

## 3.2 Exponent Laws

### Recall: Exponent Laws

Multiplying Powers  $x^9 \cdot x^4 = x^{9+4} = x^{13}$

Dividing  $x^5 \div x^2$  or  $\frac{x^5}{x^2} = x^{5-2} = x^3$

Power Law  $(x^9)^2 = x^{2 \times 9} = x^{18}$

Power of a Product  $(x^3 y^4)^3 = x^{3 \cdot 3} y^{3 \cdot 4} = x^9 y^{12}$

Power of a Quotient  $\left(\frac{x^3}{y^4}\right)^3 = \frac{x^{3 \cdot 3}}{y^{3 \cdot 4}} = \frac{x^9}{y^{12}}$

Zero Exponent  $x^0 = 1$

Negative Exponent  $x^{-5} = \frac{1}{x^5}$

where  $y \neq 0$

where  $x \neq 0$  since  $0^0$  is undefined

where  $x \neq 0$

Reminders...

**EVALUATE** - answers should be a #, without exponents; if a fraction, reduced

**SIMPLIFY** - answer will have variables in it, like bases should be combined, should be no negative exponents, in lowest terms



BEDMAS applies!

Let's try.....



1. Evaluate.

a)  $2^4$   
 $= 2 \cdot 2 \cdot 2 \cdot 2$   
 $= 16$

b)  $(-2)^3$   
 $= (-2) \cdot (-2) \cdot (-2)$   
 $= -8$

c)  $(-2)^4$   
 $= 16$

d)  $-2^4$   
 $= -2 \cdot 2 \cdot 2 \cdot 2$   
 $= -16$

e)  $3^{-4}$   
 $= \frac{1}{3^4}$   
 $= \frac{1}{3 \cdot 3 \cdot 3 \cdot 3}$   
 $= \frac{1}{81}$

f)  $7^{-1}$   
 $= \frac{1}{7}$

g)  $\left(\frac{3}{4}\right)^{-2}$   
 $= \left(\frac{4}{3}\right)^2$   
 $= \frac{4^2}{3^2}$   
 $= \frac{16}{9}$

h)  $2^{-1} + 2^3$   
 $= \frac{1}{2} + 8$   
 $= \frac{1}{2} + \frac{16}{2}$   
 $= \frac{17}{2}$

i)  $(-5)^0$   
 $= 1$

j)  $-5^0$   
 $= -1$

k)  $(-3^3)^2$   
 $= [(-1)(3^3)]^2$   
 $= (-1)^2 \cdot 3^6$   
 $= 3^6$   
 $= 729$

l)  $(3^2)^{-4}$   
 $= 3^{-8}$   
 $= \frac{1}{3^8}$   
 $= \frac{1}{6561}$

m)  $\frac{5^{10}}{5^{12}}$   
 $= 5^{10-12}$   
 $= 5^{-2}$   
 $= \frac{1}{5^2}$   
 $= \frac{1}{25}$

n)  $\frac{1}{7^{-2}}$   
 $= 7^2$   
 $= 49$

o)  $(5^3)(5^{-2})$   
 $= 5^{3+(-2)}$   
 $= 5$

p)  $\frac{3^{-2} + 2^{-3}}{4^{-2}}$   
 $= \frac{\frac{1}{3^2} + \frac{1}{2^3}}{\frac{1}{4^2}}$

$= \left(\frac{1}{9} + \frac{1}{8}\right) \div \frac{1}{16}$

$= \left(\frac{1}{9} + \frac{1}{8}\right) \times 16$

$= \left(\frac{8}{72} + \frac{9}{72}\right) \times 16$

$= \frac{17}{72} \times 16^2$   
 $= \frac{34}{9}$

OR  
 $\frac{3^{-2} + 2^{-3}}{4^{-2}}$

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

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

$= \frac{16}{9} + \frac{16}{8}$

$= \dots$

$= \frac{34}{9}$



2. Simplify. Express with positive exponents only.

a)  $-3x(5x^3y^2z)(-2x^{-1}y^4z^3)$   
 $= (-3)(5)(-2) x x^3 \cdot x^{-1} \cdot y^2 \cdot y^4 \cdot z \cdot z^3$   
 $= 30 x^3 y^6 z^4$

b)  $(3a^4)^2$   
 $= 3^2 \cdot a^8$   
 $= 9a^8$

c)  $(3a^{-3}b)^{-2}$   
 $= 3^{-2} a^6 b^{-2}$   
 $= \frac{a^6}{3^2 b^2}$   
 $= \frac{a^6}{9b^2}$

d)  $\left(\frac{4m^3n}{6m^2n^4}\right)^2$   
 $= \frac{4^2 m^6 n^2}{6^2 m^4 n^8}$   
 $= \frac{16 m^2}{36 n^6}$   
 $= \frac{4m^2}{9n^6}$

e)  $\left(\frac{8a^3b^4}{4a^{-2}b^3}\right)^{-3}$   
 $= \frac{8^{-3} a^{-9} b^{-12}}{4^{-3} a^6 b^{-9}}$   
 $= \frac{4^3 b^9}{8^3 a^6 a^9 b^{12}}$   
 $= \frac{4^3}{8^3 a^{15} b^3}$

$\left(\frac{4}{8}\right)^3 = \left(\frac{1}{2}\right)^3$   
 $= \frac{1}{8}$

$= \frac{1}{8 a^{15} b^3}$

or  
 $= \left(\frac{8^2 a^3 b^4}{4a^{-2}b^3}\right)^{-3}$   
 $= \left(\frac{2 a^5 b}{1}\right)^{-3}$   
 $= 2^{-3} a^{-15} b^{-3}$   
 $= \frac{1}{8 a^{15} b^3}$

f)  $\frac{(4x^3y^4)(-3x^{-4}y^3)^2}{(2x^4y^{-3})(3x^{-5}y^{-1})^3}$   
 $= \frac{4x^3y^4(-3)^2x^{-8}y^6}{2x^4y^{-3}3^3x^{-15}y^{-3}}$   
 $= \frac{4x^3y^4(9)y^6x^3y^3}{2x^4 \cdot 27 \cdot x^8}$   
 $= \frac{2x^6y^{16}}{3x^{12}}$   
 $= \frac{2x^6y^{16}}{3}$

Homework: Handout- circled  
questions

