Pre-Calc Final Review 2021

Name: _____ **Date:** _____

1. Determine, to the *nearest tenth of a year*, how long it would take an investment to double at a $3\frac{3}{4}\%$ interest rate, compounded continuously.

2. Condense the following expression into a single term using properties of logarithms.

$$2\log_3 x + 3\log_3 y - 5\log_3 z$$

Which single term is equivalent to the expression?

A. $\log_3 = \left(\frac{x^2y^3}{z^5}\right)$

B. $\log_3 = \left(\frac{6xy}{5z}\right)$

C. $\log_3 = (2x + 3y - 5z)$

D. $\log_3 = \left(\frac{2x + 3y}{5z}\right)$

3. Solve for x: $\log_4(x^2 + 3x) - \log_4(x + 5) = 1$

4. Solve the logarithmic equation.

$$\log_5(2) + \log_5(x - 3) = 2\log_5(4)$$

5. Solve the following logarithmic equation for x:

$$\log_2(3x - 1) = 5$$

6. What value of x satisfies the equation $2^{3x} = 24$? Write your answer in terms of a logarithm and as a decimal rounded to the nearest thousandth.

7. The amount A, in milligrams, of a 10-milligram dose of a drug remaining in the body after t hours is given by the formula $A = 10(0.8)^t$. Find, to the *nearest tenth of an hour*, how long it takes for half of the drug dose to be left in the body.

8. Growth of a certain strain of bacteria is modeled by the equation $G = A(2.7)^{0.584t}$, where:

$G =$ final number of bacteria
$A =$ initial number of bacteria
$t =$ time (in hours)

In approximately how many hours will 4 bacteria first increase to 2,500 bacteria? Round your answer to the *nearest hour*.

9. A biologist is culturing a new strain of bacteria, starting with just a few cells. When she first observes the bacteria colony, the population is 1,000 cells and is doubling every 20 minutes. This rate of growth continues for the rest of the day.

   a) Write a function that represents the population of the bacteria colony as a function of time in minutes.

   b) How long will it take the population to reach 8,000?

   c) How long will it take the population to reach 20,000?

10. Depreciation (the decline in cash value) on a car can be determined by the formula $V = C(1 - r)^t$, where V is the value of the car after t years, C is the original cost, and r is the rate of depreciation. If a car's cost, when new, is \$15,000, the rate of depreciation is 30%, and the value of the car now is \$3,000, how old is the car to the *nearest tenth of a year*?

11. A house purchased 5 years ago for \$100,000 was just sold for \$135,000. Assuming exponential growth, approximate the annual growth rate, to the *nearest percent*.

12. Seth's parents gave him \$5000 to invest for his 16th birthday. He is considering two investment options. Option A will pay him 4.5% interest compounded annually. Option B will pay him 4.6% compounded quarterly.

    Write a function of option A and option B that calculates the value of each account after n years.

    Seth plans to use the money after he graduates from college in 6 years. Determine how much more money option B will earn than option A to the *nearest cent*.

    Algebraically determine, to the *nearest tenth of a year*, how long it would take for option B to double Seth's initial investment.

13. In New York State, the minimum wage has grown exponentially. In 1966, the minimum wage was \$1.25 an hour and in 2015, it was \$8.75. Algebraically determine the rate of growth to the *nearest percent*.

14. One of the medical uses of Iodine-131 (I-131), a radioactive isotope of iodine, is to enhance x-ray images. The half-life of I-131 is approximately 8.02 days. A patient is injected with 20 milligrams of I-131. Determine, to the *nearest day*, the amount of time needed before the amount of I-131 in the patient's body is approximately 7 milligrams.

15. After an oven is turned on, its temperature, T, is represented by the equation $T = 400 - 350(3.2)^{-0.1m}$, where m represents the number of minutes after the oven is turned on and T represents the temperature of the oven, in degrees Fahrenheit.

    How many minutes does it take for the oven's temperature to reach 300° F? Round your answer to the nearest minute.

16. The number of houses in Central Village, New York, grows every year according to the function $H(t) = 540(1.039)^t$, where H represents the number of houses, and t represents the number of years since January 1995. A civil engineering firm has suggested that a new, larger well must be built by the village to supply its water when the number of houses exceeds 1,000. During which year will this first happen?

17. A certain computer loses half of its value every *two* years.

    Part A

    After how many years will the computer be worth 12.5% of its initial value?

    Part B

    If the value of the computer after 3 years is $425, what was the initial value of the computer?

    A. $601.04

    B. $850.00

    C. $1,202.08

    D. $2,404.16

18. The number of bacteria present in a Petri dish can be modeled by the function $N = 50e^{3t}$, where N is the number of bacteria present in the Petri dish after t hours. Using this model, determine, to the *nearest hundredth*, the number of hours it will take for N to reach 30,700.

19. The following question has two parts. First, answer Part A. Then, answer Part B.

    a) Corinne has $500 to invest. She wants to see how much money she would have at the end of 4 years if she invested her money in an account with a 6% interest rate. Rounded to the nearest cent, write the amount of money each option would have at the end of 4 years in the boxes below.

    Plan A–Compounded Annually: $

    Plan B–Compounded Quarterly: $

    Plan C–Compounded Monthly: $

    Plan D–Compounded Continuously: $

    b) Choose the number of years that correctly completes the sentence.

    It will take ___(1)___ for Corinne to double her investment if her investment is compounded continuously.

(1)
10 years
12 years
14 years
16 years

20. The population of country A was 40 million in the year 2000 and has grown continually in the years following. The population P, in millions, of the country t years after 2000 can be modeled by the function $P(t) = 40e^{0.027t}$, where $t \geq 0$.

Part A

Based on the model, what was the average rate of change, in millions of people per year, of the population of country A from 2000 to 2005? Give your answer to the nearest hundredth.

Part B

Based on the model, the solution to the equation $50 = 40e^{0.027t}$ gives the number of years it will take for the population of country A to reach 50 million. What is the solution to the equation expressed as a logarithm?

A. $0.027\ln(1.25)$ B. $\dfrac{\ln(1.25)}{0.027}$ C. $\ln\left(\dfrac{1.25}{0.027}\right)$ D. $\ln\left(\dfrac{0.027}{1.25}\right)$

Part C

Based on the model, in which years will the population of country A be greater than 55 million?

Select *all* that apply.

❍ 2004 ❍ 2007 ❍ 2010 ❍ 2013 ❍ 2016 ❍ 2019

Part D

For another country, country B, the population M, in millions, t years after 2000 can be modeled by the function $M(t) = 35e^{-0.042t}$, where $t \geq 0$. Based on the models, what year will be the first year in which the population of country B will be greater than the population of country A?

A. 2009

B. 2012

C. 2021

D. The population of country B will not exceed the population of country A.

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1.
Answer: 18.5 years
Objective: F-LE.A
Points: 1

2.
Answer: A
Objective: MO A2.SSE.3
Points: 1

3.
Answer: 5 and -4
Points: 1

4.
Answer: 11
Objective: MO A2.SSE.3
Points: 1

5.
Answer: 11
Objective: MO A2.SSE.2
Points: 1

6.
Answer: $x = \frac{1}{3}\log_2 24$
Points: 1

7.
Answer: 3.1
Points: 1

8.
Answer: 12
Points: 1

9.
Answer: $P(t) = 1000(2)^{\frac{t}{20}}$; 60 minutes; 86.4 minutes
Objective: CC F.LE.4
Points: 1

10.
Answer: 4.5
Points: 1

11.
Answer: 6
Objective: F-LE.A
Points: 1

12.
Answer: $A = 5000(1.045)^n$, $B = 5000(1.0115)^{4n}$, 67.57, 15.2
Objective: F-BF.A
Points: 1

13.
Answer: 4% growth
Objective: F-LE.A
Points: 1

14.
Answer: 12
Objective: F-LE.A
Points: 1

15.
Answer: 11
Points: 1

16.
Answer: 2011
Points: 1

17.
Answer: 6 years; C
Points: 1

18.
Answer: 2.14, and appropriate work is shown.
Points: 1

19.
Answer: \$631.24, \$634.49, \$635.24, \$635.62; 12 years
Objective: MO A2.REI.1
Points: 1

20.
Answer:
Points: 1