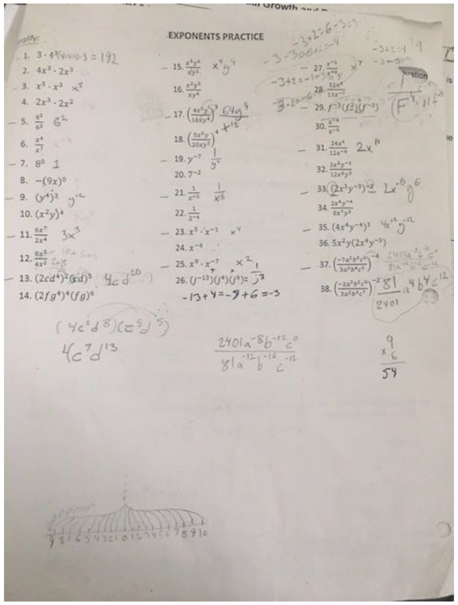
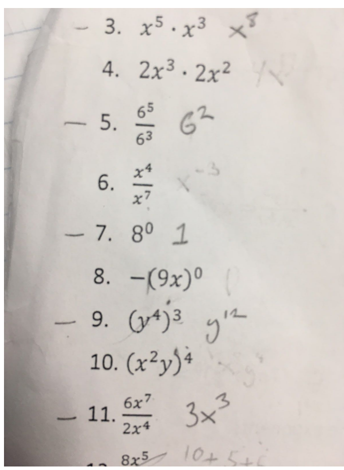
# Exponents Portfolio

| Beautiful examples (Your assignment work here! Evidence) | Amazing Narratives | How I feel about my preparedness for: |
| --- | --- | --- |
| **Exponent Rules** | a. Describe how you made sense of the exponent rules. (Pick two artifacts to include)<br>i. Exponents Review<br>ii. Exponent Rules and Practice<br>iii. Evaluating Exponents<br>This is the first exponent document we completed. Luckily, on the front of the document, there were several keys on how to complete most of the problems on the back. It went over the product rule, the quotient rule, the zero exponent rule, the power rule, the expanded power rule, and the negative exponents. These rules went over different ways to simplify the exponent problems we did on the back. This helped us get ready for the following problem sheets we would do later. One of the problems on the sheet was $\frac{6x^7}{2x^4}$ , to simplify this, we divide 6 by 2, which gives us the number 3. Now we're left with the exponents. Because they share the same variable, and they're a fraction, we subtract them. The end result is 3x^3. (3x to the power of 3)<br>In the next sheet I'll be discussing, Exponents Review, I'll go over what the Activity 2 on it was. Overall, this was a review on about four different ways to solve for different exponent expressions. In the second activity on the page, you're directed to evaluate and conjecture the following. For example, one of the problems on the page was (2^2)^3. Here's the steps: |  |



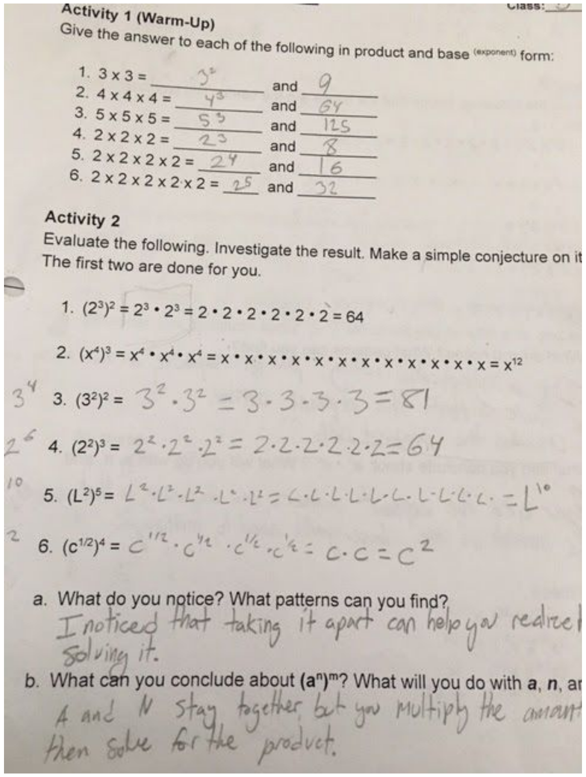
EXPONENTS PRACTICE



3. $x^5 \cdot x^3$
4. $2x^3 \cdot 2x^2$
5. $\frac{6^5}{6^3}$
6. $\frac{x^4}{x^7}$
7. $8^0$
8. $-(9x)^0$
9. $(y^4)^3$
10. $(x^2y)^4$
11. $\frac{6x^7}{2x^4}$

| | |
|---|---|
| 2^2 * 2^2 * 2^2<br><br>Because it’s 2 to the power of 2, and outside the parenthesis is to the power of 3, you separate it three times, and keep the exponent of two. | 2*2*2*2*2*2<br><br>Now you separate it even more, because of the exponent 2. Now it’s going to be multiplied 6 times. After multiplying, the result is 64. |

The habit of a mathematician I used for this was finding patterns. It was crucial to find the repetitive pattern between evaluating the expressions, especially in activity 2.



Activity 1 (Warm-Up) Class: ___

Give the answer to each of the following in product and base (exponent) form:

1. 3 x 3 = $3^2$ and 9
2. 4 x 4 x 4 = $4^3$ and 64
3. 5 x 5 x 5 = $5^3$ and 125
4. 2 x 2 x 2 = $2^3$ and 8
5. 2 x 2 x 2 x 2 = $2^4$ and 16
6. 2 x 2 x 2 x 2 x 2 = $2^5$ and 32

Activity 2

Evaluate the following. Investigate the result. Make a simple conjecture on it

The first two are done for you.

1. $(2^3)^2 = 2^3 \cdot 2^3 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 64$
2. $(x^4)^3 = x^4 \cdot x^4 \cdot x^4 = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^{12}$

$3^4$ 3. $(3^2)^2 = 3^2 \cdot 3^2 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

$2^6$ 4. $(2^2)^3 = 2^2 \cdot 2^2 \cdot 2^2 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 64$

10 5. $(L^2)^5 = L^2 \cdot L^2 \cdot L^2 \cdot L^2 \cdot L^2 = L \cdot L \cdot L \cdot L \cdot L \cdot L \cdot L \cdot L \cdot L \cdot L = L^{10}$

2 6. $(c^{1/2})^4 = c^{1/2} \cdot c^{1/2} \cdot c^{1/2} \cdot c^{1/2} = c \cdot c = c^2$

a. What do you notice? What patterns can you find?

I noticed that taking it apart can help you reduce solving it.

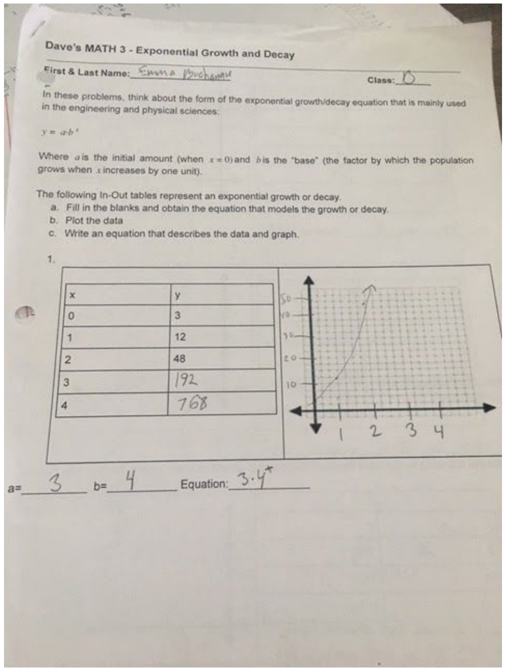
b. What can you conclude about $(a^n)^m$? What will you do with **a**, **n**, ar

A and N stay together but you multiply the amount then solve for the product.

**Exponential Growth and Decay Models**

This was a problem sheet I feel fairly confident about. We filled out the tables, then once we found out once *a* and *b* are, we create an equation for the graph next to the problem. For example, the second problem on the page had a table that looks like this:

| x | y |
|---|---|
| 0 | 1/4 |
| 1 | X (1) |


Dave's MATH 3 - Exponential Growth and Decay

First & Last Name: Emma Buchanan Class: D

In these problems, think about the form of the exponential growth/decay equation that is mainly used in the engineering and physical sciences:

$y = a \cdot b^x$

Where $a$ is the initial amount (when $x = 0$) and $b$ is the "base" (the factor by which the population grows when $x$ increases by one unit).

The following In-Out tables represent an exponential growth or decay.

a. Fill in the blanks and obtain the equation that models the growth or decay.
b. Plot the data
c. Write an equation that describes the data and graph.

1.

| x | y |
|---|---|
| 0 | 3 |
| 1 | 12 |
| 2 | 48 |
| 3 | 192 |
| 4 | 768 |



a= 3 b= 4 Equation: $3 \cdot 4^x$

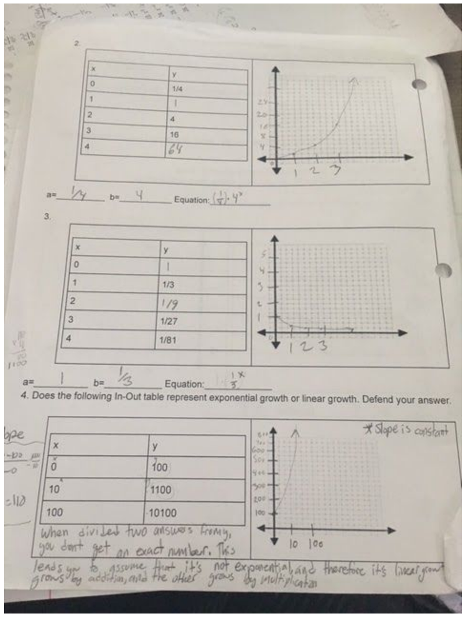
| | |
|---|---|
| 2 | 4 |
| 3 | 16 |
| 4 | X (64) |

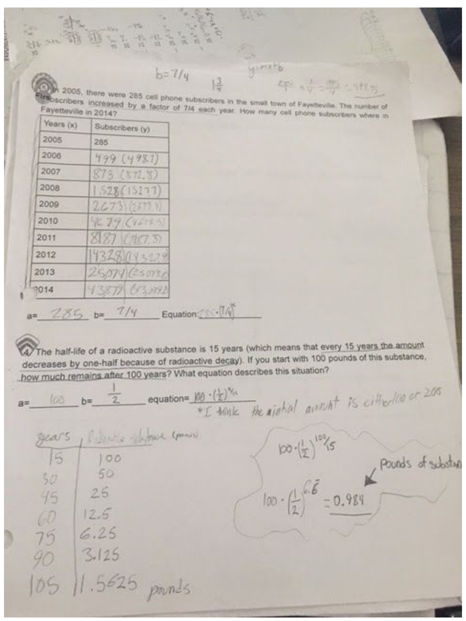
Where it's labeled X, is where we had to fill in the table. This was challenging because we needed to use the habit of a mathematician *be systematic,* because I needed to stay organized while trying to find a pattern within the table. The equation we need to create has the format of y= a*b^x. The variable *a* is the initial amount when x is zero (y), and *b* is the base, also known as the factor by which the population grows when x increases by one unit. While looking at the table I put in earlier, the initial amount would be 1/4, because x is 0 and y is 1/4. Now to find the base. You can do this by dividing two of the products of y that are right next to each other. In this case, we could divide 16 by 4, equalling 4. Then our equation would become y=(1/4)*4^x. This equation represents exponential growth, due to the rate of change (1/4), and the x representing the exponent that 4 would go by.

The next document I'll be discussing is the population and food supply problem. We did this on the board with Mr. Corner, and wrote it down in our notebooks. The problem was about finding the function for the population increase, function for the food supply increase, then finding in how many years the country will first experience food shortage using the website Desmos.com.

The problem was set up like this:

*"The population of a country is initially 2 million people, and is increasing at 4% per year. The country's food supply is initially adequate for 4 million people and is increasing at a constant rate adequate for an additional 0.5 million people per year."*





Now to set up the equation for the population. We see that it states the population's initial amount is 2 million people. But we don't want to write out 2 million, so we'll keep it at 2. Because the rate of change is increasing, we must convert the percentage and add it to 1. Therefore, 0.04 plus 1 is 1.04. Now we have enough information to set up the equation:

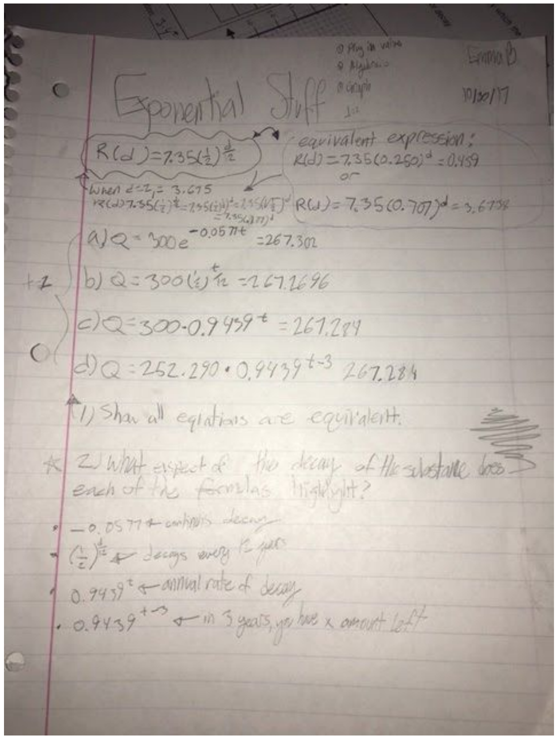
*y=2(1.04)^t (pop. t=years)*

Now for the food supply. From the sound of the problem, it looks like a linear equation because of keywords like *additional*, which isn't in an exponential growth equation like the population one, it will be linear. Linear equations are usually set up like this: y=mx+b. For m, we'll use 0.5 million, and for b, we'll use 4 million. But then again, we don't want to use a million for the numbers, so we'll shorten it and just use the shortened numbers as representatives of a million. Continuing, our equation now looks like this:

*y=0.5t+4 (food supply. t=years)*

To find in how many years the country will experience food shortage, you graph both equations on Desmos, and find where the points meet. When I did that, I got 78 years.

**Forms of Exponential Equations**


Exponential Stuff

Emma B

10/30/17

Plug in value
Algebraic
Graph

$R(d)=7.35(\frac{1}{2})^{\frac{d}{2}}$

equivalent expression: $R(d)=7.35(0.250)^d=0.459$ or $R(d)=7.35(0.707)^d=3.6758$

When d=2, = 3.675

a) $Q=300e^{-0.0577t}=267.302$

b) $Q=300(\frac{1}{2})^{\frac{t}{12}}=267.2696$

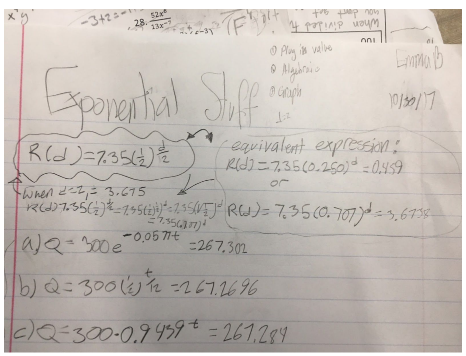
c) $Q=300\cdot 0.9459^t=267.284$

d) $Q=252.290\cdot 0.9439^{t-3}$ 267.284

1) Show all equations are equivalent.

2) What aspect of the decay of the substance does each of the formulas highlight?

- $-0.0577t$ ← continuous decay
- $(\frac{1}{2})^{\frac{t}{12}}$ ← decays every 12 years
- $0.9439^t$ ← annual rate of decay
- $0.9439^{t-3}$ ← in 3 years, you have x amount left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2. **Forms of Exponential Equations (Last Assignment on Board)**
    a. Describe how you made sense out of the Forms of Exponential Equation.

This was extremely hard to understand when Mr. Corner started writing more equations on the board next the original ones. To be honest, I got so lost on that part. The problem states,
"A scientist places 7.35 grams of element on the dish. The half-life of the element is 2 days. After d days, the number of grams remaining in the dish is a function of:
*R(d)=7.35(1/2)^d/2.* D representing days, R representing grams left in the dish.
Then in part two, two approximate equivalent expressions are given: *R(d)=7.35(0.250)^d*, and *R(d)=7.35(0.707)^d*. We must place the same number in all the equations to test if the other equations are really equivalent to the first one. For example, if we plug in 2 to all of them, it would look like this.

*R(d)=7.35(1/2)^d/2*

| | | |
|---|---|---|
| *7.35(1/2)2/2*<br>First, we plug in the number 2 where d would be, and solve for the exponential part. | *7.35*1/2*<br>After solving that, multiply 1/2 times the initial amount; 7.35. | *3.674*<br>This is the end result |

*R(d)=7.35(0.250)^d*

| | | |
|---|---|---|
| *7.35(0.250)^2* | *7.35*0.0625*<br>After solving the exponential part, | *0.459*<br>This is our end result. |

| | | |
|---|---|---|
| First, plug in the number 2 where d would be, and solve for the exponential part | we then multiply that times the initial amount, 7.35. | |

*R(d)=7.35(0.707)^d*

| | | |
|---|---|---|
| *7.35(0.707)^2*<br>We plug in the number 2 where d would be, and solve for the exponential part | *7.35*0.499849*<br>After solving the exponential part, we then multiply that times the initial amount, 7.35. | *3.674*<br>This is the result. |

As you can see, only one of the other equations were remotely close to the first equation. Except, it's one decimal number off. (3.675 and 3.674) The equation in the middle isn't even in the slightest bit close to the other answers.

We were then given four new equations to test if they were equivalent to each other. This is the work for it if we plug 2 in for *t*:

*300e^-0.0577t*

| | | |
|---|---|---|
| *300e^-0.0577^2*<br>First we plug 2 into the equation, and multiply that times -0.0577 | *300e^-0.1154*<br>Because *e* is involved with this, we need to plug it into a calculator. | *267.302*<br>This is our result. |

*300(0.5)^t/12*

| | | |
|---|---|---|
| *300(0.5)^2/12* First, we plug in 2 into the equation, divide it by 12, and multiply that times 0.5. | *300*0.083* Then we multiply 300 by 0.083. | *267.270* This is the result. |

*300.9439^t*

| | | |
|---|---|---|
| 300*0.9439^2 Plug in 2 to the equation, and solve for the exponent. | 300*0.89094721 Then, multiply 300 by the giant number you got from the exponent. | 267.284 This's the result. |

*252.29*0.9439^t-3*

| | | |
|---|---|---|
| 252.290*0.9439^-1 Solve for the exponent part, 0.0439 to the power of negative one. | 252.290*1.059 You're then left with an expression to multiply. | 267.285 This is the result. |

As you can see, all of them are fairly fairly close to each other, the only numbers the are different are the numbers that come after the decimal point. To be frank, I didn't understand how to find out how the equations were equivalent or not, until Mr. Corner said to plug in a number for the variables. Then

| | | |
|---|---|---|
| | everything became more clear. If I used any of the habits of a mathematician, I believe it'd be conjecture and test, because this work was all about testing to see if everything was equivalent. | |
| | | |