

Assignment #21

Unit 3 Exponential Review #4 2022

- Leah deposits \$150 into an account that earns 7% APR compounded monthly.
- Will deposits \$175 into an account that earns 7.85% compounded quarterly.

This is a decent high challenge problem. You will need to clearly show all of your work.

They both want to buy a really nice hover board that costs \$310.

Who's account will get to the \$310 faster. To get full credit show all of your work including doing log as a last step.

Leah

Equation:

$$y = 150 \left(1 + \frac{.07}{12}\right)^x$$

$$310 = 150 \left(1 + \frac{.07}{12}\right)^x$$

$$\frac{310}{150}$$

$$\log \left(1 + \frac{.07}{12}\right) \left(\frac{310}{150}\right) = x$$

$$\frac{124.8}{12}$$

Total Time

10.4 years

Will

Equation:

$$y = 175 \left(1 + \frac{.0785}{4}\right)^x$$

$$310$$

$$\log \left(1 + \frac{.0785}{4}\right) \left(\frac{310}{175}\right)$$

$$\frac{29.4}{4}$$

Total Time

7.35 years

Who's account gets there faster?

Will

General FOUNDATIONAL Key concepts carried over from earlier units.

1) You should be able to say what function models a certain situation. You should always be able to write out a function (maybe multiply it out) and see what family of functions it belongs to.

Examples: Write the function that describes the scenario and state the family it belongs to.

a) You start with \$200 in the bank and then you add \$20 each week.

$$y = 20x + 200 \quad \boxed{\text{Linear}}$$

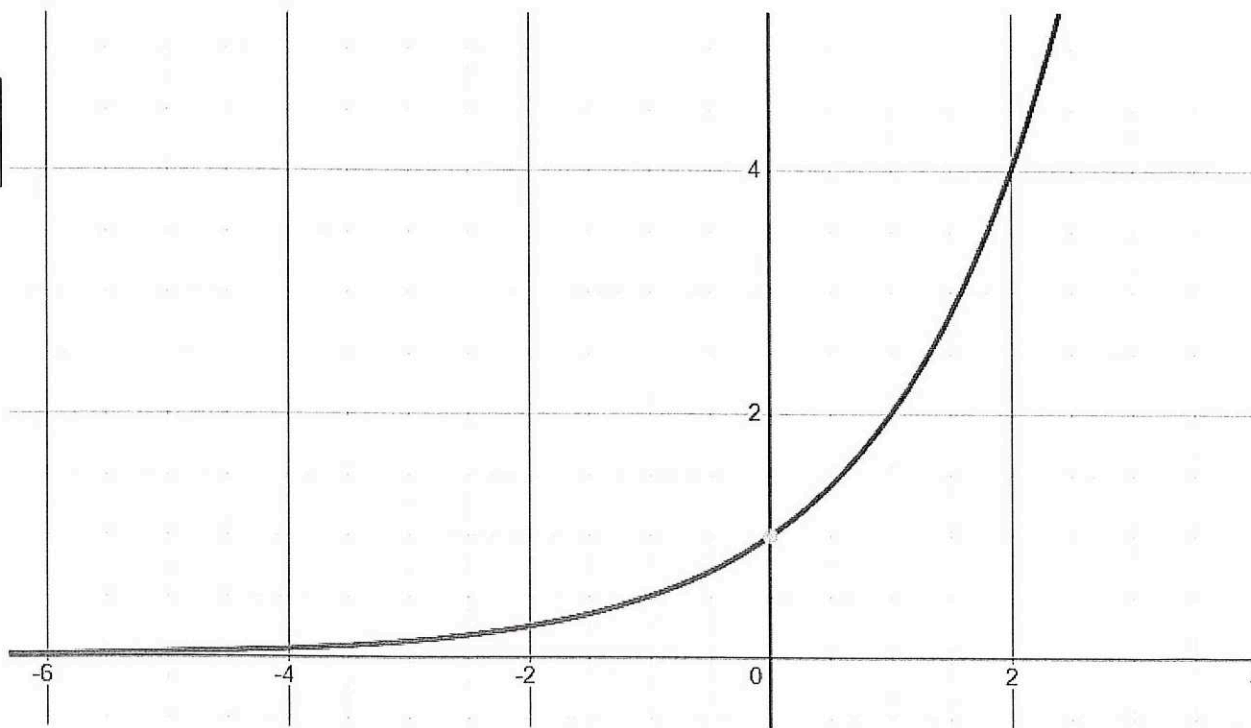
b) The area of a rectangle with a width of x and a length of four times the width.

$$A = x(4x) \quad 4x^2 \quad \boxed{\text{Quadratic}} \quad \begin{array}{|c|} \hline 4x^2 \\ \hline x \\ \hline \end{array} 4x$$

c) The volume of an open top box. The function can be modeled $y = x(18-2x)(20-2x)$

$$\text{Cubic} \quad x \cdot x \cdot x = x^3 \quad 4x^3 - 76x^2 + 360x$$

2) You should be able to identify the graphs of functions...specifically in this unit what does an exponential function look like?

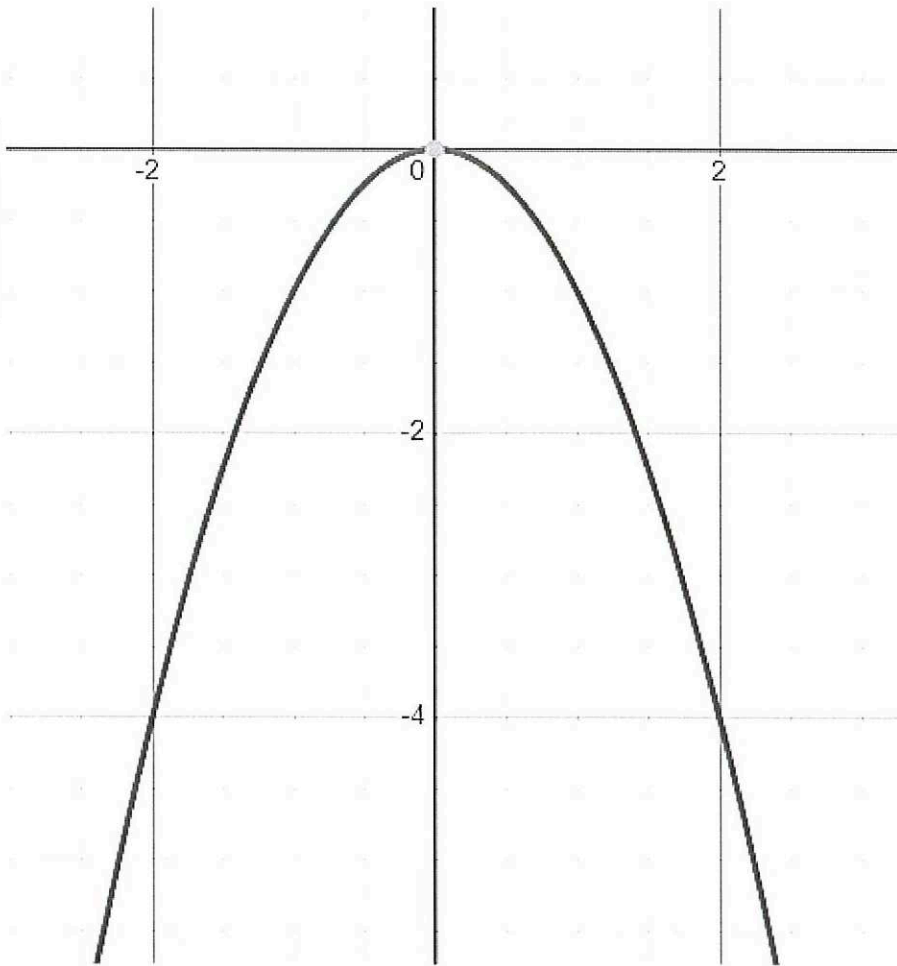


A

$$\begin{array}{r|l} 18 & -2x \\ \hline 20 & 360 \quad | \quad -40x \\ \hline -2x & -36x \quad | \quad 4x^2 \\ \hline \end{array}$$

$$4x^2 - 76x + 360$$

B



2a) Which one of the above graphs is an exponential function? Choice A or B

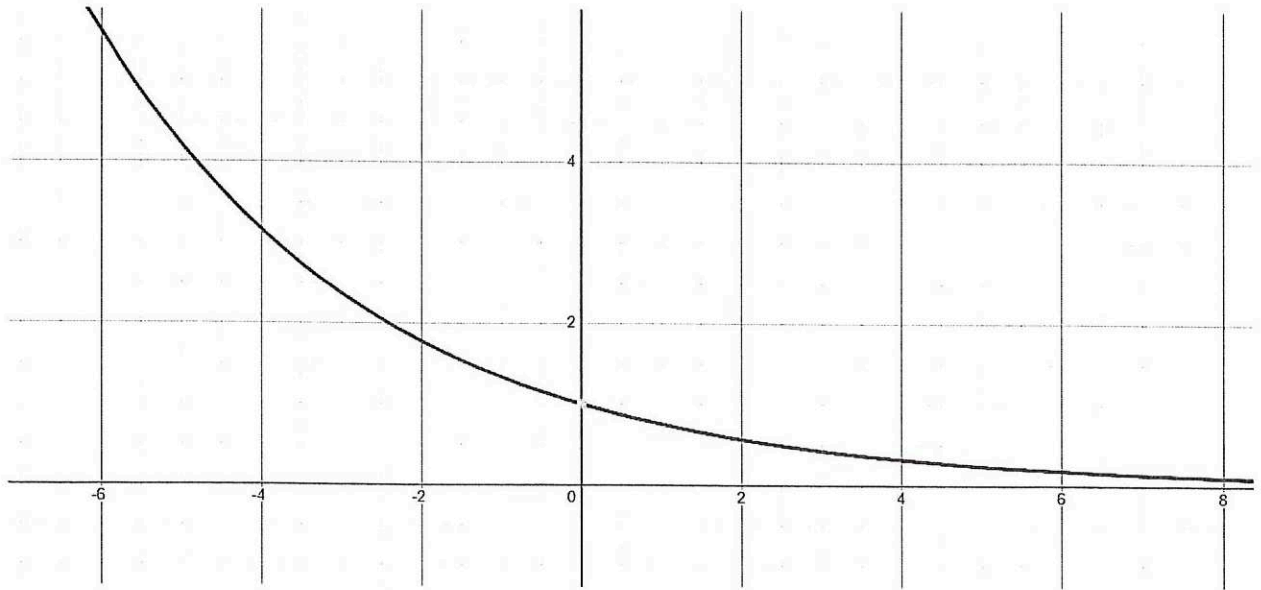
Choice A

2b) Describe the rate of change in graph A from the interval $0 \leq x < 20$

Increasing at an Increased Rate

2c) Describe the rate of change in graph B from the interval $-32 \leq x < 0$

Decreasing at a Decreased Rate



3) Remembering that we read a graph from left to right, describe the rate of change for the above function

A	B	C	D
Increasing at an increased rate	Increasing at a decreased rate	Decreasing at an increased rate	Decreasing at a decreased rate

4) I can simplify using the properties of exponents:

a) $(-12xy^5)(7xy^3)$

$$-84x^2y^8$$

Final answer 4a

$$-84x^2y^8$$

b) $10(2x^4)^5$

$$10 \cdot 2^5 \cdot x^{20} = 320x^{20}$$

Final answer 4b

$$320x^{20}$$

c) $\frac{x^8y^{-2}}{x^{12}y^4}$

$$\frac{1}{x^4y^6}$$

Final answer 4c

$$\frac{1}{x^4y^6}$$

5) I know the relationship between Log and exponential equations.

a) Re-write the exponential as a log:

$2^x = 85$

$\log_2 85 = x$

b) Re-write the log as an exponential:

$\log_4(16) = 2$

$4^2 = 16$

6) Markus bought a car for \$12,000. The value of the car will depreciate 5% each year. About how long will it take for the car to reach a value of \$8,250

$\log_{0.95} \left(\frac{8250}{12000} \right)$

$8250 = 12,000(.95)^x$

A	B	C	D
7.3 years	7.85 years	22 years	5 years

7) You got bit by a really nasty foaming dog. You now have the virus... 2.5ml of it to be exact. You have the sweats and are tired but you have a strong desire to get cured so you can continue to make it to math class each day. You have the medicine and the virus will decay by half each hour.

Write the equation to describe this scenario.

$y = 2.5 (.5)^x$

$\frac{2.5 (.5)^x}{2.5} = \frac{0.001}{2.5}$

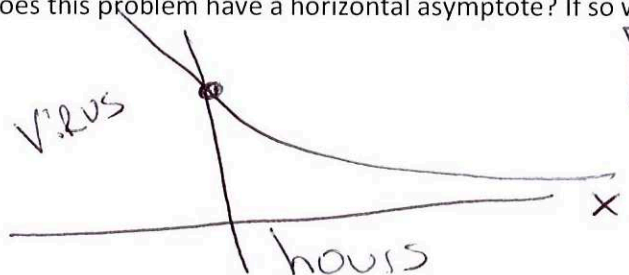
About how long will it take for the nastiness to go away.

$\log_{.5} .0004$

11.28 hours

.0004

Does this problem have a horizontal asymptote? If so what is it? What does it mean?



Yes $y = 0$

It has a horizontal asymptote at $y = 0$ because you will never be totally free of the virus. It will always be in your body

8) Re-Write the radical expression $\sqrt[4]{x^8}$ as an expression with a rational exponent

Final answer for #8

$$x^{\frac{8}{4}} \text{ or } x^2$$

9) re-write the expression $x^{\frac{4}{5}}$ as an expression with a radical sign.

* Make sure you know the Root is the denominator in the fraction

Final answer for #9

$$\sqrt[5]{x^4}$$

I can work with Log Rules:

10) Write the expression $\log_4 500 - (\log_4 5 + \log_4 20)$

$$\log_4 500 - \log_4 100 \quad \log_4 \frac{500}{100}$$

Final answer for #10

$$\log_4 5$$

11) Write the expression $\log_3 800 + \log_3 2$

$$\log_3$$

I can solve equations:

Final answer for #11

$$\log_3 1600$$

12) $\log x = 4$ (Remember that this means base 10)

$$10^4 = x$$

Final answer for #12

$$10,000$$

13) $\ln x = 4$ (remember that \ln means \log_e)

$$\log_e x = 4 \quad \text{so } e^4 = x$$

Final answer for #13

$$54.6$$

14) $\log_x 8 = 2$

$$x^2 = 8 \quad x = \sqrt{8}$$

Final answer for #14

$$2.828$$

15) $4^{2x+5} = 18^{3x-5}$

$$2x+5 = \log_4 18^{3x-5}$$

$$(3x-5) \log_4 18$$

$$(3x-5)(2.08)$$

$$2x+5 = 6.24x - 10.4$$

$$15.4 = 4.24x$$

Final answer for #15

$$3.632$$

16) $\log_3 x = 4$

Final answer for #16
81

17) I can write the equation of a curve in the form $y = U_0(r^x)$

The points of the curve in the form $y = U_0(r^x)$ go through the point (8, 128) (11, 1024). What is the equation....

Remember I should be solving $128r^3 = 1024$ in order to find the rate

Solve for r

$$128r^3 = 1024$$

$$r^3 = 8$$

$$r = 2$$

Once I know the rate I need to Go back to U_0

x	0	1	2	3	4	5	6	7	8
y	.5	1	2	4	8	16	32	64	128

Final equation for #17
 $y = .5(2)^x$

Higher Challenge Problems:

18) $\log_3(x + 8) - \log_3 4 = \log_3 5$

$$\log_3 \frac{x+8}{4} = \log_3 5$$

so $\frac{x+8}{4} = 5$

$$x+8 = 20$$

$$x = 12$$

Final answer for #18
X = 12

19) $2\log_3(x + 2) = \log_3 3$

$$(x+2)^2 = 3$$

$$x^2 + 4x + 4 = 3$$

$$x^2 + 4x + 1 = 0$$

Final answer for #19
-.536 / -3.73

20) $2\log_5(x + 3) - \log_5 4 = \log_5 x - \log_5 16$

$$\frac{(x+3)^2}{4} = \frac{x}{16}$$

$$16(x+3)^2 = 4x$$

$$16(x^2 + 9x + 9) = 4x$$

$$16x^2 + 144x + 144 = 4x$$

$$16x^2 + 140x + 144 = 0$$

$$-4 \pm \frac{\sqrt{16 - 4(1)(1)}}{2}$$

$$\frac{-4 \pm \sqrt{12}}{2}$$

Final answer for #20
 $\frac{-140 \pm \sqrt{140^2 - 4(16)(144)}}{32}$
 $\frac{-140 \pm 101.9}{32}$
-1.19
-7.55