ALG III 3/19/18

Natural Logarithm and Base e

WarmUp: You invest \$1 at a 100% interest rate for one year. You can't remember how often the interest is compounded. You are curious as to whether there is a *maximum* amount of money you could have at the end of the year.

Complete the table.

Conclusions:

Interest is Compounded	$n = ?$	Amount at the End of One Year
annually		
semiannually		
quarterly		
bimonthly		
monthly		
weekly		
daily		
hourly		
each minute		
each second		

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So as *n* gets super huge, the value of $\left(1+\frac{1}{n}\right)^{n}$ gets closer and closer, but never exceeds, e.

Let's see what impact this has on our Compound Interest equation, and answers our original question.

$$A = P\left(1+\frac{r}{n}\right)^{n\cdot t}$$

$$A = P\left(1+\frac{1}{\left(\frac{n}{r}\right)}\right)^{\left(\frac{n}{r}\cdot r\right)t}$$ Pause here and make sure you believe this is equivalent…

$$A = P\left(\left(1+\frac{1}{\left(\frac{n}{r}\right)}\right)^{\frac{n}{r}}\right)^{r\cdot t}$$ Again, pause… same thing?

Now if *n* gets super huge, $\left(1+\frac{1}{\left(\frac{n}{r}\right)}\right)^{\frac{n}{r}}$ approaches *e*, and our formula becomes $A = P\cdot e^{r\cdot t}$

Ex#1: You invest \$200 in an account that pays 4.2% annual interest, but you don't know how often it is compounded. What is the most money you could possibly have at the end of 5 years?

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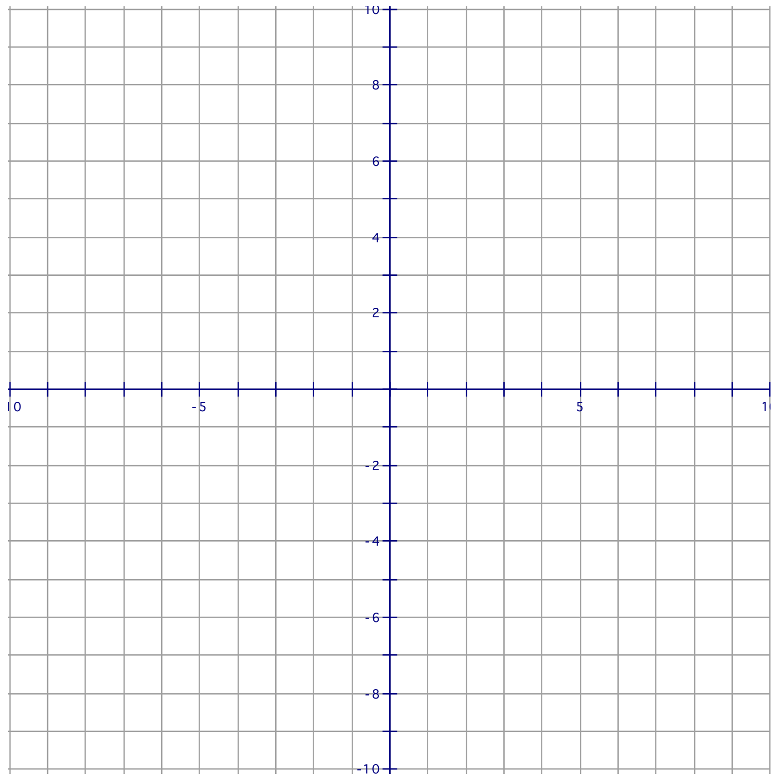
Ex#2: Given $f(x) = e^x$

a) Complete the table and graph $y = f(x)$

x	$f(x)$
-1	
0	
1	
2	



b) On the same axes, graph the inverse. Find the equation of the inverse.

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Ex#3: Simplify.

a) $\ln e^{8}$

b) $5\log_{e} e^{4}$

c) $e^{2\ln 3}$

Ex#4: Solve each equation.

a) $2e^{x} = 38$

b) $\ln e^{x+8} = 12$

c) $2e^{x-4} + 8 = 12$

d) $5\log_{e}(x-4) + 3 = 38$

Assignment: pg. 576 #11-15, 27, 33, 39, 43, 45, 47, 48