# Welcome Back MYP Math 9!

| | Assignment Effort Grade (Circle One) | Comments (What was interesting or challenging?) |
|---|---|---|
| **Monday**<br>Date: 1/29<br>Topic:_____ | 0 1 2 | I rested after FINALS :) |
| **Tuesday**<br>Date: 1/30<br>Topic:_____ | 0 1 2 | New Semester! |
| **Wednesday**<br>Date: 1/31<br>Topic: 1A: Exponents | 0 1 2 | |
| **Thursday**<br>Date: _____<br>Topic:_____ | 0 1 2 | |
| **Friday**<br>Date: _____<br>Topic:_____ | 0 1 2 | |

From Tuesday's homework...

5c

$2xyyz - zz3$

$2xy^2z - 3z^2$

## Unit 5: Exponentials and Logarithms

Warm-up: Expand the multiplication.

1) $a^4 \cdot d^3 =$

$a \cdot a \cdot a \cdot a \cdot d \cdot d \cdot d$

2) $\left(2x^2\right)^3 =$ $(2x^2)(2x^2)(2x^2)$

$2 \cdot x \cdot x \cdot 2 \cdot x \cdot x \cdot 2 \cdot x \cdot x = 222xxxxxx$

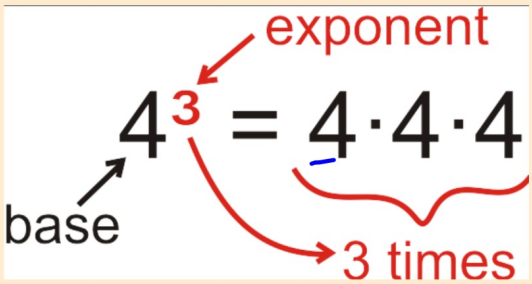
## Class Plan:

1. Warm-up
2. Laws of Indices (Exponents) Investigation
3. Joke break!
4. Examples and Practice

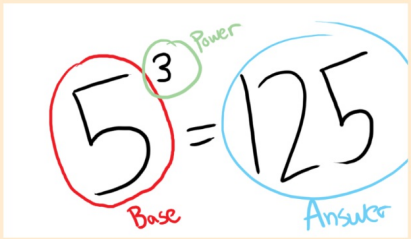
Exit ticket

# Unit 5: Exponentials and Logarithms

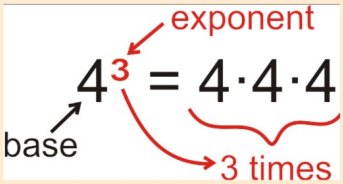
- What is an exponent?
- What is the base?




{Expanded form.}



# Investigation:Index Laws




(Calculator may help as well)

<--- Use expanded form to discover the laws/properties.

(Properties of Exponents) READ 1st

***Do not MEMORIZE....Understand the relationships!***

$$b^m \cdot b^n = b^{\square}$$

$$\frac{b^m}{b^n} = b^{\square}$$

$$(b^m)^n = b^{\square}$$

When done: Record in notebook & show teacher

# Property Investigation

Original = Expanded Form = Simplified, one base (Exponential Form)

$$x^2 \cdot x^4 = x \cdot x \cdot x \cdot x \cdot x \cdot x = x^6$$

1. Rewrite each expression in expanded form (***shown above***). Then rewrite it in ***simplified*** exponential form with a single base.

**a)** $5^3 \cdot 5^4 =$ 5·5·5·5·5·5·5 $= 5^{7}$

**b)** $a^2 \cdot a^3 =$ _____ $= a^{\square}$

2. Examine the simplified form and the exponents in parts **a - b.**

i. What operation did you do with the exponents to simplify your expression?

ii. Write a rule for simplifying exponents when we multiply terms with the same base:

$$b^m \cdot b^n = b^{\square}$$

# Answers to Investigation

Original = Expanded Form = Simplified, one base (Exponential Form)

$$x^2 \cdot x^4 = x \cdot x \cdot x \cdot x \cdot x \cdot x = x^6$$

1. Rewrite each expression in expanded form (***shown above***). Then rewrite it in ***simplified*** exponential form with a single base.

a) $5^3 \cdot 5^4 =$ 5·5·5·5·5·5·5 $= 5^{7}$

b) $a^2 \cdot a^3 =$ a·a·a·a·a $= a^{5}$

2. Examine the simplified form and the exponents in parts **a - b.**

i. What operation did you do with the exponents to simplify your expression?

ADD

ii. Write a rule for simplifying exponents when we multiply terms with the same base:

$$b^m \cdot b^n = b^{m+n}$$

# Property Investigation

Original = Expanded Form = Simplified, one base **(Exponential Form)**

$$x^2 \cdot x^4 = x \cdot x \cdot x \cdot x \cdot x \cdot x = x^6$$

3. Rewrite each expression in expanded form (***shown above***). Then rewrite it in ***simplified*** exponential form with a single base.

**a)** $\left(3^2\right)^4 =$ _____ $= 3^{\square}$

**b)** $\left(xy^6\right)^2 =$ _____ $= x^{\square}y^{\square}$

**c)** $\left(2w^5\right)^5 =$ _____ $=$ _____

4. Examine the simplified form and the exponents in parts **a - c.**

i. What operation did you do with the exponents to simplify your expression?

ii. Write a rule for simplifying exponents when a base is raised by more than one exponent:

$$\left(b^m\right)^n = b^{\square}$$

# Answers to Investigation

Original = Expanded Form = Simplified, one base (Exponential Form)

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

3. Rewrite each expression in expanded form (***shown above***). Then rewrite it in ***simplified*** exponential form with a single base.

a) $(3^2)^4 = (3^2)(3^2)(3^2)(3^2) = 3^{8}$

b) $(xy^6)^2 = (xy^6)(xy^6) = x \cdot x \cdot y \cdot y \cdots y = x^{2}y^{12}$

c) $(2w^5)^5 = (2w^5)(2w^5)(2w^5)(2w^5)(2w^5) = 32w^{25}$

$2^5 \quad w^{25}$

4. Examine the simplified form and the exponents in parts **a - c.**

i. What operation did you do with the exponents to simplify your expression?

multiply

ii. Write a rule for simplifying exponents when a base is raised by more than one exponent:

$$(b^m)^n = b^{m \cdot n}$$

# Property Investigation

5. Rewrite in expanded form. Then rewrite it in ***simplified*** exponential form with a single base.

**a)** $\frac{3^5}{3^1} =$ _____ $= 3^{\square}$

b) $\frac{y^7}{y^2} =$ _____ $= y^{\square}$

6. Examine the simplified form and the exponents in parts **a – b** from #5.

i. What operation did you do with the exponents to simplify your expression?

ii. Write a rule for simplifying exponents when we are dividing terms with the same base:

$$\frac{b^m}{b^n} = b^{\square}$$

# Answers to Investigation

5. Rewrite in expanded form. Then rewrite it in ***simplified*** exponential form with a single base.

a) $\frac{3^5}{3^1} = \frac{3\cdot3\cdot3\cdot3\cdot3}{3} = 3^{4}$

b) $\frac{y^7}{y^2} = \frac{y\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y}{y\cdot y} = y^{5}$

6. Examine the simplified form and the exponents in parts **a – b** from #5.

i. What operation did you do with the exponents to simplify your expression?

Subtract

ii. Write a rule for simplifying exponents ~~when we are dividing~~ terms with the same base:

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

## B Chapter 2 INDEX LAWS

If the bases $a$ and $b$ are both positive, and the indices $m$ and $n$ are integers, then:

| | |
|---|---|
| $a^m \times a^n = a^{m+n}$ | To **multiply** numbers with the **same base**, keep the base and **add** the indices. |
| $\frac{a^m}{a^n} = a^{m-n}$ | To **divide** numbers with the same base, keep the base and **subtract** the indices. |
| $(a^m)^n = a^{mn}$ | When **raising** a **power** to a **power**, keep the base and **multiply** the indices. |
| $(ab)^n = a^n b^n$ | The power of a product is the product of the powers. |

# Today's joke!

Knock, knock
who's there?


Canoe who?

Canoe help me with my homework?

9th Grade Math Tutoring support:
*Monday: Berg, Connelly, Oberembt **Room W101 and W125**
*Tuesday: Peer Tutoring, **Garages**
*Wednesday: Peer Tutoring, **Garages**
*Thursday: Paulson, Perkins **Rooms W118B and W124**

**Yes! Come to after school help :)**

## B EXAMPLES — INDEX LAWS

**Example 5** — Self Tut

Simplify using $a^m \times a^n = a^{m+n}$:

**a** $11^5 \times 11^3$ **b** $a^4 \times a^5$ **c** $x^4 \times x^a$

**a**
$$\begin{aligned} & 11^5 \times 11^3 \\ &= 11^{5+3} \\ &= 11^8 \end{aligned}$$

**b**
$$\begin{aligned} & a^4 \times a^5 \\ &= a^{4+5} \\ &= a^9 \end{aligned}$$

**c**
$$\begin{aligned} & x^4 \times x^a \\ &= x^{4+a} \\ &= x^{a+4} \end{aligned}$$

## B EXAMPLES — INDEX LAWS

### Example 6

Simplify using $\frac{a^m}{a^n} = a^{m-n}$: **a** $\frac{7^8}{7^5}$ **b** $\frac{b^6}{b^m}$

**a** $\frac{7^8}{7^5} = 7^{8-5}$

$= 7^3$

**b** $\frac{b^6}{b^m} = b^{6-m}$

## B EXAMPLES — INDEX LAWS

**Example 7** — Self

Simplify using $(a^m)^n = a^{mn}$:

**a** $(2^4)^3$ **b** $(x^3)^5$ **c** $(b^7)^m$

**a**
$$(2^4)^3 = 2^{4\times 3} = 2^{12}$$

**b**
$$(x^3)^5 = x^{3\times 5} = x^{15}$$

**c**
$$(b^7)^m = b^{7\times m} = b^{7m}$$

## B EXAMPLES — INDEX LAWS

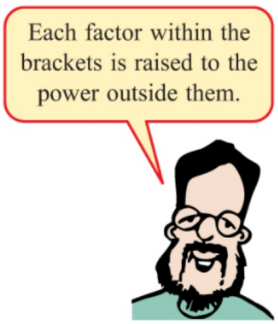
**Example 11** — Self Tutor

Remove the brackets of:

**a** $(3a)^2$ **b** $\left(\frac{2x}{y}\right)^3$

**a** $(3a)^2 = 3^2 \times a^2$
$= 9a^2$

**b** $\left(\frac{2x}{y}\right)^3 = \frac{2^3 \times x^3}{y^3}$
$= \frac{8x^3}{y^3}$



## B EXAMPLES — INDEX LAWS

**Example 12**

Express in simplest form, without brackets: **a** $(3a^3b)^4$ **b** $\left(\frac{x^2}{2y}\right)^3$

**a**
$$\begin{aligned}(3a^3b)^4 &= 3^4 \times (a^3)^4 \times b^4 \\ &= 81 \times a^{3\times 4} \times b^4 \\ &= 81a^{12}b^4\end{aligned}$$

**b**
$$\begin{aligned}\left(\frac{x^2}{2y}\right)^3 &= \frac{(x^2)^3}{2^3 \times y^3} \\ &= \frac{x^{2\times 3}}{8 \times y^3} \\ &= \frac{x^6}{8y^3}\end{aligned}$$

**B** **EXIT TICKET** **INDEX LAWS**

# DQ: Exit ticket

## Done?:

Turn in and

Return to homework


Properties of Indices (Exponents) Exit Ticket Name_____

**Directions:** **Simplify each expression using properties you learned today.**

1) $x^3 \cdot x^4 =$ _____ 2) $\left(w^5\right)^3 =$ _____ 3) $\frac{r^9}{r^2} =$ _____

**Challenge: Create your own problem with all 3 properties.**

*Atleast* 20 minutes of math homework each evening.

## EXERCISE 2B

**1** Simplify using the index law $a^m \times a^n = a^{m+n}$:

**a** $5^4 \times 5^2$ **b** $6^5 \times 6^6$ **c** $a \times a^5$ **d** $a^3 \times a^7$

**e** $b^{12} \times b^2$ **f** $a^2 \times a^n$ **g** $b^m \times b^9$ **h** $p^2 \times p \times p^4$

**2** Simplify using the index law $\frac{a^m}{a^n} = a^{m-n}$:

**a** $\frac{3^9}{3^2}$ **b** $\frac{7^{13}}{7^9}$ **c** $5^7 \div 5^4$ **d** $\frac{a^8}{a^3}$

**e** $\frac{b^{18}}{b^{12}}$ **f** $\frac{p^n}{p^2}$ **g** $\frac{y^5}{y^b}$ **h** $b^{2n} \div b$

**3** Simplify using the index law $(a^m)^n = a^{mn}$:

**a** $(2^9)^2$ **b** $(3^7)^3$ **c** $(5^4)^7$ **d** $(a^2)^6$

**e** $(q^3)^3$ **f** $(d^6)^n$ **g** $(x^y)^8$ **h** $(g^{2a})^5$

**Challenge: Create a problem that uses all 3 rules and provide a solution.**

# Solutions to 2B (#1 - #3)

**EXERCISE 2B**

| | | | | |
|---|---|---|---|---|
| **1** | **a** $5^6$ | **b** $6^{11}$ | **c** $a^6$ | **d** $a^{10}$ |
| | **e** $b^{14}$ | **f** $a^{2+n}$ | **g** $b^{m+9}$ | **h** $p^7$ |
| **2** | **a** $3^7$ | **b** $7^4$ | **c** $5^3$ | **d** $a^5$ |
| | **e** $b^6$ | **f** $p^{n-2}$ | **g** $y^{5-b}$ | **h** $b^{2n-1}$ |
| **3** | **a** $2^{18}$ | **b** $3^{21}$ | **c** $5^{28}$ | **d** $a^{12}$ |
| | **e** $q^9$ | **f** $d^{6n}$ | **g** $x^{8y}$ | **h** $g^{10a}$ |