Name: ANSWERS Date: Period:

Exponent Law Explorations

1. Product Law

Complete all the missing parts in the following table:

$x^m \times x^n$	Exponential form	Expanded form
E.g. $3^1 \times 3^4$	$(3)^{1+4} = (3)^5$	$(3) \times (3)(3)(3)(3)$
$5^2 \times 5^{\boxed{3}}$	$(5)^{2+3} = 5^5$	$(5)(5) \times (5)(5)(5)$
$(-4)^{\boxed{2}} \times (-4)^{\boxed{2}}$	$(-4)^{\boxed{2}+\boxed{2}} = (-4)^4$	$(-4)(-4) \times (-4)(-4)$
E.g. $(3)^{-2} \times (3)^4$	$(3)^{-2+4} = (3)^2$	$\frac{1}{(3)(3)} \times (3)(3)(3)(3)$
$(-2)^{-1} \times (-2)^{-3}$	$(-2)^{\boxed{-1}+\boxed{-3}} = (-2)^{-4}$	$\frac{1}{(-2)} \times \frac{1}{(-2)(-2)(-2)}$
$(-6)^{\boxed{3}} \times (-6)^{\boxed{2}}$	$(-6)^{3+2} = (-6)^5$	$(-6)(-6)(-6) \times (-6)(-6)$

Complete the **Product Law**:

When multiplying like bases you must add *the exponents.*

2. Quotient Law

Complete all the missing parts in the following table:

$x^m \div x^n$	Exponential form	Expanded form
E.g. $3^4 \div 3^1$	$(3)^{4-1} = (3)^3$	$(3)(3)(3)(3) \div (3)$
$5^3 \div 5^{\boxed{2}}$	$(5)^{3-2} = (5)^1$	$(5)(5)(5) \div (5)(5)(5)$
$(-3)^3 \div (-3)^2$	$(-3)^{\boxed{3}-\boxed{2}} = (-3)^1$	$(-3)(-3)(-3) \div (-3)(-3)$
$(-4)^{\boxed{4}} \div (-4)^{\boxed{2}}$	$(-4)^{\boxed{4}-\boxed{2}} = (-4)^2$	$(-4)(-4)(-4)(-4) \div (-4)(-4)$
E.g. $(3)^{-4} \div (3)^2$	$(3)^{-4-2} = (3)^{-6}$	$\frac{1}{(3)(3)(3)(3)} \div (3)(3)$
$(-2)^{-1} \div (-2)^{-3}$	$(-2)^{\boxed{-1}-\boxed{-3}} = (-2)^2$	$\frac{1}{(-2)} \div \frac{1}{(-2)(-2)(-2)}$
$(-6)^{-3} \div (-6)^2$	$(-6)^{-3-2} = (-6)^{-1}$	$\frac{1}{(-6)(-6)(-6)} \div \frac{1}{(-6)}$

Complete the **Quotient Law**:

When dividing like bases you must subtract *the exponents.*

3. Power of a Power Law

Complete all the missing parts of the following table:

$(x^m)^n$	Exponential form	Expanded form
E.g. $(2^3)^2$	$(2)^{3\times2}=(2)^6$	(2)(2)(2)(2)(2)(2)
$(5^2)^{\boxed{4}}$	$(5)^{2\times2}=5^4$	(5)(5)(5)(5)
$((-3)^3)^2$	$(-3)^{\boxed{3}\times\boxed{2}}=(-3)^6$	(-3)(-3)(-3)(-3)(-3)(-3)
$((-4)^{\boxed{2}})^2$	$(-4)^{\boxed{2}\times\boxed{2}}=(-4)^4$	(-4)(-4)(-4)(-4)
E.g. $(-3)^{-4})^2$	$(-3)^{-4\times2}=(-3)^{-8}$	$\left(\frac{1}{-3}\right)\left(\frac{1}{-3}\right)\left(\frac{1}{-3}\right)\left(\frac{1}{-3}\right)\left(\frac{1}{-3}\right)\left(\frac{1}{-3}\right)\left(\frac{1}{-3}\right)\left(\frac{1}{-3}\right)$
$((4)^{-3})^{-2}$	$(4)^{\boxed{-3}\times\boxed{-2}}=(4)^6$	(4)(4)(4)(4)(4)(4)
$((-2)^{-1})^{-3}$	$(-2)^{\boxed{-1}\times\boxed{-3}}=(-2)^3$	(-2)(-2)(-2)
$((3)^2)^{-2}$	$(3)^{\boxed{2}\times\boxed{-2}}=(3)^{-4}$	$\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)$

Complete the **Power of a Power Law:**

When raising a power to another power you must multiply *the exponents.*

4. Power of a Product Law

Complete all the missing parts of the following table:

$(x\times y)^m$	Exponential form	Expanded form
E.g. $(2\times4)^3$	$(2)^{1\times3}\times(4)^{1\times3}=(2)^3\times(4)^3$	(2)(2)(2)×(4)(4)(4)
$(3\times2)^{\boxed{3}}$	$(3)^{1\times3}\times(2)^{1\times3}=(3)^{\boxed{3}}\times(2)^{\boxed{3}}$	(3)(3)(3) × (2)(2)(2)
$(-3\times2)^3$	$(-3)^{1\times3}\times(2)^{\boxed{1\times3}}=(-3)^3\times(2)^3$	(-3)(-3)(-3) × (2)(2)(2)
$(4\times3)^{-2}$	$(4)^{1\times-2}\times(3)^{1\times-2}=(4)^{\boxed{-2}}\times(3)^{\boxed{-2}}$	$\left(\frac{1}{4}\right)\left(\frac{1}{4}\right)\times\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)$
$(-2\times4)^{\boxed{-3}}$	$(-2)^{\boxed{1\times-3}}\times(4)^{\boxed{1\times-3}}=(-2)^{-3}\times(4)^{-3}$	$\left(\frac{1}{-2}\right)\left(\frac{1}{-2}\right)\left(\frac{1}{-2}\right)\times\left(\frac{1}{4}\right)\left(\frac{1}{4}\right)\left(\frac{1}{4}\right)$
$(-3\times2)^{\boxed{2}}$	$(-3)^{1\times2}\times(2)^{1\times2}=(-3)^2\times(2)^2$	(-3)(-3) × (2)(2)

Complete the **Power of a Product Law:**

When finding the power of a product you must multiply *the exponent outside the bracket by all the exponents inside the bracket.*

5. Power of a Quotient Law

Complete all the missing parts in the following table:

$\left(\frac{x}{y}\right)^m$	**Exponential form**	**Expanded form**
E.g. $\left(\frac{2}{4}\right)^3$	$\frac{(2)^{1\times3}}{(4)^{1\times3}} = \frac{(2)^3}{(4)^3}$	$\left(\frac{2}{4}\right)^1 \times \left(\frac{2}{4}\right)^1 \times \left(\frac{2}{4}\right)^1$
$\left(\frac{3}{2}\right)^{\boxed{4}}$	$\frac{(3)^{1\times4}}{(2)^{1\times4}} = \frac{(3)^{\boxed{4}}}{(2)^{\boxed{4}}}$	$\left(\frac{3}{2}\right)^1 \times \left(\frac{3}{2}\right)^1 \times \left(\frac{3}{2}\right)^1 \times \left(\frac{3}{2}\right)^1$
$\left(\frac{-3}{4}\right)^3$	$\frac{(-3)^{\boxed{1\times3}}}{(4)^{\boxed{1\times3}}} = \frac{(-3)^3}{(4)^3}$	$\left(\frac{-3}{4}\right)^1 \times \left(\frac{-3}{4}\right)^1 \times \left(\frac{-3}{4}\right)^1$
$\left(\frac{-4}{-3}\right)^{\boxed{2}}$	$\frac{(-4)^{1\times2}}{(-3)^{1\times2}} = \left(\frac{-4}{-3}\right)^2$	$\left(\frac{-4}{-3}\right)^1 \times \left(\frac{-4}{-3}\right)^1$
$\left(\frac{-3}{-4}\right)^{-2}$	$\frac{(-3)^{\boxed{1\times-2}}}{(-4)^{\boxed{1\times-2}}} = \frac{(-3)^{-2}}{(-4)^{-2}}$	$\frac{1}{\left(\frac{-3}{-4}\right)^1 \times \left(\frac{-3}{-4}\right)^1}$

Complete the **Power of a Quotient Law**:

When finding the power of a quotient you must multiply *the exponent outside the bracket by all the exponents inside the bracket.*

6. Zero Exponent Law

Complete all the missing parts in the following table:

$(x)^0$	**Exponential form**	**Expanded form**
E.g. $(4)^0$	$(4)^0 = 1$	$\frac{4}{4} = 1$
$(y)^0$	$(y)^0 = 1$	$\frac{y}{y} = 1$
$(-3)^0$	$(-3)^{\boxed{0}} = 1$	$\frac{(-3)}{(-3)} = 1$
$(-6)^{\boxed{0}}$	$(-6)^0 = 1$	$\frac{(-6)}{(-6)} = 1$

Complete the **Zero Exponent Law**:

The value of any base to the zero exponent is 1.

7. **Negative Exponent Law**:
Complete all the missing parts in the following table:

$(\mathbf{x})^{-n}$	**Exponential form**	**Expanded form**
E.g. $(4)^{-2}$	$\frac{1}{(4)(4)}=\frac{1}{(4)^2}$	$\left(\frac{1}{4}\right)\left(\frac{1}{4}\right)$
$(5)^{-3}$	$\frac{1}{(5)(5)(5)}=\frac{1}{(5)^3}$	$\left(\frac{1}{5}\right)\left(\frac{1}{5}\right)\left(\frac{1}{5}\right)$
$(-6)^{-2}$	$\frac{1}{(-6)(-6)}=\frac{1}{(-6)^{\boxed{2}}}$	$\left(\frac{1}{-6}\right)\left(\frac{1}{-6}\right)\left(\frac{1}{-6}\right)$

Complete the **Negative Exponent Law**:
$(\mathbf{x})^{-n}$ *is defined to be the* reciprocal *of* $(\mathbf{x})^{n}$.
(multiplicative inverse)