

12.4 Simplify Rational Expressions

TEKS A.4.A

Before

You simplified polynomials.

Now

You will simplify rational expressions.

Why

So you can model a cost over time, as in Example 5.



Key Vocabulary

- **rational expression**
- **excluded value**
- **simplest form of a rational expression**

A **rational expression** is an expression that can be written as a ratio of two polynomials where the denominator is not 0. A rational expression is undefined when the denominator is 0. A number that makes a rational expression undefined is called an **excluded value**. For example, $\frac{2}{x-3}$ is undefined when $x = 3$. So, 3 is an excluded value.

EXAMPLE 1 Find excluded values

Find the excluded values, if any, of the expression.

a. $\frac{x+8}{10x}$

b. $\frac{5}{2y+14}$

c. $\frac{4v}{v^2-9}$

d. $\frac{7w+2}{8w^2+w+5}$

Solution

a. The expression $\frac{x+8}{10x}$ is undefined when $10x = 0$, or $x = 0$.

▶ The excluded value is 0.

b. The expression $\frac{5}{2y+14}$ is undefined when $2y+14 = 0$, or $x = -7$.

▶ The excluded value is -7 .

c. The expression $\frac{4v}{v^2-9}$ is undefined when $v^2-9 = 0$, or $(v+3)(v-3) = 0$. The solutions of the equation are -3 and 3 .

▶ The excluded values are -3 and 3 .

d. The expression $\frac{7w+2}{8w^2+w+5}$ is undefined when $8w^2+w+5 = 0$.

▶ The discriminant is $b^2 - 4ac = 1^2 - 4(8)(5) < 0$. So, the quadratic equation has no real roots.

▶ There are no excluded values.

REVIEW DISCRIMINANT

For help with finding the discriminant of a quadratic equation, see p. 678.



GUIDED PRACTICE for Example 1

Find the excluded values, if any, of the expression.

1. $\frac{x+2}{3x-5}$

2. $\frac{2}{5y^2+2y+3}$

3. $\frac{n-6}{2n^2-5n-12}$

4. $\frac{2m}{m^2-4}$