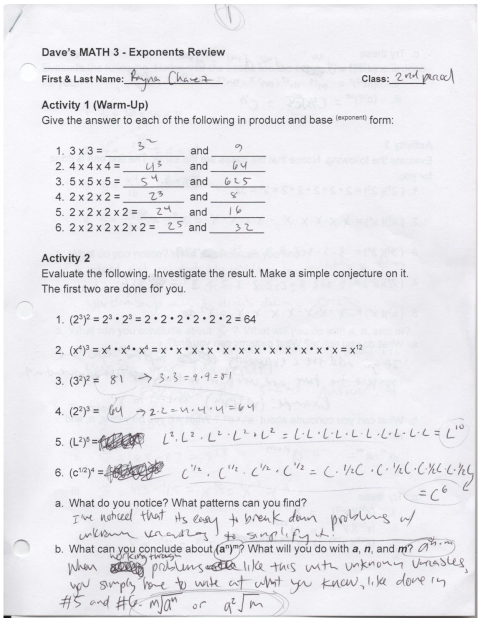
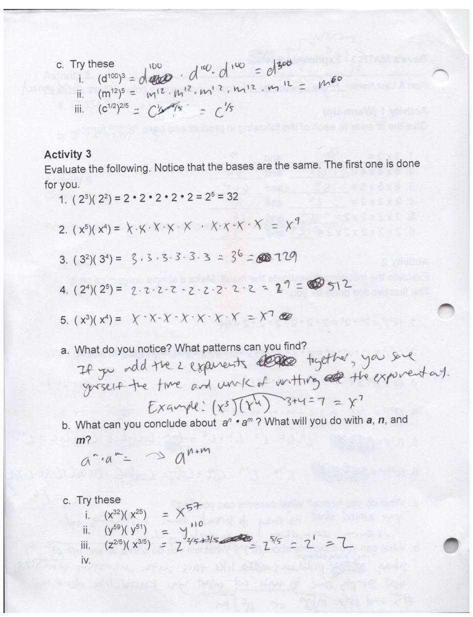
Rayna Chavez

Exponents Units Portfolio Learning Statement

Seeing as the scans of my work down below may not be large enough to see, here is the sharing link to a google documents folder containing all of these photo scans.

<table>
<tr><th>Beautiful examples (Your assignment work here! Evidence)</th><th>Amazing Narratives</th><th>How I feel about my preparedness for:</th></tr>
<tr><td>Exponent Rules
Photo 1-3:

Dave's MATH 3 - Exponents Review
First & Last Name: Rayna Chavez Class: 2nd period
Activity 1 (Warm-Up)
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 = 5^4 and 625
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. $(3^2)^2 = 81 \rightarrow 3 \cdot 3 = 9 \cdot 9 = 81$
4. $(2^2)^3 = 64 \rightarrow 2 \cdot 2 = 4 \cdot 4 \cdot 4 = 64$
5. $(L^2)^5 = L^2 \cdot L^2 \cdot L^2 \cdot L^2 \cdot L^2 = L \cdot L \cdot L \cdot L \cdot L \cdot L \cdot L \cdot L \cdot L \cdot L = L^{10}$
6. $(c^{1/2})^4 = c^{1/2} \cdot c^{1/2} \cdot c^{1/2} \cdot c^{1/2} = c \cdot 1/2c \cdot c \cdot 1/2c \cdot c \cdot 1/2c \cdot c \cdot 1/2c = c^6$
a. What do you notice? What patterns can you find?
I've noticed that its easy to break down problems w/ unknown variables to simplify it.
b. What can you conclude about $(a^n)^m$? What will you do with a, n, and m? $a^{n \cdot m}$
When working through problems like this with unknown variables, you simply have to write out what you knew, like done in #5 and #6. $m\sqrt{a^n}$ or $a^2\sqrt{m}$

c. Try these
i. $(d^{100})^3 = d^{100} \cdot d^{100} \cdot d^{100} = d^{300}$
ii. $(m^{12})^5 = m^{12} \cdot m^{12} \cdot m^{12} \cdot m^{12} \cdot m^{12} = m^{60}$
iii. $(c^{1/2})^{2/5} = c^{1/5}$
Activity 3
Evaluate the following. Notice that the bases are the same. The first one is done for you.
1. $(2^3)(2^2) = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^5 = 32$
2. $(x^5)(x^4) = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^9$
3. $(3^2)(3^4) = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 3^6 = 729$
4. $(2^4)(2^5) = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^9 = 512$
5. $(x^3)(x^4) = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^7$
a. What do you notice? What patterns can you find?
If you add the 2 exponents together, you save yourself the time and work of writing the exponent out.
Example: $(x^3)(x^4)$ 3+4=7 = x^7
b. What can you conclude about $a^n \cdot a^m$? What will you do with a, n, and m?
$a^n \cdot a^m = \rightarrow a^{n+m}$
c. Try these
i. $(x^{32})(x^{25}) = x^{57}$
ii. $(y^{59})(y^{51}) = y^{110}$
iii. $(z^{2/5})(x^{3/5}) = z^{2/5+3/5} = z^{5/5} = z^1 = z$
iv.</td>
<td>The Exponents Review packet [shown in photos 1-3] wasn't difficult for me. Overall, I moved through the whole Exponents Rules unit pretty smoothly, however, this first, Exponent Review packet was easier than it all. I finished the packet in under 20 minutes--which, surprisingly, is fast for me. I'm a slow worker)--however I spent more time on activities 4 and 5, as they came at me with more difficulty. Not to say that it was too difficult, but if I had to pluck a weakness out of this packet that I have with exponents, It would be the content covered in these activities.
The last 2 columns in the Exponents Rules and Practice packet were pretty difficult for me and took me some time and aid to complete them. Working on every other problem in this packet, I solved many of them incorrectly at first and had to learn from my mistakes by resolving them. However, I learned how to do many of the problems I previously hadn't grasped--though sadly, not all of them. I never learned how to solve problems #26, #29 and #37. There was still unclarity there after I finished the packer, however moving through the rest of this unit afterwards, I've gotten practice with exponents and am now able to solve these problems.
The last packet in the Exponent Rules portion of this unit, "Evaluating Exponential Equations" [shown in photo 4], was a bit confusing for me, and honestly, still is. I didn't understand how I could apply the knowledge we have gained from the other packets to prove whether Henrie or Henrietta made the correct conclusion. The content was still pretty new to me and I, personally, hadn't gotten enough practice with working with exponential equations to solve these and problems. I could have reached out to my teachers for some extra help on this (and other) packets, instead of only asking me peers for help. I think that for this problem, asking my peers for help only steered me in the wrong direction</td>
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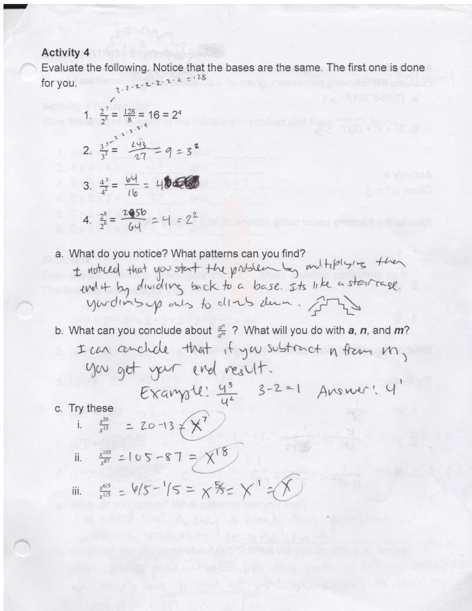


Activity 4

Evaluate the following. Notice that the bases are the same. The first one is done for you.

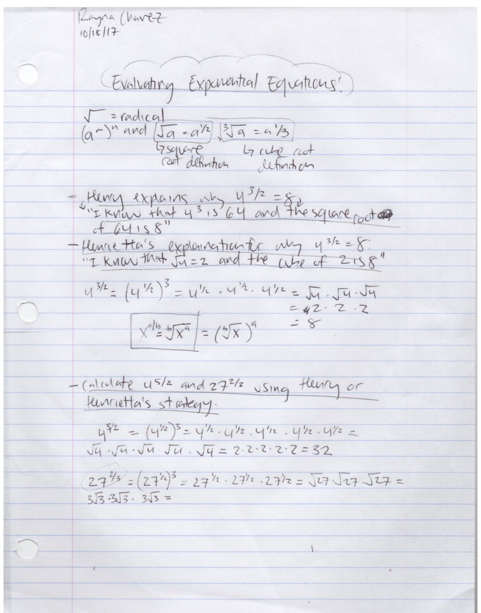
1. $\frac{2^7}{2^3} = \frac{128}{8} = 16 = 2^4$
2. $\frac{3^5}{3^3} = \frac{243}{27} = 9 = 3^2$
3. $\frac{4^3}{4^2} = \frac{64}{16} = 4$
4. $\frac{2^8}{2^6} = \frac{256}{64} = 4 = 2^2$

a. What do you notice? What patterns can you find?
I noticed that you start the problem by multiplying then end it by dividing back to a base. Its like a staircase.

b. What can you conclude about $\frac{a^m}{a^n}$? What will you do with a, n, and m?
I can conclude that if you subtract n from m, you get your end result.
Example: $\frac{4^3}{4^2}$ 3-2=1 Answer: 4^1

c. Try these
i. $\frac{x^{20}}{x^{13}} = 20-13 = x^7$
ii. $\frac{x^{105}}{x^{87}} = 105-87 = x^{18}$
iii. $= 4/5 - 1/5 = x^{1} = x$

Photo 4:



10/18/17

Evaluating Exponential Equations!

$\sqrt{\ } =$ radical

$(a^m)^n$ and $\sqrt{a} = a^{1/2}$ square root definition; $\sqrt[3]{a} = a^{1/3}$ cube root definition

- Henry explains why $4^{3/2} = 8$: "I know that 4^3 is 64 and the square root of 64 is 8"
- Henrietta's explanation for why $4^{3/2} = 8$: "I know that $\sqrt{4} = 2$ and the cube of 2 is 8"

$4^{3/2} = (4^{1/2})^3 = 4^{1/2} \cdot 4^{1/2} \cdot 4^{1/2} = \sqrt{4} \cdot \sqrt{4} \cdot \sqrt{4} = 2 \cdot 2 \cdot 2 = 8$

- Calculate $4^{5/2}$ and $27^{3/2}$ using Henry or Henrietta's strategy.

$4^{5/2} = (4^{1/2})^5 = 4^{1/2} \cdot 4^{1/2} \cdot 4^{1/2} \cdot 4^{1/2} \cdot 4^{1/2} = \sqrt{4} \cdot \sqrt{4} \cdot \sqrt{4} \cdot \sqrt{4} \cdot \sqrt{4} = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

$27^{3/2} = (27^{1/2})^3 = 27^{1/2} \cdot 27^{1/2} \cdot 27^{1/2} = \sqrt{27} \cdot \sqrt{27} \cdot \sqrt{27} = 3\sqrt{3} \cdot 3\sqrt{3} \cdot 3\sqrt{3} =$
</td>
<td>because communication was loose.</td>
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Exponential Growth and Decay Models

Photos 5-6:
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<td>This portion of the unit was okay in difficulty for me. I found, overall that a lot of what we were working with with continuous compounding was pretty simple for me. For example, the Continuous Compounding assignment *[shown in photo 5-6]* was straightforward for me and took me about 15 minutes to complete. The only portion I got a little stuck on is #3 of this paper. I knew how to plug in the numbers, but I entered it into my calculator incorrectly, so when we went over it in class, I had to go back and find the error of my ways. I also showed this same understanding of continuous compounding in the Population and Food Supply *[shown in photo 7]* worksheet as</td>
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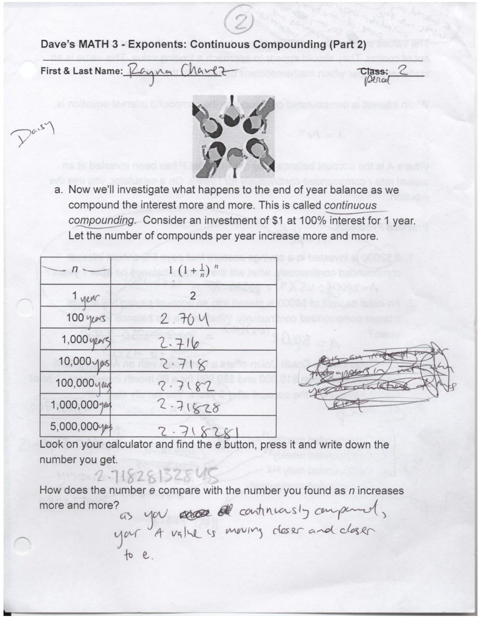


Dave's MATH 3 - Exponents: Continuous Compounding (Part 2)

First & Last Name: Rayna Chavez Class: 2 period

a. Now we'll investigate what happens to the end of year balance as we compound the interest more and more. This is called *continuous compounding*. Consider an investment of $1 at 100% interest for 1 year. Let the number of compounds per year increase more and more.

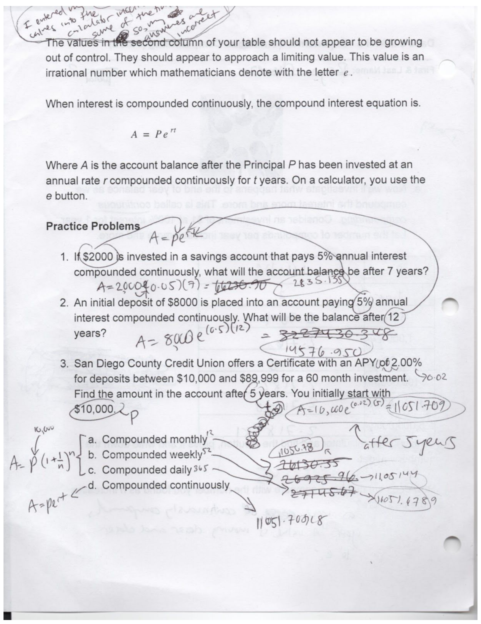
n	$1\left(1+\frac{1}{n}\right)^n$
1 year	2
100 years	2.704
1,000 years	2.716
10,000 years	2.718
100,000 years	2.7182
1,000,000 years	2.71828
5,000,000 years	2.718281

Look on your calculator and find the *e* button, press it and write down the number you get.

2.718281828459

How does the number *e* compare with the number you found as *n* increases more and more?

as you continuously compound, your A value is moving closer and closer to e.



I entered my values into the calculator incorrectly some of the time so my answers are incorrect

The values in the second column of your table should not appear to be growing out of control. They should appear to approach a limiting value. This value is an irrational number which mathematicians denote with the letter e.

When interest is compounded continuously, the compound interest equation is.

$$A = Pe^{rt}$$

Where *A* is the account balance after the Principal *P* has been invested at an annual rate *r* compounded continuously for *t* years. On a calculator, you use the *e* button.

Practice Problems

$A = Pe^{rt}$

1. If $2000 is invested in a savings account that pays 5% annual interest compounded continuously, what will the account balance be after 7 years?
   $A = 2000e^{(0.05)(7)} = \cancel{66230.90}$ 2835.135
2. An initial deposit of $8000 is placed into an account paying 5% annual interest compounded continuously. What will be the balance after 12 years?
   $A = 8000e^{(0.5)(12)} = \cancel{3227430.348}$ 14576.950
3. San Diego County Credit Union offers a Certificate with an APY of 2.00% for deposits between $10,000 and $89,999 for a 60 month investment. Find the amount in the account after 5 years. You initially start with $10,000. P
   0.02
   $A = 10{,}000e^{(0.02)(5)} = 11051.709$ after 5 years

   $A = P\left(1+\frac{1}{n}\right)^n$
   a. Compounded monthly 12 — 11050.78
   b. Compounded weekly 52 — ~~26130.35~~
   c. Compounded daily 365 — ~~26925.96~~ 11,051.44
   d. Compounded continuously — ~~27145.67~~ 11051.6789

   $A = Pe^{rt}$ — 11051.70918

Photo 7:

well.
After this portion of the unit, I had grasped exponential growth and decay rate problems as well. For example, with the previous practice we had with growth and decay rate, I found the "Exponential Growth and Decay Rate" *[shown in photos 8-10]* the clearest packet of this unit. This topic was easy for me to understand, so completing this packet went smoothly and was good practice for me.

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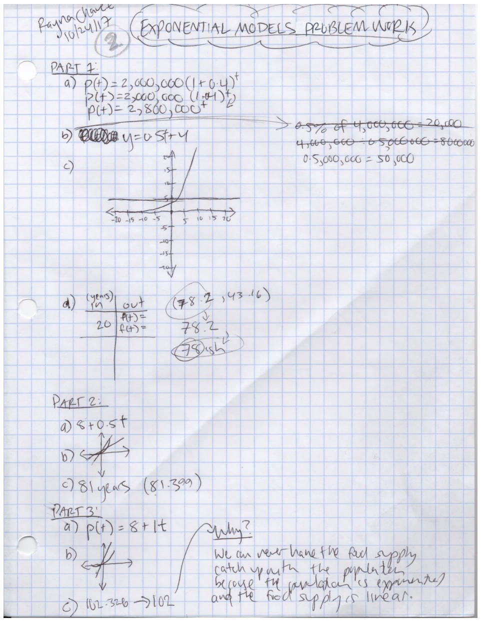
<td>
Rayna Chance
10/24/17
2
EXPONENTIAL MODELS PROBLEM WORK
PART 1:
a) $p(t) = 2{,}000{,}000(1+0.4)^t$
$p(t) = 2{,}000{,}000\,(1.4)^t$
$p(t) = 2{,}800{,}000^t$
b) $y = 0.5t + 4$
~~0.5% of 4,000,000 = 20,000~~
~~4,000,000 · 0.5,000,000 = 800000~~
0.5,000,000 = 50,000
c)
d) (years) in | out
20 | p(t) =
f(t) =
(78.2, 43.16)
78.2
78ish
PART 2:
a) $8 + 0.5t$
b)
c) 81 years (81.399)
PART 3:
a) $p(t) = 8 + 1t$
b)
c) 102.326 → 102
Why?
We can never have the food supply catch up with the population because the population is exponential and the food supply is linear.

Photos 8-10:⇩</td>
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Dave's MATH 3 - Exponential Growth and Decay Rate

First & Last Name: Rayna Chavez Class: 2 period

Definition

Growth or Decay Rate - The percentage change in a quantity per 1 unit of time is called the growth or decay rate *r*.

growth $b = 1 + r$ and, $b = 1 - r$ decay $\frac{9\%}{100} = 0.09$

$r = b - 1$

Where r is a percentage written as a decimal and b is the base of an exponential function of the form $f(t) = a \cdot b^t$ where t = time.

Match an equation to each situation, and then indicate whether the situation is an example of exponential growth or decay.

1. A coin has a value of $1.17 in 1995. Its value has been increasing at a rate of 9% per year.

   a. $V(t) = 1.17(1.09)^t$ b. $V(t) = 1.17(0.91)^t$

   0.09

x	y
1995	1.17
1996	
etc	

2. A business owner has just paid $6000 for a computer. It depreciates at a rate of 22% per year. How much will it be worth in 5 years?

   decay = r = b - 1 0.22

   a. $A(5) = 6000(1.22)^5$ b. $A(5) = 6000(0.78)^5$

3. A city has a population of 14,358 residents in 2017. Since then, the population has been decreasing at a rate of about 5.5% per year.

x	y
2017	14,358

   a. $P(t) = 14,358(1.055)^t$ b. $P(t) = 14,358(0.945)^t$

   r = b - 1

   0.055

4. The Gross Domestic Product (GDP) of Germany in 2005 was approximatley 2.9 trillion U.S. dollars (US$) and has been growing by a rate of about 2.5% per year.

   Source: Estimated from the CIA World Factbook and www.data.un.org

   $0.025 + 1 = 1.025$

   a. Find an equation for a model for the GDP of Germany.

   $W(t) = 2.9$ trillion $(1.025)^t$

   b. Use your model to estimate GDP of Germany in 2010.

   $W(5) = 2.9$ trillion $(1.025)^5$ 1.131

   $W(5) = 2.9$ trillion (1.131)

   3.28 trillion

X	Y
(2005) 0	2.9 trillion
(2006) 1	—
(2007) 2	—
(2008) 3	—
(2010) 5	—

5. A survey of Boulder, Colorado, residents asked about the optimal size for growth. The results of this survey state that most residents thought that a growth in population at a rate of 10% per year was desirable. In the year 2000, there were approximately 96,000 people in Boulder.

   Source: Census 2000

   0.010

   1.010

   a. Find an equation for a model for the population of Boulder, Colorado, if the growth rate is 10% per year.

   $P(t) = 96,000(1.010)^t$

   b. Use your model to estimate the population of Boulder, Colorado, in 2002 to see what the population of Boulder would be if the 10% growth rate has been achieved.

   $P(2) = 96,000(1.010)^2$

   $P(2) = 96,000(0.0001)$

   9.6

6. In 2008, South Africa had a population of about 43.8 million, but that population was estimated to be decreasing by approximately 0.5% per year

   Source: CIA World Factbook 2008.

   $1 - 0.005 = 0.995$

   a. Find an equation for a model for the population of South Africa.

   $P(t) = 43.8$ million $(0.995)^t$

   b. Use your model to estimate the population of South Africa in 2020.

   $P(12) = 43.8$ million $(0.995)^{12}$

   $P(12) = 43.8$ million (0.9416)

   $P(12) = 41.24$ million

x	y
(2008) 0	43.8m
1	
(2010) 2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
(2020) 12	

7. Write an exponential model for a population that started with 200 animals and is shrinking at an annual rate of 2% per year. How many animals will be left in 5 years?

   $P(t) = 200(0.98)^t$

   $P(5) = 200(0.98)^5$

   $P(5) = 181$ animals

8. A new Tesla car bought for $35,000 depreciates only 28% ~~in 3~~ per year~~s~~. What is the value of the car after 5.5 years or approximately 100,000 miles? (Calculations are based on an average drive of 50 miles per day) Reference: https://electrek.co/2017/08/22/tesla-model-3-depreciation-report/

   $V(x) = 35,000(0.72)^x$

   $V(5.5) = 35,000(0.72)^{5.5}$

   $V(5.5) = 35,000(0.164)$

   $V(5.5) = 5746.412$ dollars

9. The population of the Virgin Islands can be modeled by

   $V(t) = 109.8(0.99939)^t$

   Where $V(t)$ is the population of the Virgin Islands in thousands t years since 2010.

   Source: CIA World Factbook 2010.

x	y
(2010) 0	
1	
2	
3	
4	
(2015) 5	

   a. Estimate the population of the Virgin Islands in 2015.

   b. According to this model, what is the decay rate of the Virgin Islands' population?

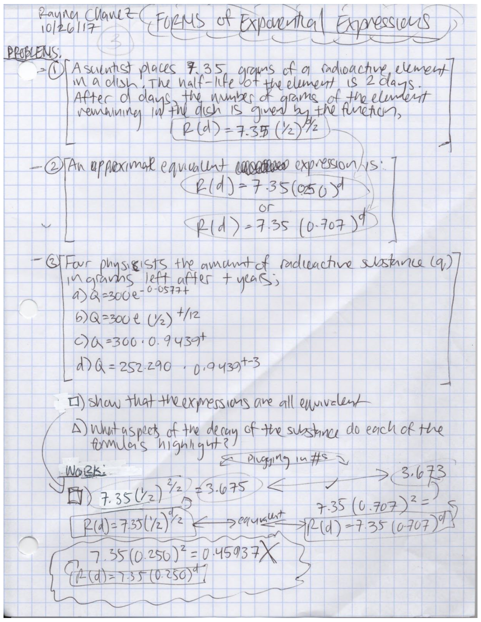
   $V(5) = 109.8(0.99939)^5$

   109.46 thousand people

   $\frac{0.99939}{0.00061}$ or .061%

Forms of Exponential Equations

Photos 11-12:



Rayna Chavez 10/26/17 Forms of Exponential Expressions

PROBLEMS:

① A scientist places 7.35 grams of a radioactive element in a dish. The half-life of the element is 2 days. After d days, the number of grams of the element remaining in the dish is given by the function, $R(d) = 7.35(1/2)^{d/2}$

② An approximate equivalent expression is: $R(d) = 7.35(0.50)^d$ or $R(d) = 7.35(0.707)^d$

③ Four physicists the amount of radioactive substance (q) in grams left after t years:

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

b) $Q = 300e(1/2)^{t/12}$

c) $Q = 300 \cdot 0.9439^t$

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

□) Show that the expressions are all equivalent

△) What aspect of the decay of the substance do each of the formulas highlight?

WORK: plugging in #s

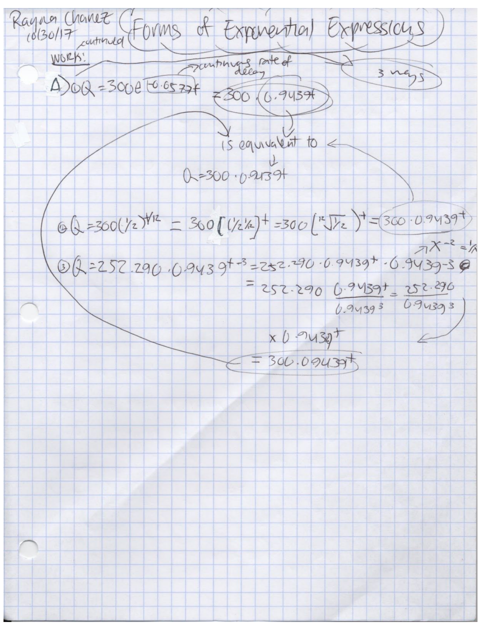
□) $7.35(1/2)^{2/2} = 3.675$ — 3.675

$7.35(0.707)^2 =$

$R(d) = 7.35(1/2)^{d/2}$ ⟷ equivalent ⟷ $R(d) = 7.35(0.707)^d$

$7.35(0.250)^2 = 0.459375$ X

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



Rayna Chavez 10/30/17 continued Forms of Exponential Expressions

WORK: continuous rate of decay — 3 ways

△) a) $Q = 300e^{-0.0577t} = 300 \cdot (0.9439)^t$

is equivalent to

$Q = 300 \cdot 0.9439^t$

b) $Q = 300(1/2)^{t/12} = 300[(1/2)^{1/12}]^t = 300(\sqrt[12]{1/2})^t = 300 \cdot 0.9439^t$

$x^{-2} = 1/x^2$

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

$= 252.290 \cdot \frac{0.9439^t}{0.9439^3} = \frac{252.290}{0.9439^3}$

$\times 0.9439^t$

$= 300 \cdot 0.9439^t$

This far into this unit, things were flowing fairly smoothly, however, I hit a boulder when I reached this Forms of Exponential Equations problem *[shown in photos 11-12]*. One issue is that I didn't have enough time to work on it, so there was a limit to how far I could more through the problem. We had about 15 minutes total of worktime in class, but after that, I only had about 5 more minutes to work on it at home before I fell asleep while working on it, The following day when we reviewed it, however, it made total sense and I practically slapped my head in having not figured out the solutions. Given that I had little time and was tired in class and at home when working on it is probably why this one really stumped me and why I barely moved anywhere with it on my own. It frustrated me that I feel I could have gotten to the solution but didn't and I think that this is a sign that I need more sleep or something.