



Name: _____ Date : _____

IM2 UNIT 4 TEST V1 – Exponential Functions

Teacher: Mr. Santowski and Mr. Smith and Mr. Rawlings

Score: _____/

PART 1 - CALCULATOR INACTIVE QUESTIONS

Show all work and write all answers in the spaces provided. Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for correct method, provided the answer is supported by written work.

1. Evaluate the following expressions. (6 marks)

a. $(-1)^3 + 2^3 - 3^3 + 4^3$

b. $2^0 + \left(\frac{1}{8}\right)^{-1} - 2^{-2}$

2. Simplify the following algebraic expressions. All final answers should be written with positive exponents. (6 marks)

a. $(2x^2y^{-3})(4x^{-3}y)$

b. $\left(\frac{2a^4b^{-1}}{3ab^2}\right)^{-3}$

3. Solve the following exponential equations for x . Show the keys steps in your solutions or show your justification/verification for any that you solved using a guess & check method. (12 marks)

a. $3^{x-4} = 9$

b. $2^{3x} = \frac{1}{2^{-9}}$

c. $\left(\frac{1}{5}\right)^{3x-4} = 25^{\frac{x}{2}}$

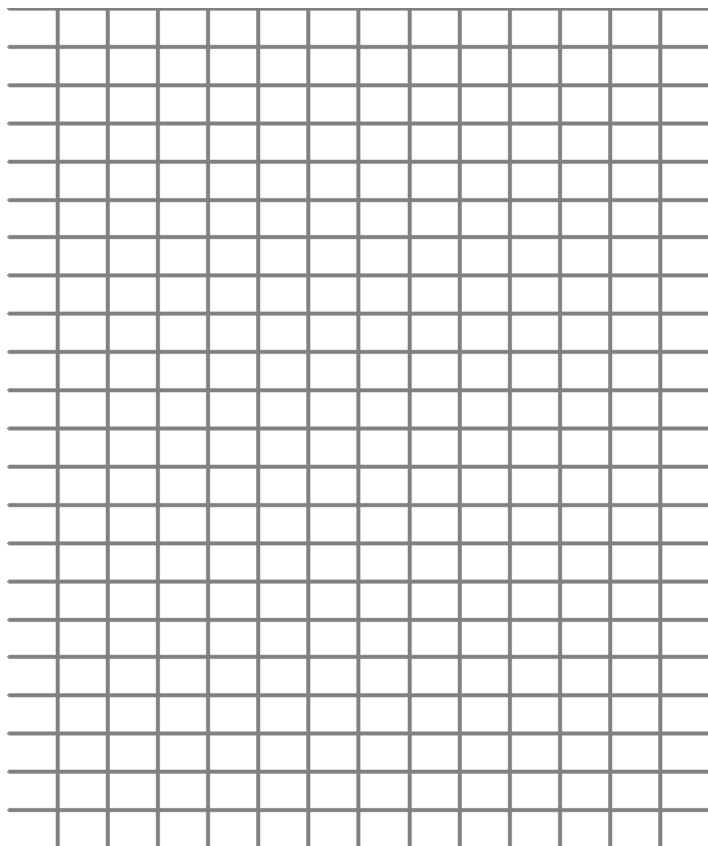
d. $4^{-x+2} = 8^{x+1}$

4. Given the equation $y = 2(3)^x + 1$, prepare a graph of this exponential function. Neatly draw your own axes and please label your graphs as completely as you can (including the asymptote).

(8 marks)

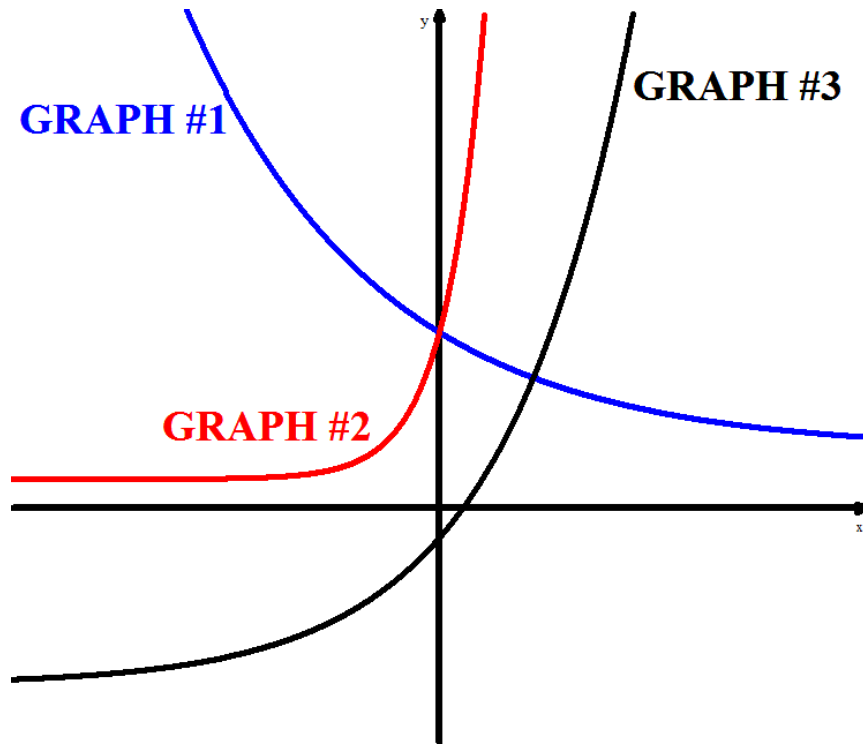
From your work, answer the following analysis questions:

- Where do you predict the asymptote to be? Explain/show your reasoning/thinking.
- Where is the y-intercept of the graph? Explain/show your reasoning/thinking.
- Does the graph show growth or decay?



5. You are given the following three exponential graphs below as well as 6 equations. Match ONE equation to EACH graph, justifying your decisions for your matchings.

(6 marks)



Equations:

$A: y = 5(2)^x - 4$

$B: y = -4(0.8)^x + 2$

$C: y = 5(1.1)^x + 1$

$D: y = 4(0.8)^x + 2$

$E: y = 5(3)^x + 1$

$F: y = 5(4)^x - 4$

The equations for GRAPH #1 is: Reasoning:

The equations for GRAPH #2 is: Reasoning:

The equation for GRAPH #3 is: Reasoning:



Name: _____ Date : _____

IM2 UNIT 4 TEST – Exponential Functions

Teacher: Mr. Santowski and Mr. Smith and Mr. Rawlings

Score: _____/

PART 2 - CALCULATOR ACTIVE QUESTIONS

Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for correct method, provided the answer is supported by working. Solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer

1. How much money must be invested now in order to grow to \$25,000 in 7 years from now. The investment earns 5.5% p.a compounded quarterly.

(4 marks)

2. Below is some information on the changes of the populations of two towns since the year 2000.

(12 marks)

MathVille	Scienceton
Population in 2000 was 3500 Exponentially decaying by 3% per year since 2000.	Population in 2000 was 1000 Exponentially growing by 7% per year since 2000.

- a. Explain why the equation for Mathville's population is $P = 3500(0.97)^x$.
- b. What is Mathville's population in 2015?
- c. Write an equation for modeling Scienceton's population.
- d. Which town has a greater population in 2015? Explain/show your reasoning.
- e. When were the populations of the two towns the same? (Give answer correct to one decimal place)

3. Mr. R has been investing money for the past fifteen years (since January of 2001). He initially invested \$50,000 in an account that is earning interest at a rate of 7% p.a. **compounded monthly**. (10 marks)

a. Mr. R has written the equation for the growth of his money as $y = 50000 \left(1 + \frac{0.07}{12}\right)^{12x}$. Explain to Mr. R why this equation is CORRECT.

b. In what **year** did the value of his investment first exceed \$75,000? Show/explain how you determined your answer.

c. What was the value of Mr. R's investment at the beginning of this year (January of 2016)? Show/explain how you determined your answer.

Unfortunately, Mr. R's investment has been **decreasing** in value since January of 2016 at a rate equivalent to **12% p.a. compounded monthly**.

d. Determine the predicted value of the investment in June of 2016.

4. The temperature changes of Mr. S's coffee can be modeled with the equation $y = 22 + 62\left(\frac{1}{2}\right)^{\frac{x}{30}}$ where **y is the temperature** of the coffee in degrees Celsius and **x is the number of minutes** since he bought the coffee. He bought his cup of coffee at 8:00 am this morning.
- (12 marks)
- a. Explain why a **decreasing** exponential function makes sense for the context of this question.
- b. The point $(20, 61)$ should be on the graph or the data table. Explain what this point means in the context of this question.
- c. What is the temperature of the coffee when:
- i. He first bought the coffee?
- ii. One and a half hours after he bought the coffee?
- d. At what time is the temperature of the coffee below 45°C ?
- e. Where is the asymptote for this graph and **WHY** is there an asymptote in the first place?