

Rational Expressions

• A rational expression is a quotient of polynomials.

• Examples:
$$\frac{x-3}{5x+1}$$
, $\frac{3x^2+6x+7}{2x-6}$, $\frac{3q}{4q^4-4q-12}$

• Values that make the denominator zero are *excluded values* and the rational expressions are considered to be <u>undefined</u> at those values.

Simplifying Rational Expressions

- A rational expression is in simplest form when the numerator and denominator have no common factors except for 1.
- To simplify a rational expression, factor the numerator and denominator and *divide out* any common factors.
- Find *excluded* values using original expression or when original denominator is in factored form.

• Example:
$$\frac{2x+2}{5x+5} = \frac{2(x+1)}{5(x+1)} = \frac{2}{5}$$
; The excluded value is $x = -1$

Finding Excluded Values

Example:
$$\frac{2ab(a-2)(b+3)}{3ab(a^2-4)}$$

Completely factor the original denominator.

$$3ab(a^2 - 4)$$

= $3ab(a + 2)(a - 2)$

The excluded values are a = 0, 2, and - 2 and b = 0.

Simplify each rational expression, if possible. State the excluded value(s).

a.
$$\frac{10}{2x^2} = \frac{2 \cdot 5}{2 \cdot x \cdot x} = \frac{2 \cdot 5}{2 \cdot x \cdot x}$$
$$= \frac{5}{2 \cdot x \cdot x}$$
The excluded value i

$$\overline{x^2}$$
 The excluded value is $x = 0$.

b. $\frac{n}{2n+8}$

The expression is already in simplest form. The excluded value is n = -4.

Λ

$$\mathbf{c} \cdot \frac{4y^2}{8y(y-2)} = \frac{2 \cdot 2 \cdot y \cdot y}{2 \cdot 2 \cdot 2 \cdot y(y-2)}$$
$$= \frac{y}{2(y-2)}$$
The excluded values are $y = 0$ and $y = 2$.

Simplify each rational expression, if possible. State the excluded value(s).

d.
$$\frac{1-y^2}{y-1} = \frac{(1-y)(1+y)}{y-1}$$

Difference of Two Squares Pattern

$$=\frac{-1(y-1)(1+y)}{y-1}$$

 $=\frac{-1(y-1)(1+y)}{(1+y)}$

Rewrite 1 - y as -(y - 1)

= -y - 1

Simplify.

The excluded value is y = 1.

Simplify the rational expression, if possible. State the excluded value(s).

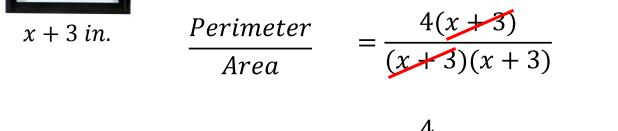
On Your Own

1. $\frac{2b+8}{7b+28}$	2. $\frac{2a-6}{4a^2-12a}$	3. $\frac{z^2 - 6z - 16}{8 - z}$
$\frac{2}{7}; b = -4$	$\frac{1}{2a}; a = 0, a = 3$	-z - 2; z = 8

Real Life Application



The side length of the square clock is represented by the expression x + 3 *in*. Write and simplify a rational expression for the ratio of the perimeter to the area.



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