

Name: \_\_\_\_\_  
 Class/Block: \_\_\_\_\_ Date: \_\_\_\_\_

<http://maine.edc.org/file.php/1/tools/ExpRuleDivisionCoef.html>

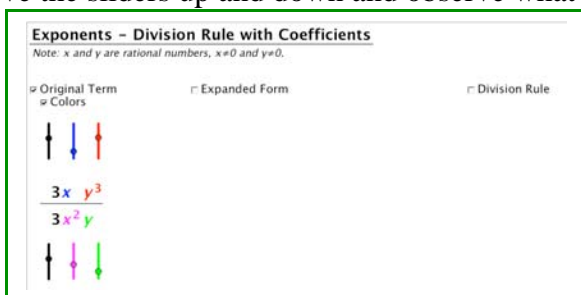
## Exploration: Division Rules of Exponents

### Introduction

In this exploration you will use the *Exponents - Division Rule with Coefficients* applet to explore division properties of exponents.

**Step 1:** Launch the *Exponents - Division Rule with Coefficients* applet

- Check the **Colors** checkbox to make each part of the term a different color.
- Move the sliders up and down and observe what happens to the coefficients and terms.



**Step 2:** Move the sliders to *set up the problem provided*.

$$\frac{x^5}{x^4}$$

- Move the **black** sliders until the numbers at the front of the terms (the coefficients) disappear
- Move the **red** and **green** sliders until the **y** variables disappear
- Move the **blue** slider until the exponent associated with **x** in the numerator is equal to **5**
- Move the **pink** slider until the exponent associated with **x** in the denominator is equal to **4**

**Step 3:** Check the *Expanded Form* checkbox to see the term expanded out.

- Notice how many times the term in the numerator and denominator is repeated.
- How does the number of times repeated relate to the exponent?

$$\frac{x^5}{x^4} = \frac{x \cdot x \cdot x \cdot x \cdot x}{x \cdot x \cdot x \cdot x}$$

**Step 4:** Check the *Shade Pairs of 1* checkbox

Notice how the factors of x can be divided out of the numerator and denominator

☒ Shade Pairs of 1

$$\frac{x \cdot x \cdot x \cdot x \cdot x}{x \cdot x \cdot x \cdot x} = x$$

**Step 5:** Check the *Division Rule* checkbox.

☒ Division Rule

$$\frac{5-4}{x}$$

**Step 6:** Fill in the table for example provided.

**Example:**

Original Expression	Expanded Form	Division Rule with Solution
$\frac{x^5}{x^4}$	$\frac{x \cdot x \cdot x \cdot x \cdot x}{x \cdot x \cdot x \cdot x} = x$	$x^{5-4} = x$

Name: \_\_\_\_\_

Class/Block: \_\_\_\_\_ Date: \_\_\_\_\_

**Directions:** Set up each problem in the applet. Fill in the table. Answer the associated questions.

**Problem 1.**

Original Expression	Expanded Form	Division Rule with Solution
$\frac{x^4}{x^3}$	_____ =	

**1a.** In the **Expanded Form**, how does the number of times the x is repeated relate to the exponent?

**1b.** What operation do you use on the exponents to get the final solution?

**1c.** In the example above, the exponent for **x** in the **numerator** is 4 and the **denominator** is 3.  
What is the sign on the solution? (positive or negative)

**Problem 2.**

Original Expression	Expanded Form	Division Rule with Solution
$\frac{x^3}{x^5}$	_____ =	

**2a.** In the example above, the exponent for **x** in the **numerator** is 3 and the **denominator** is 5.  
What is the sign on the solution? (positive or negative)

**Problem 3.**

Original Expression	Expanded Form	Division Rule with Solution
$\frac{x^5y^3}{x^4y}$	_____ =	

**3a.** When you have two different bases in the expression, how do you find the solution?

**3b.** In the example above, what is the sign of the **exponent for x** in the solution?

**3c.** In the example above, what is the sign of the **exponent for y** in the solution?

Name: \_\_\_\_\_

Class/Block: \_\_\_\_\_ Date: \_\_\_\_\_

**Problem 4.**

Original Expression	Expanded Form	Division Rule with Solution
$\frac{x^2y^4}{x^4y}$	_____ =	

**4a.** In the example above, what is the sign of the *exponent for x* in the solution?

**4b.** In the example above, what is the sign of the *exponent for y* in the solution?

**Problem 5.**

Original Expression	Expanded Form	Division Rule with Solution
$\frac{14x^3y^5}{7xy^3}$	_____ =	
$\frac{18x^2y^4}{6x^5y^3}$	_____ =	
$\frac{2x^3y^4}{4x^4y}$	_____ =	

**5a.** Explain what happens to the *coefficients* when you apply the division rule to the problems above.

**5b.** Explain how the operation on *coefficients* is different from what you do with the *exponents*.  
Give an example if needed.

**Problem 6.**

This resource was collaboratively designed by OER in Mathematics Professional Development Project partners from Maine RSU#54 & RSU#11 and staff from Education Development Center, Inc. This work is licensed under the Creative Commons Attribution-Non Commercial-Share Alike 3.0 License.



Name: \_\_\_\_\_

Class/Block: \_\_\_\_\_ Date: \_\_\_\_\_

Original Expression	Expanded Form	Division Rule with Solution
$\frac{y^4}{y^4}$	_____ =	

**6a.** When you divide like bases with the same exponent, what do you notice about the expanded form?

**6b.** What is the solution using the division rule?

**6b.** What is the value of the solution whenever the resulting exponent is zero?

**Conclusion:**

**a.** State the division rule in words. Give an example of the division rule.

**b.** State the zero power rule in words. Give an example of the zero power rule.

