



Name: _____ Date : _____

IM 3 UNIT 6 TEST V2 - Exponential & Logarithmic Functions
Teacher: Mr. Santowski and Mr. Smith

Score: _____

PART 2 - CALCULATOR ACTIVE QUESTIONS

In terms of showing work, please show (i) key substitutions into appropriate formula(s) & (ii) any key intermediate steps (algebraic/graphic) in working toward your solution and then (iii) the final answer(s). All final answers should be rounded to two decimal places

1. Solve for the unknown in each of the equations given below. All final answers should be rounded to two decimal places.

(8 marks)

(a) $8^{x-4} = 75$

(b) $11 + 3e^{2-x} = 15$

(c) $\ln(2x + 5) = 3$

2. Mr. S is going to make an investment of \$30,000 into an account that offers interest at 8.5% per year.

- a. If the interest is to be compounded MONTHLY, how much INTEREST will he have earned in 14 years?
- b. If the interest is to be compounded CONTINUOUSLY, how much INTEREST will he have earned in 14 years?

- c. Explain WHY the two amounts (from Q(a) and Q(b)) are **not** the same.

(7 marks)

3. Ms. A invests \$25,000 for 8 years. She would like the investment to grow to a value of \$45,000 in those 8 years. What should be the annual interest rate (compounded continuously)?

(3 marks)

4. You are told that the **half-life** of radium is 1690 years.

(6 marks)

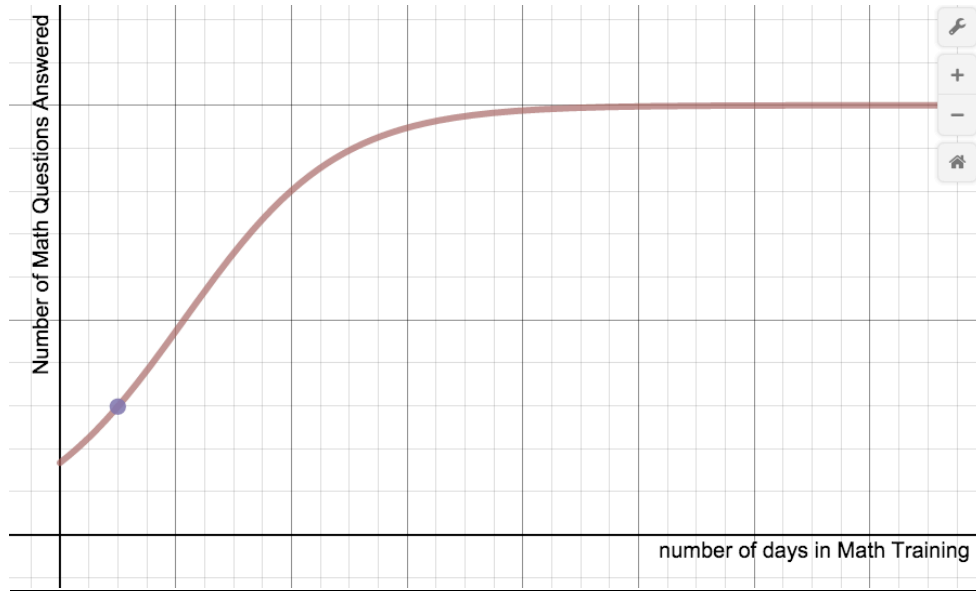
- a. If 25 grams are present now, how much will be present in 400 years?
- b. How long will it take for 87.5% of the radium to disappear/decompose?

5. Tanya has just inherited a diamond ring valued at \$15000. If diamonds have **continuously** appreciated in value at an annual rate of 16%, what was the value of the ring 7 years ago when the ring was purchased?

(3 marks)

6. In your next year of IB Maths, Mr. S asks you to be part of a Math Contest team. First, however, you have to learn how to answer Math Contest questions. How quickly you learn and master the different types of questions can be modelled with a **learning curve** and we can use the equation $N(t) = \frac{500}{5 + 25e^{-0.11t}}$, where t is time in days since you began learning how to answer math contest questions and $N(t)$ is the number of questions you can answer per day, given t days of training. (For example, $N(5) = 25.75$, meaning that after 5 days of training, you can answer 25.75 (or 26) math contest questions per day). The graph is included below.

(8 marks)



Use your TI-84 to help answer the following questions. Values estimated from the graph will **NOT BE SCORED**.

- How many questions per day can you answer after training for 3 weeks? (round to the nearest integer)
- How long does it take before you can answer 60 questions per day? (round to the nearest integer)
- Mr. S wants you to answer a minimum of 90 questions per day by the time you've trained for 1 month. Show/explain whether or not this is a reasonable expectation.
- At what **limiting value** does the number of daily questions you can answer level off? Give a reason as to **why** there is a limit.

7. Let $N(t)$ represent the number of students attending CAC as a function of time, t , in years since 2012. The number of students is modeled by $N(t) = 1100 - Be^{rt}$.

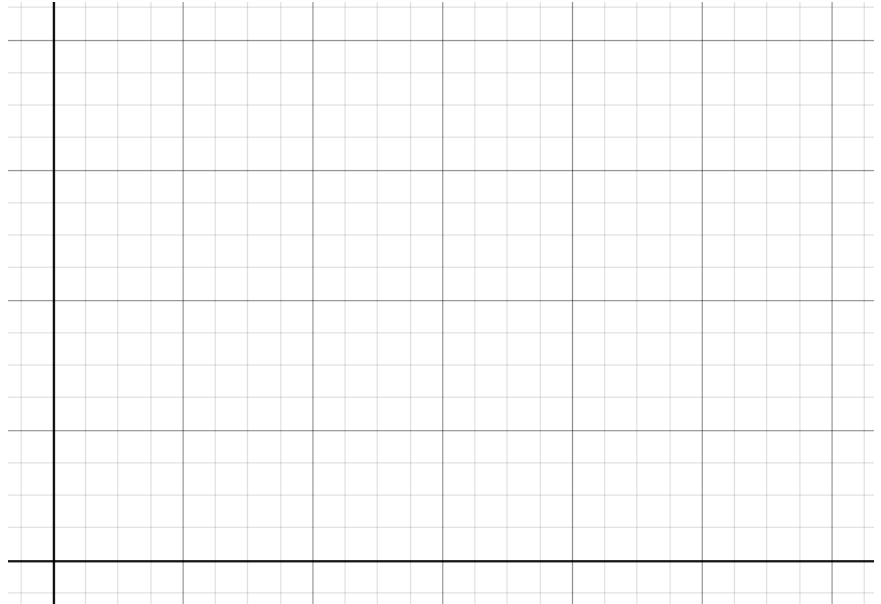
(10 marks)

- a. Given that $N(0) = 400$, show that the value of B is 700.
- b. If $N(4) = 850$ and knowing that $B = 700$, show that the value of r is .
- c. Given the values of B and r in Q7a and Q7b, evaluate and interpret $N(10)$.
- d. As time increases without bound, what happens to the number of students at CAC? Support your answer with a graph of the function **OR** an algebraic/mathematical explanation.

8. Mr. Santowski and Mr. Smith each have started up separate textbook publishing companies. For Mr. Santowski's company, the monthly revenues since January 1, 2015 are modeled by the equation $R(t) = 12000 + 24000e^{-0.07t}$ and for Mr. Smith's company, the monthly revenues since January 1, 2015 are modeled by the equation $R(t) = 11000(1.0225)^t$.

(8 marks)

- a. Use your TI-84 to produce a graph given domain and range of $0 < t < 40$ and $0 < R(t) < 40000$ and **sketch** your graph here.



- b. Evaluate and interpret $R(6)$ for both companies.
- c. When do these companies have the same monthly revenue?