3.2 Exponent Laws

Name:_____ Block_____

Investigation #1:

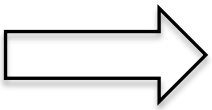
Expression	Repeated Multiplication	Simplified Power
$3^3 \times 3^2$		
$-3^3 \times -3^2$		
$(-3)^3 x (-3)^2$		

1) Product Power Law:

Multiplication Rule

$$m^a \times m^b = m \text{ ——}$$

When powers with the same bases are multiplied together their exponents are _____ together.



When m≠0

Example #1: Simplify, then evaluate.

a) $7^5 \times 7^3$

b) $5^2 \times 5^6$

c) $(-4)^2 \times (-4)^3$

Write each as a *single power*:

203. $7^5 \times 7^6 =$	204. $(-11)^6 \times (-11)^{50} =$	205. $m^4 \times m^{60} =$	206. $9^{12} \times (-9^6) =$
207. $-m^2 \times m =$	208. $m^9 \times m =$	209. $(-11) \times (-11)^9 =$	210. $8 \times 8^9 \times 8^0 =$

Investigation #2:

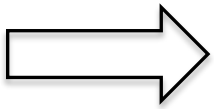
Expression	Repeated Multiplication	Simplified Power
$3^3 \div 3^2$		
$-3^3 \div -3^2$		
$(-3)^3 \div (-3)^2$		

2) Quotient Product Law:

Division Rule

$$\frac{m^a}{m^b} = m^{\_\_\_\_}$$

When powers with the same base are divided their exponents are _____.



When m≠0

Also written as $x^a \div x^b = x^{a-b}$

Example #2: Simplify, then evaluate.

a) $3^6 \div 3^3$

b) $\frac{x^7}{x^3}$

c) $2^2 \times 2^6 \div 2^3$

Write each as a single power.

199. $\frac{m^{30}}{m^3} =$	200. $\frac{m^{12}}{m^5} =$	201. $\frac{m^{20}}{m^9} =$	202. Spot the error. $\frac{m^{14}}{m^7} = m2$
211. Spot the error. $(-4)^{120} \div (-4)^{20} =$ $=(-4)^6$	212. $(-11)^{25} \div (-11)^3 =$	213. Spot the error. $-8^{400} \div 8^{300} =$ $=8^{100}$	214. Evaluate. $10^{30} \div 10^{30} =$

Investigation #3:

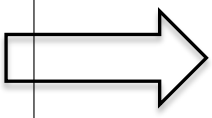
Power of a Power	Repeated Multiplication	Repeated Multiplication	Simplified Power
$(3^2)^3$			
$(5^2)^4$			

3) Power of a Power Law:

Power Raised to an Exponent

311. $\left(m^a\right)^b = m$_____

312. When a power is raised to an exponent, the exponents are _____ together.



When m≠0

Write as a single power.

315. $\left(N^2\right)^3 =$	316. $\left(N^3\right)^2 =$	317. $\left(N^5\right)^3 =$	318. $\left(N^7\right)^2 =$
319. $\left(N^6\right)^3 =$	320. $\left(N^2\right)^4 =$	321. $\left(N^8\right)^2 =$	322. $\left(N^7\right)^0 =$
323. $9^5 \times 9^{20} =$	324. $(9^5)^{20} =$	325. $9^5 \times 9^4 =$	326. $(9^5)^4 =$

Investigation #4:

Power of a Product	Repeated Multiplication	Repeated Multiplication	Simplified Power
$(3\times 4)^2$			
$(8\times 7)^3$			

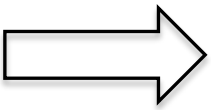
HINT: $(xy)^a = x^a y^a$

4) Power of a Product Law:

Product Rule

355. $(m \times n)^a = m^{\square} n^{\square}$

356. When a product is raised to an exponent each number in the brackets is raised to the same _____.



When m≠0

Write each product as product of two powers.

359. $(5 \times 2)(5 \times 2)(5 \times 2)$	360. $(mn)(mn)(mn)(mn)(mn)$	361. $(m^2n)(m^2n)(m^2n)(m^2n)(m^2n)$
362. $(5 \times 2)^3$	363. $(mn)^5$	364. $(m^2n)^5$

365. When a product is raised to an exponent what happens to each number in the brackets?

Investigation #5:

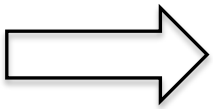
Power of a Quotient	Repeated Multiplication	Simplified Power
$\left(\frac{3}{4}\right)^2$		
$\left(\frac{1}{6}\right)^3$		

5) Power of a Quotient Law:

Quotient Rule

357. $\left(\frac{m}{n}\right)^a = \frac{m^{\square}}{n^{\square}}$

358. When a quotient is raised to an exponent each number in the brackets is raised to the same _____.



When n≠0

Example #1: Simplify, then evaluate.

a) $(4^2)^0$

b) $\left(\frac{5}{3}\right)^3$

PRACTICE

Write each quotient as a quotient of two powers.

366. $\frac{2\times2\times2\times2\times2}{3\times3\times3\times3\times3}$

367. $\frac{mmm}{nnn}$

368. $\frac{2m\times2m\times2m\times2m}{5n\times5n\times5n\times5n}$

369. $\left(\frac{2}{3}\right)^5$

370. $\left(\frac{m}{n}\right)^3$

371. $\left(\frac{2m}{n}\right)^4$

372. When a quotient is raised to an exponent what happens to each number in the brackets?

Summary of Exponent Laws:

Rules of Exponents or Laws of Exponents	
Multiplication Rule	$a^x \times a^y = a^{x+y}$
Division Rule	$a^x \div a^y = a^{x-y}$
Power of a Power Rule	$\left(a^x\right)^y = a^{xy}$
Power of a Product Rule	$(ab)^x = a^x b^x$
Power of a Fraction Rule	$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$
Zero Exponent	$a^0 = 1$

Homework

ASSIGNMENT #3 Section 3.2 pg 86-87

Questions #1- 13, 15-17 (*18-22)