

PART 1 - CALCULATOR INACTIVE Section – Show the key steps in your solutions.

1. Simplify each of the following and express your answer in lowest terms (if applicable).

(6 marks)

a. $2^{-2} \times 8^2 =$

b. $(-5)^0 - \frac{1}{4^{-2}} =$

c. $\frac{2^{-2}}{2^{-3} \times 2^{-4}} =$

2. Evaluate the following exponential functions for the given values of x.

(6 marks)

a. Evaluate $f(x) = 2 + \frac{1}{2}(2)^{x+1}$ if $x = 2$

b. Evaluate $f(-1)$ if $f(x) = 4\left(\frac{1}{2}\right)^x$

3. Write the following numbers in scientific notation.

(4 marks)

a. 310,600

b. 0.0000675

4. The following numbers are written in scientific notation. Rewrite each number in non-scientific notation.

(4 marks)

a. 1.61303×10^{-3}

b. $1.25E8$

5. Simplify $\frac{(9 \times 10^{-3})(5 \times 10^6)}{3 \times 10^{-2}}$. Your final answer must be expressed in proper scientific notation.

(3 marks)

6. 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.

(6 marks)

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

b. $5^{x+1} = \left(\frac{1}{5}\right)^{2x+5}$

7. Solve and verify $\left(\frac{1}{8}\right)^{-x-2} = 32^{2x-3}$. (HINT: Can you re-express the bases using a common base?)

(6 marks)

Feb 2015 Exponential Functions UNIT TEST | Name _____

8. Graph the following exponential equation: $y = -(2)^x + 4$. You are required to identify the (i) state the equation of the asymptote, (ii) y intercept, (iii) range of the function. You MAY produce a data table from the equation and include two additional points on the graph.

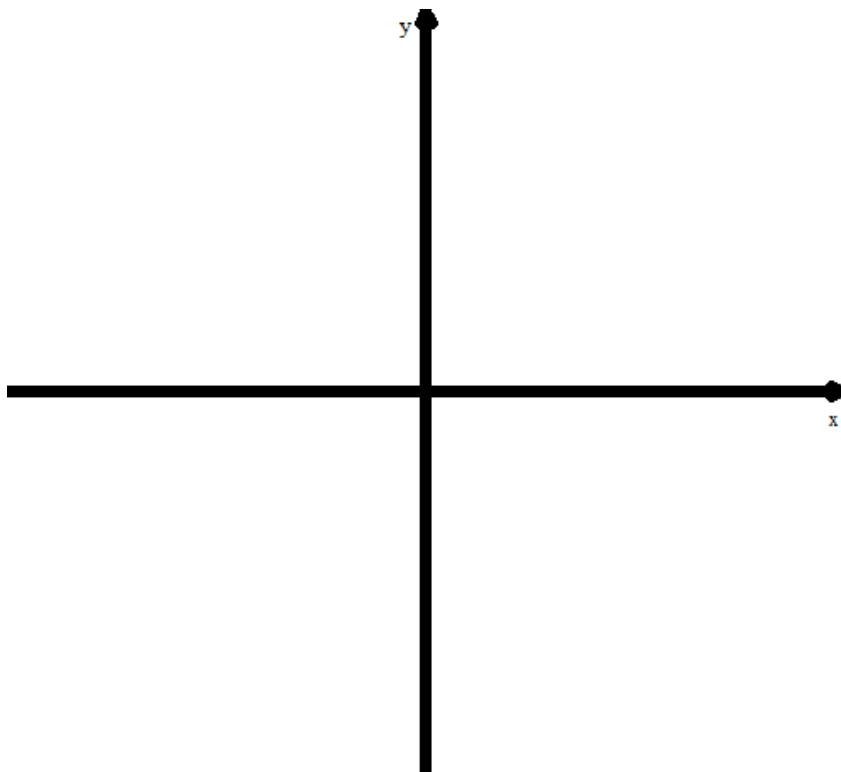
(7 marks)

EQN to be graphed: $y = -(2)^x + 4$

(i) Equation of Asymptote:

(ii) y – intercept:

(iii) Range:



9. Here is a graph of an exponential function, $y = c(1 + r)^x$.

(6 marks)



- a. This graph shows (a) exponential growth, (b) linear growth, (c) a constant negative slope, (d) exponential decay. (circle one choice)

- b. In this graph, the value of r COULD be: (a) $r = 0.25$, (b) $r = -0.25$, (c) $r = 25$, (d) $r = -25$. (circle one choice.)
Explain your reasoning.

- c. On the same graph, you are going to make a second sketch of a function. In this second function, the value of c must be LESS THAN the original value of c and the value of $(1 + r)$ must be GREATER than that of the original function, although the nature/shape of the graph of your function MUST still be consistent with your answer from Qa.

PART 2 – CALCULATOR ACTIVE – Show the key steps of the solutions to the following questions.

10. The following questions deal with investments that Ms. A has recently made, in order to start saving for her

retirement. The compound interest formula is given as $FV = PV\left(1 + \frac{r}{n}\right)^{nt}$.

(8 marks)

a. On January 1st 2015, Ms. A invested \$20,000 into an investment that earns 7% p.a., compounded quarterly. Ms. A would like to know the future value of this investment in 10½ years. Show/explain the analysis that leads to your final answer.

(4)

b. Today, she will invest some additional money so that she can purchase a house. The investment will earn 5% interest, compounded monthly. If she needs the investment to be worth \$45,000 in 9 years, how much should she invest today? Show/explain the analysis that leads to your answer.

(4)

11. Amin has become a world famous medical researcher who has developed a medicine to cure MATHITIS. Once the medicine is taken, it is used up as it kills the bacteria that cause MATHITIS. The mathematical model $A(t) = 50(0.85)^t$ can be used to describe the amount of medicine still left in the body, where t is the time in hours since the dose was taken and $A(t)$ is the amount of medicine left in the body measured in milligrams. Therefore a new dose of medicine is required every 8 hours.

(10 marks)

a. Given the equation used to model this problem, what is the amount of the initial dose taken by a patient?

(1)

b. Explain what the point $(3, 30.7)$ means in the context of this question.

(2)

c. How long does it take for HALF the medicine to get used up in the body? Show/explain your solution. (Round answer to the nearest tenth of an hour)

(3)

d. How much of the medicine is still in a patient's body after 8 hours (BEFORE they take their next dose?)

(2)

e. A patient takes the second dose exactly at 8 hours. Now another 4 hours passes. How much of the medicine remains in the body after this 12 hour time period? Show/explain the analysis that leads to your answer.

(2)

Feb 2015 Exponential Functions UNIT TEST | Name _____

12. In the year 2030, Shivani has become a leading industrial entrepreneur (working for the Tata Group) in India and due to her awesomeness, the company's profit starts to increase, according to the equation $D = 150(1.0955)^t$, where D represents the annual profit, in billions of US dollars and t represents the years since 2030.

(9 marks)

- a. Write the number 150 billion in scientific notation. (1)
- b. At what yearly rate does the Tata's Group profits increase? (1)
- c. What is the company's expected profit in 2050 (answer in billions of dollars)? (2)
- d. In what year will Tata Group's profits be \$200 billion? Show/explain your solution. (Give your final answer rounded to the nearest tenth of a year.) Show/explain the analysis that leads to your answer. (3)
- e. Shivani introduces some new changes to the way the company operates. As a result, the company's yearly rate changes. Shivani notices that the profits have increased from \$150 billion to \$225 billion in 5 years. Determine the company's new annual rate of growth. (2)

BONUS: AT END OF TEST (TIME PERMITTING)

13. Mr. S is taking some ANTI-MATH medicine. Unfortunately, this medicine has an affect on his memory if he takes too much. To help him with his dosage, Mr. S only has a couple of pieces of information. On Sunday, Mr. S took his initial amount of medicine. On Monday the amount in his body was 67.5 mg. On Wednesday he had 50.625 mg in his body.

a. Create a data table to help you organize the given information.

b. Use the information that you just organized to create an equation to model the amount of medicine in Mr. S's body. Define your variables (what will x and y represent?)

Sun	Mon	Tues	Wed	Thurs

X will represent →

Y will represent →

c. Mr. S was only supposed to take a maximum dose of 80 mg of medicine on Sunday. Did Mr. S take too much? Explain how you determined your answer.

Mr. S needs to retake his medicine when the amount drops below 10 mg.

d. When should he take his next dose? Explain/show how you determined your answer.

e. How much should he take so that he doesn't overdose and affect his memory?