Welcome Back MYP Math 9!

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

Class Plan:

1. Warm-up

2. Introduce Unit 5: Indices (Exponentials)

Consider questions to be answered

3. 1A ALGEBRAIC NOTATION

   2A EVALUATING INDICES

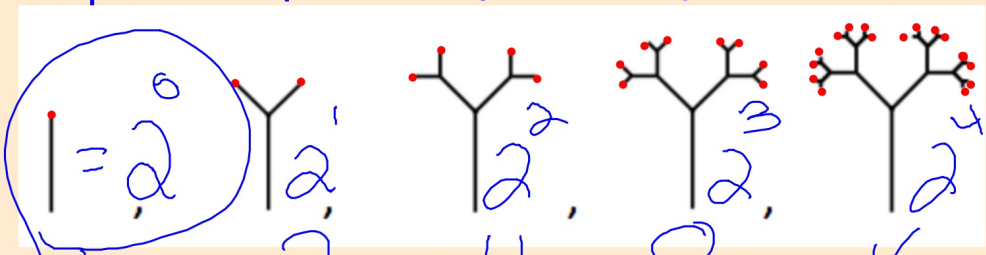
4. Practice

Unit 5: Exponentials (or Indices)

Warm-up: What's the pattern?

How many *endpoints* are there at each step?

Step 0 Step 1 Step 2 Step 3 Step 4



1 2 4 8 16

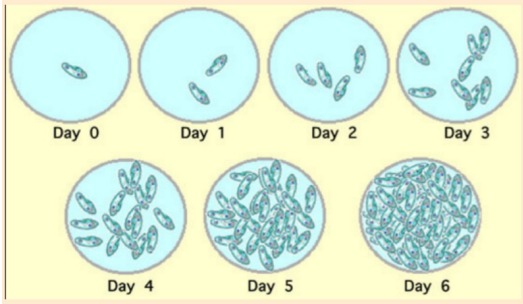
×2 ×2 ×2 ×2

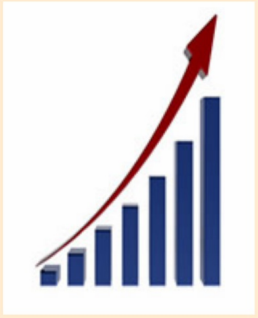
Unit 5: Exponentials and Logarithms
Questions to be answered in the unit:

- What is an exponent?
- What is the base?
- Why are exponents beneficial?
- When are exponents applied in real life?

Unit 5: Exponentials (or Indices)

What are some applications of exponents?





People who use Exponents:

Economists, Bankers, Financial Advisors, Insurance Risk Assessors, Biologists, Engineers, Computer Programmers, Chemists, Physicists, Geographers, Sound Engineers, Statisticians, Mathematicians, Geologists and many other professions

http://passyworldofmathematics.com/exponents-in-the-real-world/

1/30 Unit 5: Exponentials NOTES

Review Notation...

Algebra is a powerful tool used to make problem solving easier. Algebra involves using letters such as x to represent unknown values we want to find, or **variables** which can change depending on the situation.

1A ALGEBRAIC NOTATION

- $2a$ is used rather than $2 \times a$ or $a2$
- $2ab$ is used rather than $2ba$.

- to **leave out** the "$\times$" **signs** between any multiplied quantities
- to write **numerals (numbers) first** in any product
- where products contain two or more letters, we write them in **alphabetical order**.

1A NOTES ALGEBRAIC NOTATION

Simplify Repeated Addition

PRODUCT NOTATION

When we simplify **repeated sums**, we use **product notation**.

(groups)

For example: $x + x = 2 \times x$ {2 lots of x}

$= 2x$

$x + x + x = 3 \times x$ {3 lots of x}

$= 3x$

NOTES

Example 1

Simplify using product notation:

a $c+c+c-d\times 7$ **b** $n\times 4\times m-3\times n$

a) $3c-7d$ b) $4mn-3n$

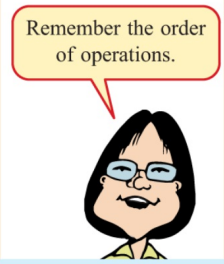
a $c+c+c-d\times 7$
$=3\times c-d\times 7$
$=3c-7d$

b $n\times 4\times m-3\times n$
$=4mn-3n$

Unit 5: Exponentials and Logarithms

What do exponents allow us to do?

Find the integer equal to: **a** 2^5 **b** $2^3 \times 5^2 \times 7$



Indices or Exponents are used to show repeated multiplication.

Simplify using index notation:

a $p \times p \times p \times p \times 3$ **b** $5 \times z \times z \times z \times y + y \times y$

Simplify Repeated Multiplication NOTES

INDEX NOTATION (Exponent Notation)

When we simplify **repeated products**, we use **index notation**.

For example: $x \times x = x^2$ and $x \times x \times x = x^3$

Indices or Exponents are used to represent products more easily.

Product - quantity obtained by multiplying.

Simplify Repeated Multiplication

Example 2

Simplify using index notation:

a $p \times p \times p \times p \times 3$

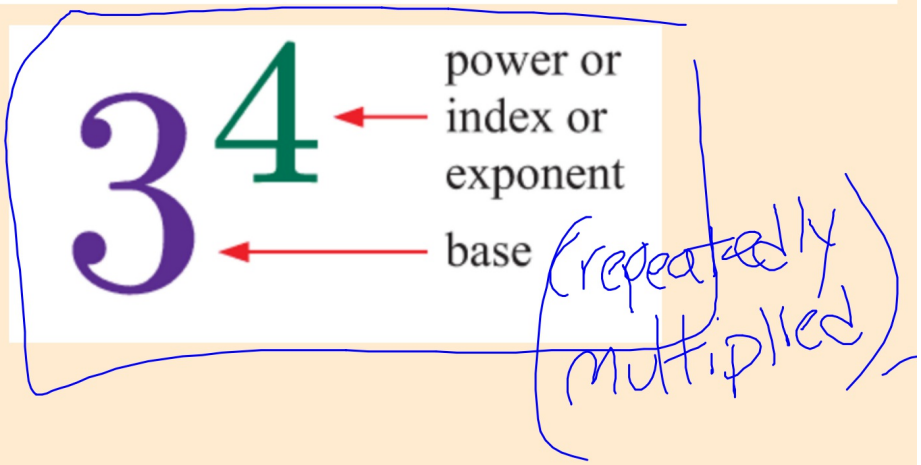
b $5 \times z \times z \times z \times y + y \times y$

$3p^4$

$5z^3y + y^2$

2A NOTES EVALUATING INDICES

We have seen that to simplify the product $3 \times 3 \times 3 \times 3$, we can write 3^4.



2A EVALUATING INDICES

If n is a positive integer, then a^n is the product of n factors of a.

$$a^n = \underbrace{a \times a \times a \times a \times \ldots. \times a}_{n \text{ factors}}$$

Example 1

Find the integer equal to: **a** 2^5 **b** $2^3 \times 5^2 \times 7$

a
$$\begin{aligned} & 2^5 \\ &= 2 \times 2 \times 2 \times 2 \times 2 \\ &= 32 \end{aligned}$$

b
$$\begin{aligned} & 2^3 \times 5^2 \times 7 \\ &= 2 \times 2 \times 2 \times 5 \times 5 \times 7 \\ &= 8 \times 25 \times 7 \\ &= 1400 \end{aligned}$$

NEGATIVE BASES

NOTES

So far we have only considered **positive** bases raised to a power.

However, the base can also be negative. To indicate this we need to use brackets.

How are $(-2)^2$ and -2^2 related?

Notice that $(-2)^2 = (-2)(-2) = 4$

$=$

whereas $-2^2 = -1(2^2) = -1 \cdot 4 = -4$

$=$

$=$

Exponent Pattern...

Consider the statements below:

$$(-1)^1 = -1 \qquad (-2)^1 = -2$$
$$(-1)^2 = -1 \times -1 = 1 \qquad (-2)^2 = -2 \times -2 = 4$$
$$(-1)^3 = -1 \times -1 \times -1 = -1 \qquad (-2)^3 = -2 \times -2 \times -2 = -8$$
$$(-1)^4 = -1 \times -1 \times -1 \times -1 = 1 \qquad (-2)^4 = -2 \times -2 \times -2 \times -2 = 16$$

From the pattern above it can be seen that:

- a **negative** base raised to an **odd** power is **negative**
- a **negative** base raised to an **even** power is **positive**.

Example 3

Evaluate:

a $(-3)^4$ **b** -3^4 **c** $(-3)^5$ **d** $-(-3)^5$

81 −81 −243 −243

$(-3)(-3)(-3)(-3)(-3) =$

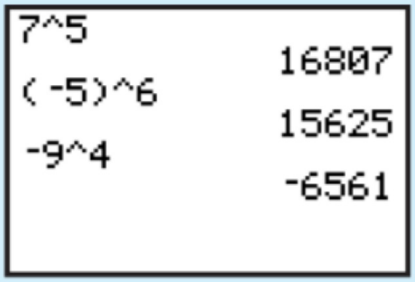
\+ \+

Example 4

Find, using your calculator:

a 7^5 **b** $(-5)^6$ **c** -9^4

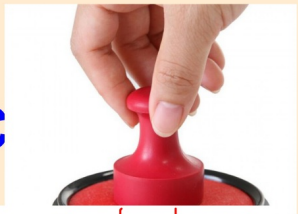
TI-84 Plus



Exercises:1A.1 #3-5(a-h),
2A.1 #1-2 2A.2 #1 2A.3 #1-2

Show Ms. Paulson:

1A.1 #4e AND #5c



4 Write in expanded form:

a y^3 **b** $4x^4$ **c** $3a^2b$

d $(6p)^2$ **e** $2g^2 + h^3$ **f** $m^5 - 7n^2$

$2 \cdot g \cdot g + h \cdot h \cdot h$

5 Simplify:

a $9 \times a - a \times b \times 4 \times b$ **b** $t \times t + s \times t \times s$

c $2 \times x \times y \times y \times z - z \times z \times 3$ **d** $a \times a \times a - (a + a)$

e $x + x + x - 8 \times y \times y$ **f** $m \times n \times m \times n \times m - m \times 2$

g $d + d + d - d \times c \times 6$ **h** $s + s + s \times t \times t \times 5 \times t$

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

Exercises: 1A.1 #3-5(a-h), 2A.1 #1-2 2A.2 #1 2A.3 #1-2

EXERCISE 1A.1

3 Simplify using index notation:

a $b \times b \times b \times b$ **b** $4 \times x \times x$

c $y \times y \times y \times 7$ **d** $6 \times q \times q \times q \times p \times p$

e $c \times c \times d \times c \times 2$ **f** $5 \times m \times m + n \times n \times n \times 6$

4 Write in expanded form:

a y^3 **b** $4x^4$ **c** $3a^2b$

d $(6p)^2$ **e** $2g^2 + h^3$ **f** $m^5 - 7n^2$

$s^2 + 5st^3$

5 Simplify:

a $9 \times a - a \times b \times 4 \times b$ **b** $t \times t + s \times t \times s$

c $2 \times x \times y \times y \times z - z \times z \times 3$ **d** $a \times a \times a - (a + a)$

e $x + x + x - 8 \times y \times y$ **f** $m \times n \times m \times n \times m - m \times 2$

g $d + d + d - d \times c \times 6$ **h** $s + s + s \times t \times t \times 5 \times t$

Exercises:1A.1 #3-5(a-h), 2A.1 #1-2 2A.2 #1 2A.3 #1-2

EXERCISE 2A.1

1 Find the integer equal to:

a 2^3 **b** 5^2 **c** 2^7 **d** 6^3

e $2 \times 3^2 \times 5^3$ **f** $2^3 \times 3 \times 7^2$ **g** $3^2 \times 5^2 \times 11$ **h** $2^5 \times 5^3 \times 13$

2 Copy and complete the values of these common powers. Try to remember them.

a $2^1 = ...,\ 2^2 = ...,\ 2^3 = ...,\ 2^4 = ...,\ 2^5 = ...,\ 2^6 = ...$

b $3^1 = ...,\ 3^2 = ...,\ 3^3 = ...,\ 3^4 = ...$

c $5^1 = ...,\ 5^2 = ...,\ 5^3 = ...,\ 5^4 = ...$

d $7^1 = ...,\ 7^2 = ...,\ 7^3 = ...$

Exercises:1A.1 #3-5(a-h), 2A.1 #1-2
2A.2 #1 2A.3 #1-2

EXERCISE 2A.2

1 Simplify:

a $(-1)^4$	**b** $(-1)^5$	**c** -1^5	**d** $-(-1)^5$
e -2^4	**f** $(-2)^4$	**g** $-(-2)^4$	**h** $-(-5)^2$
i $-(-5)^3$	**j** -3^3	**k** $(-3)^4$	**l** -7^2

Exercises:1A.1 #3-5(a-h), 2A.1 #1-2 2A.2 #1 2A.3 #1-2

EXERCISE 2A.3

1 Use your calculator to find the value of the following, recording the entire display:

a 2^{12} **b** $(-5)^7$ **c** -3^4 **d** 7^7

e 8^5 **f** $(-9)^3$ **g** -9^3 **h** 1.22^{11}

i -0.972^{15} **j** $(-1.08)^{23}$

2 **a** Use your calculator to find the value of:

i 7^{-1} **ii** $\frac{1}{7^1}$ **iii** 3^{-2} **iv** $\frac{1}{3^2}$

v 4^{-3} **vi** $\frac{1}{4^3}$ **vii** 13^0 **viii** 172^0

b Discuss what happens when a number is raised:

i to a negative power **ii** to the power zero.

SOLUTIONS

EXERCISE 1A.1

3 **a** b^4 **b** $4x^2$ **c** $7y^3$ **d** $6p^2q^3$
e $2c^3d$ **f** $5m^2 + 6n^3$

4 **a** $y \times y \times y$ **b** $2 \times 2 \times x \times x \times x \times x$
c $3 \times a \times a \times b$ **d** $2 \times 2 \times 3 \times 3 \times p \times p$
e $2 \times g \times g + h \times h \times h$
f $m \times m \times m \times m \times m - 7 \times n \times n$

5 **a** $9a - 4ab^2$ **b** $t^2 + s^2t$ **c** $2xy^2z - 3z^2$
d $a^3 - 2a$ **e** $3x - 8y^2$ **f** $m^3n^2 - 2m$
g $3d - 6cd$ **h** $2s + 5st^3$ **i** $4g^3 - 3g$
j $2x - xy^2 + 5$ **k** $3ab^2 + ab + b$
l $10v^3w - 6vw^2 + 7w$

SOLUTIONS

EXERCISE 2A.1

1 **a** 8 **b** 25 **c** 128 **d** 216
e 2250 **f** 1176 **g** 2475 **h** 52 000

2 **a** $2^1 = 2,\ 2^2 = 4,\ 2^3 = 8,\ 2^4 = 16,\ 2^5 = 32,\ 2^6 = 64$
b $3^1 = 3,\ 3^2 = 9,\ 3^3 = 27,\ 3^4 = 81$
c $5^1 = 5,\ 5^2 = 25,\ 5^3 = 125,\ 5^4 = 625$
d $7^1 = 7,\ 7^2 = 49,\ 7^3 = 343$

SOLUTIONS

EXERCISE 2A.2

1 **a** 1 **b** −1 **c** −1 **d** 1 **e** −16 **f** 16
g −16 **h** −25 **i** 125 **j** −27 **k** 81 **l** −49

EXERCISE 2A.3

1 **a** 4096 **b** −78 125 **c** −81 **d** 823 543
e 32 768 **f** −729 **g** −729 **h** 8.911 650 327
i −0.653 121 490 1 **j** −5.871 463 646

2 **a** **i** $0.\overline{142\,857}$ **ii** $0.\overline{142\,857}$ **iii** $0.\overline{1}$ **iv** $0.\overline{1}$
v 0.015 625 **vi** 0.015 625 **vii** 1 **viii** 1

b **i** It is the reciprocal of the number raised to the positive power.

ii Any non-zero number raised to the power zero is 1.