

# PC11 Lesson 6.1

Saturday, February 4, 2017 4:45 PM



## Ch.6 Notes

## 6.1 Rational Expressions

Warm Up

Factor fully.

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

b)  $x^2 - x - 12$

c)  $2x^2 - 8x - 10$

$$= (x-3)(x-1) \quad = (x+3)(x-4) \quad = 2(x+1)(x-5)$$

Any algebraic expression that can be written as the quotient of two polynomials is called a **rational expression**. *(a fraction)*

A rational expression cannot contain roots of variables, or variables as exponents.

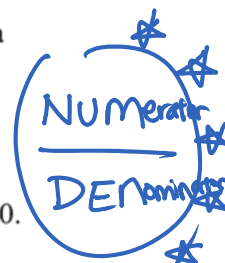
*↳  $\sqrt{x}$*

*$2^x$*

Rational expressions are not defined for values of the variable that make the denominator 0.

These values are called **non-permissible values**. *(NPV)*

*you can't divide by zero*



**Example 1:** Determine the non-permissible values for each rational expression.

a.  $\frac{3mn}{2m}$

$$\frac{2m}{2} \neq \frac{0}{2}$$

$$m \neq 0$$

b.  $\frac{a^2 - 5a}{a - 3}$

$$a - 3 \neq 0$$

$$a \neq 3$$

*\* Find NPV before simplifying \**

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

$$x^2+1 \neq 0$$

$$x^2 \neq -1$$

$$x \neq \pm\sqrt{-1}$$

cannot  $\sqrt{-1}$   
No NPV

d.  $\frac{5x}{x^2-3x-4}$

$$x^2-3x-4 \neq 0$$

$$(x+1)(x-4) \neq 0$$

$$x \neq -1 \quad x \neq 4$$

**Equivalent Rational Expressions**

To write an equivalent form of a rational expression, multiply or divide the numerator and denominator by the same monomial or binomial. When stating that rational expressions are equivalent, the values of the variable for which the expressions are undefined must be identified.

(like finding equivalent fractions.)

**Example 2:** Use multiplication and division to write two equivalent forms of the rational expression

NPV  
 $2(x-1) \neq 0$

$x-1 \neq 0$

$x \neq 1$

$$\frac{(x+5)(x-1)}{2(x-1)} \times 5$$

$$= \frac{5(x+5)(x-1)}{10(x-1)}$$

$$\frac{(x+5)(x-1)}{2(x-1)} \div (x-1)$$

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

if you multiply by  $(x-1)$  or another variable  
NPV changes \*

**Simplifying Rational Expressions**

A rational expression can be reduced to lower terms by dividing the numerator and denominator by a common factor.

→ It is imperative that we **factor first** if possible!

A rational expression is in simplest form (or lowest terms) when the numerator and denominator have no common factors other than 1.

It is important to remember the rules of cancelling out fractions:

Does  $\frac{2x-3}{2x} = -3$  ?

What about  $\frac{10-8}{2}$ , does it equal  $5-8=-3$ ?

No. Cannot cancel 2x

To cancel, make sure terms are  
being multiplied.

**Remember:**

- Factor first.
- state restrictions
- cancel terms (only ones being multiplied together)

**Example 3:** Write each rational expression in simplest form.

a.  $\frac{-21y}{35x} \div 7$

NPV  
 $x \neq 0$

$$= \frac{-3y}{5x}$$

b.  $\frac{3x^2 + 4x}{7x}$

NPV  
 $x \neq 0$

$$= \frac{\cancel{x}(3x+4)}{\cancel{7x}}$$

$$= \frac{3x+4}{7}$$

c.  $\frac{x^2 - 5x - 6}{x^2 - 36}$

factor 1st

NPV  
 $x^2 - 36 \neq 0$   
 $x^2 \neq 36$   
 $x \neq \pm 6$

$$= \frac{(\cancel{x-6})(x+1)}{(x+6)(\cancel{x-6})}$$

$$= \frac{x+1}{x+6}$$

d.  $\frac{25 - x^2}{2x^2 - 9x - 5}$

$$= \frac{(5-x)(5+x)}{(2x+1)(x-5)}$$

$$= \frac{(-1)(\cancel{x-5})(5+x)}{(2x+1)(\cancel{x-5})}$$

$$= \frac{(-1)(5+x)}{(2x+1)}$$

$$= \frac{-5-x}{2x+1}$$

NPV  
 $2x^2 - 9x - 5 \neq 0$   
 $(2x+1)(x-5) \neq 0$   
 $2x+1 \neq 0 \quad x \neq 5$   
 $x \neq -\frac{1}{2}$