

Unit 4

Unit 4.1 Notes: Simplifying Rational Expressions

Objective: To simplify rational expressions and state excluded values in the domain

<p>Which one is correctly simplified?</p> $\frac{\cancel{2}+2+5}{\cancel{2}}=7$ <p>A</p> $\frac{\cancel{2} \cdot 2 \cdot 5}{\cancel{2}}=10$ <p>B</p>	<p>B is correct because multiplication and division cancel each other out</p> <p>A would need subtraction to cancel the 2</p>
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A Rational Expression is: "Algebra fraction"

* The answer will not exist when the denominator is 0

Ex: $\frac{x+2}{x-5} \quad x=5 \quad = \frac{(5)+2}{(5)-5}$
 $= \frac{7}{0}$ **DNE**

Does not exist

Up to this point with a domain (all possible x's) of all real numbers. Rational functions are the first time we will deal with a domain other than this.

1. For the example above, is there any value of x that we could plug in to make it so the equation not exist? Why or why not?

$x \neq 5$ since plugging in 5 would make the bottom equal 0 & you can't divide a number by 0

As with all other expressions we have dealt with, you will be required to simply rational expressions.

The big idea to simplifying rational expressions is to: Factor & Cancel

- 1) Factor top & bottom
- 2) Look at domain
- 3) Cancel factors

2. Example: Simplify the following rational expressions. State any values that are not included in the domain.

a) $\frac{x-1}{5x-5} = \frac{x-1}{5(x-1)}$
 $\frac{\cancel{x-1}}{5(\cancel{x-1})} = \frac{1}{5}$
 x-1 is on top and bottom, so we cancel it
 $x \neq 1$

b) $\frac{21a^2}{7a^3} = \frac{3a^2}{a^3} = \frac{3}{a}$
 $a \neq 0$

c) $\frac{2n-3}{6n-9} = \frac{2n-3}{3(2n-3)} = \frac{1}{3}$
 $n = \frac{3}{2}$
 $n \neq \frac{3}{2}$

d) $\frac{3x^2-9x}{x-3} = \frac{3x(x-3)}{x-3}$
 $\frac{3x \cdot \cancel{x-3}}{\cancel{x-3}} = 3x$
 $x \neq 3$

e) $\frac{3x-6}{x^2+x-6} = \frac{3(x-2)}{(x-2)(x+3)}$
 $\frac{3 \cdot \cancel{x-2}}{\cancel{x-2}(x+3)} = \frac{3}{x+3}$
 $x=2 \quad x=-3$
 $x \neq 2, -3$

f) $\frac{x-3}{3-x}$
 * Put in standard form before factoring
 $\frac{x-3}{-x+3} = \frac{x-3}{-(x-3)} = -1$
 $x=3$
 $x \neq 3$

g) $\frac{4-x^2}{7x-14}$

h) $\frac{y^2-16}{4-y}$

i) $\frac{4-w}{w^2-8w+16}$

*** Use this process for word problems ***

There are 4 major things to consider when trying to tackle a word problem.

1) What is the problem asking?	2) What information is given?	3) What do I already know that I can use? <i>* formulas, processes, etc.</i>	4) Does my answer make sense? <i>ex: shouldn't have a negative answer for length</i>
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3. Example: You are choosing between two wastebaskets. One is cylindrical with a height of $(2a + 8)$ and a radius of a . The other one is a rectangular prism with a square base area of $4a^2$ and a height of h . If both wastebaskets have the same volume, what is the height of the rectangular wastebasket? Give your height in terms of h .

③ Rectangular: $V = l \cdot w \cdot h$
 $l \cdot w = 4a^2$

Cylindrical: $V = \pi r^2 h$
 $h = 2a + 8$
 $r = a$

Plug in info

$l \cdot w \cdot h = \pi r^2 h$
 $4a^2 h = \pi a^2 (2a + 8)$

The question wants us to solve for h , get h by itself

$h = \frac{\pi a^2 (2a + 8)}{4a^2}$
 $= \frac{\pi (2a + 8)}{4} = \frac{2a\pi + 8\pi}{4}$

$h = \frac{a\pi + 4\pi}{2}$

4. A square has side length $6x + 2$. A rectangle with width $3x + 1$ has the same area as the square. What is the length of the rectangle?

5. The length of a rectangular prism is 5 more than twice the width. The volume is $2w^3 + 7w^2 + 5w$. What is a simplified expression for the height of the prism?

③ $V = l \cdot w \cdot h$
 $V = 2w^3 + 7w^2 + 5w$

$l = 2w + 5$

↑
5 more (+) than twice width (x2)

$\frac{2w^3 + 7w^2 + 5w}{(2w + 5)w} = \frac{(2w + 5)wh}{(2w + 5)w}$

Get h by itself

$\frac{2w^3 + 7w^2 + 5w}{(2w + 5)w} = h$

$\frac{10w^2}{5 \cdot 2} \cdot \frac{w(2w^2 + 7w + 5)}{(2w + 5)w} = \frac{w(2w + 5)(w + 1)}{(2w + 5)w}$

$\frac{2w^2 + 2w^2 + 5w + 5}{2w(w + 1) + 5(w + 1)} = \frac{2w^2 + 2w^2 + 5w + 5}{(2w + 5)(w + 1)}$

$h = w + 1$