Dividing Exponential Expressions

Part A

Emily was trying to simplify the exponent expression $\frac{5^7}{5^3}$. She started by writing out the factored forms in the numerator and the denominator. When she looked at this factored form, she noticed a "form of one" (FOO).

1. Write out the factored form of $\frac{5^7}{5^3}$. Where do you see any form(s) of one?

$$\frac{5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5}{5\cdot5\cdot5} = 5^2$$

2. Discuss with your group **how you can use** forms of one to simplify Emily's expression. What did you decide? What is your simplified result?

Remove all forms of 1.

3. Copy and complete the table below in your notebook. Expand each expression into factored form and then rewrite it with new exponents as shown in the example.

Original Form	Factored Form	Simplified Exponent Form
$\frac{x^7}{x^3}$	$\frac{x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x}{x\cdot x\cdot x}$	x^4
$\frac{2^4}{2^2}$	$\frac{2\cdot2\cdot2\cdot2}{2\cdot2}$	2^2
$\frac{3^4}{3^5}$	$\frac{3\cdot3\cdot3\cdot3}{3\cdot3\cdot3\cdot3\cdot3}$	$\frac{1}{3}$
$\frac{x^3y^2}{xy^2}$	$\frac{x\cdot x\cdot x\cdot y\cdot y}{x\cdot y\cdot y}$	x^2
$\frac{x^8y^5}{x^4y^2}$	$\frac{x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot y\cdot y\cdot y\cdot y\cdot y}{x\cdot x\cdot x\cdot x\cdot y\cdot y}$	x^4y^3

4. Work with your group to compare the bases and exponents of the original form to the base and exponent of the simplified exponent form. **Write a statement to describe the relationship you see.**

5. Using the relationship you described above, can you rewrite $\frac{3^{58}}{3^{32}}$ without needing to factor the numerator and denominator? What is your simplified result?

$\frac{3^{58}}{3^{32}} \cdot 3^{58-32} = 3^{21}$

6. Why are you able to use your strategy? Because it "gets you the correct result" is not the answer. ☺ What does using your strategy actually represent? (Hint: Think about forms of one.)

By subtracting the exponents, we are removing the forms of 1.

Part B

What happens when you have numerical coefficients? Copy and complete the table below in your notebook. Expand each expression into factored form and then rewrite it with new exponents as shown in the example. **All exponents must be positive and coefficients should be whole numbers.** Some of your simplified forms may still be in fractional form!

Original Form	Factored Form	Simplified Exponent Form
$\frac{12x^4y^3}{4x^2y^2}$	$\frac{12 \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y}{4 \cdot x \cdot x \cdot y \cdot y}$	$3x^2y$
$\frac{25x^7}{5^3}$	$\frac{5 \cdot 5 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x}{5 \cdot 5 \cdot 5}$	$\frac{x^7}{5}$
$\frac{7x^3y^2}{7x^5y}$	$\frac{7 \cdot x \cdot x \cdot x \cdot y \cdot y}{7 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y}$	$\frac{y}{x^2}$
$\frac{7x^3y^3}{3x^4y} \cdot 6x^2$	$\frac{7 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot 6 \cdot x \cdot x}{3 \cdot x \cdot x \cdot x \cdot x \cdot y}$	$14xy^2$
$\frac{12x^2y^4z^2}{9x^3y^2z}$	$\frac{12 \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot z \cdot z}{9 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot z}$	$\frac{4y^2z}{3x}$