac{2x+7}{1-x^2}$$

Rational Function: Function defined by a formula that is a rational expression.

$$f(x) = \frac{2}{x+4}$$

Domain of a rational function: Set of all real numbers except those that made the denominator zero.

$$f(x) = \frac{2}{x+4}$$

If  $x = -4$ , the fraction is not defined so the value  $x = -4$  is excluded from the domain.

Domain of  $f = (-\infty, -4) \cup (-4, \infty)$

1) Find the domain:  $f(x) = \frac{2x-3}{(x+4)(x-1)}$

Simplifying rational expression (reduce fractions)

### Simplifying Rational Expressions

1. Factor the numerator and the denominator completely.
2. Divide both the numerator and the denominator by any common factors.

Simplify:

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

Solution:

Factor the numerator and denominator

$$\frac{(x+1)(x+3)}{1(x+1)}$$

Reduce

$$\frac{\cancel{(x+1)}(x+3)}{1\cancel{(x+1)}}$$

$$x + 3 \text{ and } x \neq -1$$

Try these

$$2) \frac{4x+20}{x^2+5x}$$

$$3) \frac{x^2+3xy-10y^2}{3x^2-7xy+2y^2}$$

Explain why the following are incorrect:

$$4) \frac{1}{\frac{x^2-4}{4}}$$

$$1$$

$$x^2 - 1$$

$$5) \frac{x}{\frac{x^2-9}{x-3}}$$

$$1 \quad 1$$

$$x - 3$$

Multiplying and Dividing Rational Expressions

Rewrite all division problems as multiplication then multiply.

Division: Take the reciprocal of the divisor and multiply

Note: the divisor is the second expression in a division problem

Dividend  $\div$  divisor = quotient

$$\frac{x}{7} \div \frac{6}{y}$$

$$\frac{x}{7} \cdot \frac{y}{6}$$

Change to multiplication:

$$6) \frac{7}{x-5} \div \frac{28}{3y-15}$$

7)

$$\frac{y^2+y}{y^2-4} \div \frac{y^2-1}{y^2+5y+6}$$

Multiply Rational Expression.

- Factor the numerators and denominators completely
- Divide the numerators and denominators by the common factor
- Multiply the remaining factors in the numerator and denominator

Example

$$\frac{x+3}{x-4} \cdot \frac{x^2-2x-8}{x^2-9}$$

$$\frac{1(x+3)}{1(x-4)} \cdot \frac{(x-4)(x+2)}{(x+3)(x-3)}$$

$$\frac{1\cancel{(x+3)}}{1\cancel{(x-4)}} \cdot \frac{\cancel{(x-4)}(x+2)}{\cancel{(x+3)}(x-3)}$$

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

Try These:

•

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

•

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