

MAP 4CI Unit 6 – Algebraic Models

Lesson 1: Exponent Laws

1. Multiplication Law: $x^m \times x^n = x^{m+n}$

When multiplying powers with the same base, keep the base the same and add the exponents.

Ex. 1. $x^3 \times x^2$ (Note: $x^3 \times x^2 =$) Ex. 2 $2^3 \times 2^4$

2. Division Law: $x^m \div x^n = x^{m-n}$

When dividing powers with the same base, keep the base the same and subtract the exponents.

Ex. 1 $x^5 \div x^2$ Ex. 2 $2^4 \div 2^3$ Note: $2^4 \div 2^3$

$$= \frac{2^4}{2^3}$$

$$= \frac{2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2}$$

3. Power of a Power Law: $(x^m)^n = x^{m \times n}$

If a power is raised to an exponent, multiply the exponents.

Ex. $(x^3)^2 =$ NOTE: $(x^3)^2 =$

4. Power of a Product Law: $(x \cdot y)^m = x^m y^m$

If a Product is raised to an exponent, distribute the exponent to each factor in the base.

NOTE: This rule does NOT apply to the power of a sum or difference!

Ex. 1 $(x \cdot y)^5 =$ Ex. 2 $(3x^5 y^3)^2$

5. Power of a Quotient Law: $\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$

If a Quotient is raised to an exponent, distribute the exponent to every factor in the numerator and denominator.

Ex. 1 $\left(\frac{x}{y}\right)^2 = \left(\frac{x}{y}\right)\left(\frac{x}{y}\right)$

Ex. 2 $\left(\frac{2}{3}\right)^2$

Ex. 3 $\left(\frac{2x^3}{3y^2}\right)^3$

6. Zero Exponents: $x^0 =$

Any power with an exponent of zero is equal to one.

Ex. 1 $(-2)^0 =$

Ex. 2 $-2^0 = -(2^0)$

Ex. 3 $(-237x^3y^7)^0 =$

Proof:

$3^2 \div 3^2$

$3^2 \div 3^2$

So, $3^0 = 1$

7. Negative Exponents: $x^{-m} = \frac{1}{x^m}$

A negative in the exponent of a power means to 'flip the base' or 'take the reciprocal'. A negative exponent has nothing to do with the sign of the number.

Ex. 1 $x^{-2} =$

Ex. 2 $4^{-2} =$

Ex. 3 $\left(\frac{4}{5}\right)^{-3} =$

Ex. 4 $\left(\frac{1}{3}\right)^{-2} =$

Ex. 4 Simplify first, then evaluate using $x = 2$.

$(x^{-3})(x^2)(x^5)$

When $x = 2$,

