MAC 1105 COLLEGE ALGEBRA
TEST 2

Name KEY Score 46

Directions: Answer each question showing ALL work for full credit.

1. How long will it take for a population to double if it grows at a rate of 11.2% per year? Round your answer to the nearest hundredth of a year. (4 points)

$2 = 1 \cdot (1.112)^x$ $\quad a = 1$ (doesn't matter what it is)

$b = 1.112$

$x = \log_{1.112}(2)$ $\quad n = 1$

$x = \frac{\log 2}{\log 1.112} = 6.53$ yrs

2. Ben is saving his money for college. He has \$8,763 in his savings account right now. His goal is to have \$10,000 when he is ready to start college in three years. Assume that the money in Ben's account will grow exponentially and he does not make any additional deposits during this time period. Calculate the percent growth rate per year Ben will need to earn on his money in order for him to reach his financial goal. Round your answer to the nearest tenth of a percent. Hint: Find the growth factor for every three years then use it to find the growth factor for every one year. (6 points)

$a = 8763$

$b = \frac{10000}{8763} = 1.141161703$

$n = 3$

$b^{\frac{1}{n}} = 1.044999865 = 1 + r$

so $r = 4.5\%$ per year

3. A typical beehive contains 20,000 insects. The population increases in size by a factor of 2.5 every 6 weeks.

a) Write a formula that gives the number of bees after x weeks. In your formula, let y represent the number of bees. (4 points)

$a = 20000$

$b = 2.5$

$n = 6$

$y = 20000(2.5)^{\frac{x}{6}}$

b) Use your formula to find out how many bees there will there be after 4 weeks? (2 points)

Plug in $x=4$ into above formula

get $y = 36840$ bees

4. The table below represents exponential decay. Fill in the missing values. (6 points)

t	0	1	2	3	4
C	10	8	6.4	5.12	4.096

$a = 10$

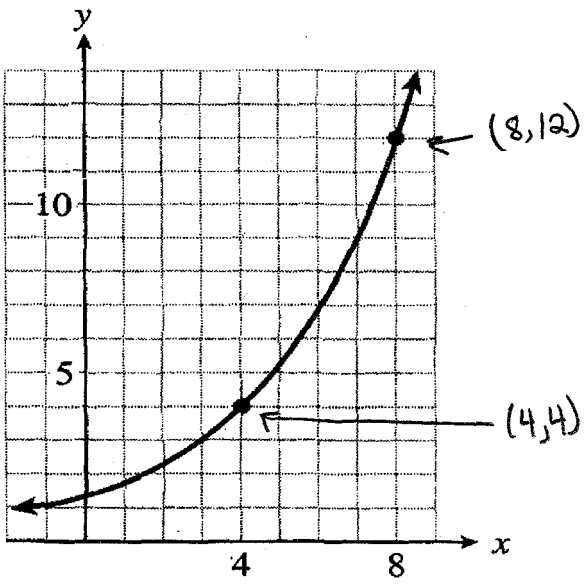
$b = 0.8$

$n = 2$

$y = 10(0.64)^{\frac{x}{2}}$

$= 10(0.8)^x$

5. The graph below represents exponential growth. Find a formula for the graph. (6 points)



$a = ?$ (need to find)

$b = \frac{12}{4} = 3$

$n = 8 - 4 = 4$

$y = a(3)^{\frac{x}{4}}$ plug in $(4,4)$

$4 = a(3)^{\frac{4}{4}}$

$a = \frac{4}{3}$

$y = \frac{4}{3}(3)^{\frac{x}{4}}$

6. **Special Directions:** If you use the graphing features of your calculator to help you answer this question then be sure to write down a suitable window that shows the point of intersection AND what you are using for Y_1 and Y_2. On the other hand, if you choose to use logarithms then make sure to show ALL steps in your work.

The number of infected people with a certain illness is given by the formula $N(t) = 26 \cdot 2^{t/6}$ where t represents the number of days since the outbreak. Determine how long it will take for 14,942 people to become infected. (6 points)

Logarithm way: $14942 = 26 \cdot 2^{x/6}$ divide by 26

$574.6923077 = 2^{x/6}$ convert

$\frac{x}{6} = \log_2(574.6723077)$ use change of base formula

$\frac{x}{6} = \frac{\log_{10}(574.6723077)}{\log_{10}(2)}$ solve for x

$x = 55$ days

Calculator way: $y_1 = 26 \cdot 2^{x/6}$

$y_2 = 14942$

Use 2nd Trace option 5

get $x = 55$ days

window (one possibility)

Xmin: 0

Xmax: 100

Ymin: 0

Ymax: 20000

7. Choose TWO out of the THREE equations below and solve them using algebra and/or logarithms. Draw an 'X' through the problem you choose not to do. Round your answers to the nearest hundredth. (3 points each)

$3(\log_7(2x)) + 5 = 7$

$\log_7(2x) = \frac{2}{3}$

$7^{2/3} = 2x$

$x = \frac{1}{2} \cdot 7^{2/3} \approx 1.83$

$127 = 2(10^{0.5x}) - 17.3$

$10^{0.5x} = 72.15$

$0.5x = \log_{10}(72.15)$

$x = 3.72$

$\log_8(x+5) - \log_8(x) = 1$

$\log_8\left(\frac{x+5}{x}\right) = 1$

$8^1 = \frac{x+5}{x}$

$8x = x+5$

$7x = 5$

$x = \frac{5}{7} \approx 0.71$

8. a) You are given that $\log_b(2) = 0.60551$ and $\log_b(3) = 0.95971$ and $\log_b(5) = 1.40595$. Use this information to determine the value of the following. Do not round your final answers. (1.5 points each)

$\log_b(6) = \log_b(3 \cdot 2) = \log_b(3) + \log_b(2) = 0.95971 + 0.60551 = 1.56522$

$\log_b(9) = \log_b(3^2) = 2 \cdot \log_b(3) = 2 \cdot 0.95971 = 1.91942$

$\log_b\left(\frac{3}{2}\right) = \log_b(3) - \log_b(2) = 0.95971 - 0.60551 = 0.3542$

b) Use the change of base formula and your calculator to compute the following. Round your answer to the nearest hundredth. (1.5 points)

$\log_5(60) = \frac{\log_{10}(60)}{\log_{10}(5)} \approx 2.54$