Bellwork

Simplify each of the following:

1. $\frac{xxxx}{xx}$

2. $\frac{xyyzzz}{xxxyzzzz}$

3. $\frac{xxxyyyyzz}{xyyyyyz}$

Properties of Exponents

1. Zero Exponent
2. Multiplying like bases
3. Dividing like bases
4. Power of a power
5. Product of a power
6. Quotient of a power
7. Negative Exponents

Zero Exponent

Anything to the power of zero = 1

Examples:

$x^0 = 1$

$(xy)^0 = 1$

$(xyz)^0 = 1$

Try these:

1. $(a^2bc)^0x^0z$

2. $(a^{12}(b^6c^2d^3f^2g^0h)^0)^0$

Multiplying Like Bases

Property:

$a^m a^n = a^{m+n}$

Examples:

$bb^6 = b^{1+6} = b^7$

$a^9 a^{-2} = a^{9+(-2)} = a^{9-2} = a^7$

Try these:

1. $x^{12}x^{-8}y^{-5}y^9$

2. $m^{-10}m^{15}n^8n^{-2}$

Dividing Like Bases

Property:

$$\frac{a^m}{a^n} = a^{m-n}$$

Examples:

$$\frac{b^5}{b^3} = b^2$$

$$\frac{a^9}{a^{15}} = \frac{1}{a^6}$$

Try these:

1. $\frac{m^5n^2}{m^3n^4}$

2. $\frac{x^{-3}y^{-1}z^2}{x^{-4}y^3z^{-3}}$

Power of a Power

Property:

$(a^m)^n = a^{mn}$

Examples:

$(a^4)^3 = a^{4(3)} = a^{12}$

$a(b^2)^7 = ab^{2(7)} = ab^{14}$

Try These:

1. $x(y^2)^5(z^0)^3$

2. $a^0(b^7)^5c^3$

You could also use other properties...

$(a^4)^3 = a^4a^4a^4 = a^{4+4+4} = a^{12}$

$a(b^2)^7 = ab^2b^2b^2b^2b^2b^2b^2$
$= ab^{2+2+2+2+2+2+2}$
$= ab^{14}$

Product to a Power

Property:

$(a^n b^m)^c = a^{nc} b^{mc}$

Examples:

$(a^2 b^3)^2 = a^{2(2)} b^{3(2)} = a^4 b^6$

$a(b^5 c^2)^3 = a b^{5(3)} c^{2(3)} = a b^{15} c^6$

Try These:

1. $(t^9 r^3 s)^2$

2. $a^2 b^{-3} (b c^2 d^4)^3$

Quotient to a Power

Property:

$$\left(\frac{a^m}{a^n}\right)^c = \frac{a^{mc}}{a^{nc}}$$

Example:

$$\left(\frac{3ab^2}{c}\right)^3 = \frac{3^{1(3)}a^{1(3)}b^{2(3)}}{c^{1(3)}} = \frac{3^3a^3b^6}{c^3} = \frac{27a^3b^6}{c^3}$$

Try this:

$$\left(\frac{-4x^7y^{-7}}{x^{-1}y^{-9}}\right)^2$$

Negative Exponents

Property:

- No negative exponents allowed!
- If... $\frac{a}{b^{-n}} = ab^n$ - If... $\frac{b^{-n}}{a} = \frac{1}{ab^n}$

Examples:

$$\frac{3x^2y^{-6}}{z^{-3}} = \frac{3x^2z^3}{y^6}$$

Try this:

$$\frac{4x^{-3}y^8z^{-5}}{-2x^{-10}y^5z^4}$$