Name _____

Secondary 3 Honors SAGE Review Teacher _____ Date _____ Period _____

F.LE.4

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. The amount A in an account with continuously compounding interest after t years is given by $A = Pe^{rt}$ where P is the original amount and r is the annual interest rate as a decimal. Nadav invests \$6,000 in an account that earns 5% interest compounded continuously. What is the total amount of her investment after 8 years? Round your answer to the nearest cent.

a. \$327,588.90
b. \$9850.95
c. \$8950.95
d. \$14,950.95

____ 2. Solve $3^{2x} = 6561$ for x.

a. $x = 8$
b. $x = 4$
c. $x = 19$
d. $x = 6.5$

____ 3. Which expression represents the value of x in the equation $3^{2x} = 30$?

a. $x = \dfrac{\log 30}{2}$
b. $x = \dfrac{\log_3 30}{2}$
c. $x = \dfrac{\log 30}{\log 3}$
d. $x = 2\log_3 30$

____ 4. The amount A (in dollars) of money in Shania's bank account, which is compounded monthly, can be modeled by the exponential function $A = 300(1.005)^{12t}$ where t is the time in years. In which year will the amount in the account first exceed \$900?

a. 19th year
b. 30th year
c. 221st year
d. 37th year

____ 5. Which expression represents the value of x in the equation $b^{x-2} = c$?

a. $x = \dfrac{\log c}{b} + 2$
b. $x = \dfrac{\log c}{\log b} + 2$
c. $x = \dfrac{c}{\log b} + 2$
d. $x = \dfrac{\log b}{\log c} + 2$

____ 6. What is the approximate value of x in the equation $5^{2x} = 20$?

a. $x = 0.715$
b. $x = 0.931$
c. $x = 1.301$
d. $x = 3.723$

____ 7. If there are initially 5000 bacteria in a culture, and the number of bacteria doubles each hour, the number N of bacteria after t hours can be found using the formula $N = 5000\left(2^t\right)$. About how long will it take the culture to grow to 40,000 bacteria?

a. 1.8 hr
b. 0.9 hr
c. 3.3 hr
d. 17.5 hr

____ 8. The half-life of carbon-14 is about 5730 years. The amount A, in grams, of carbon-14 remaining in a sample of A_0 grams after time t, in years, is modeled by $A = A_0 \cdot 2^{-\frac{t}{5730}}$. What is an equivalent equation solved for t?

a. $t = \dfrac{\log_2 \dfrac{A_0}{A}}{5730}$

b. $t = -5730 \log_2 \dfrac{A_0}{A}$

c. $t = \dfrac{\log_2 \dfrac{A}{A_0}}{5730}$

d. $t = -5730 \log_2 \dfrac{A}{A_0}$

Short Answer

9. Solve $2.43^x = 32$ for x. Give your result to the nearest hundredth.

10. Solve $4e^x - 2 = 14$ for x. Give your result to the nearest thousandth.

11. Solve $2^{x-1} = 12$ for x. Express the answer as a calculator-ready expression.

12. The number N of bacteria in a culture is modeled by the function $N(t) = 500(2)^{0.5t}$, where t is the time in hours. After how many hours will the population reach 1,000,000 bacteria? Give an exact answer in terms of logarithms as well as the answer rounded to the nearest hour. Show your work.

13. A customer at a restaurant orders a cup of tea, so the waiter places a tea bag into a room temperature mug, pours in boiling water, and lets the mug sit while the tea steeps and cools. The function $T(t) = 72 + 140e^{-0.14t}$ models the temperature T, in degrees Fahrenheit, of the tea as a function of the time t, in minutes. For safety reasons, the waiter does not want to serve the tea until its temperature is no more than 125 °F. How long should the waiter allow the mug of tea to sit before serving? To be safe, round up to the nearest minute.

Problem

14. Marcus deposits $500 in an account that earns 3% annual interest compounded continuously. Assume there are no other deposits and no withdrawals.

    a. After how many years would the account balance triple? Give an exact answer in terms of logarithmic expressions as well as the answer rounded to the nearest tenth of a year. Show your work.

    b. If Marcus wants the account balance to triple in 20 years, what annual interest rate would an account earning interest compounded continuously need to have? Give an exact answer in terms of logarithmic expressions as well as the answer rounded to the nearest tenth of a percent. Show your work.

Essay

15. The population of Town A was 50,000 in 2000, and was increasing by approximately 5.1% per year. The population of Town B was 100,000 in 2000, and was decreasing by approximately 8.1% per year.

    Part A: Write an exponential model for the population of Town A. Estimate the population in the year 2008.

    Part B: Write an exponential model for the population of Town B.

    Part C: Use the model from *Part B* to estimate the population of Town B in the year 2025. Is this a good approximation? Explain why or why not.

    Part D: Which model represents exponential growth? Which model represents exponential decay? Explain why exponential growth or exponential decay models can be used for this data.

    Part E: According to the model, approximately how many years would it take the population of Town A to double? Determine the solution algebraically.

    Part F: According to the model, in how many years would the population of Town B decrease by 25%? Determine the solution by graphing.

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A.CED.1,2,3,4

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Jeremy receives a base salary of $25,000 plus 5% commission on his sales. Jeremy received a total salary of $45,000 last year. How much were his total sales?

a. $20,000
b. $70,000
c. $400,000
d. $900,000

____ 2. A radioactive isotope decays exponentially. The time it takes for half of the amount to decay is called the isotope's half-life. A certain isotope has a half-life of 12 hours. If after 72 hours there are 0.325 mg left, what was the isotope's initial mass?

a. 5,324.8 mg
b. 20.8 mg
c. 0.289 mg
d. 1,331.2 mg

____ 3. A farmer has 120 yards of fencing to build around a rectangular orchard. Let w be the width of the orchard. Write an equation giving the area of the orchard. Find the dimensions of the orchard when the area is 900 square yards.

a. $120w - w^2$; The width is 58 yd, and the length is 62 yd.
b. $60w - w^2$; The width is 50 yd, and the length is 18 yd.
c. $60w - w^2$; The width is 30 yd, and the length is 30 yd.
d. $w^2 - 60w$; The width is 72 yd, and the length is 48 yd.

____ 4. The formula for the volume V of a cylinder is $V = \pi r^2 h$ where r is the radius of the base of the cylinder and h is its height. The radius of a particular cylinder is increased by 1 foot while keeping the height the same. The ratio of the volume of the larger cylinder to the volume of the original cylinder is 4:1. What is the measure of the radius of the original cylinder?

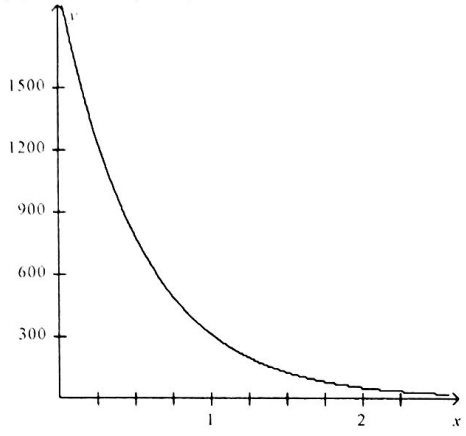
a. 2 feet
b. 1 foot
c. 3 feet
d. 4 feet

____ 5. The side length of a square is the positive square root of the side length of a larger square. If the difference in the areas of the two squares is $72\ cm^2$, what is the side length of the larger square?

a. 3 cm
b. 6 cm
c. 9 cm
d. 12 cm

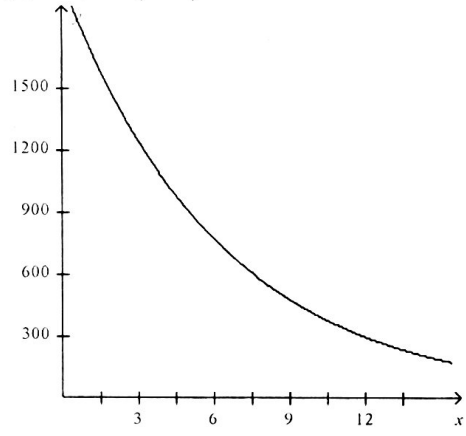
____ 6. A bacteria population starts at 2,032 and decreases at about 15% per day. Write a function representing the number of bacteria present each day. Graph the function. After how many days will there be fewer than 321 bacteria?

a. $f(x) = 2,032(0.15)t$



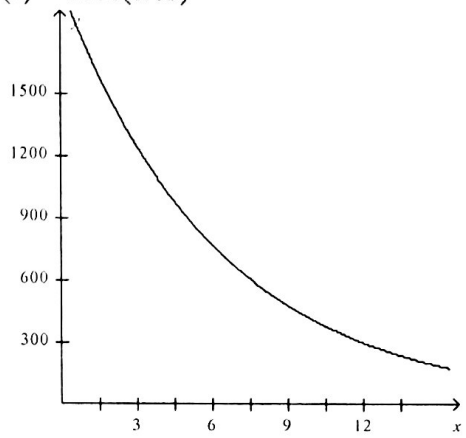
After about 1.05 days, there will be fewer than 321 bacteria.

b. $f(x) = 2,032(0.85)t$



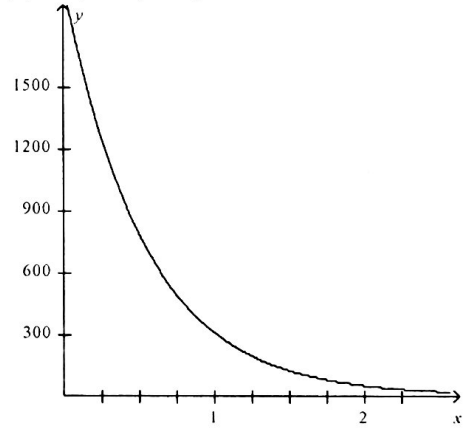
After about 0.19 days, there will be fewer than 321 bacteria.

c. $f(x) = 2032(0.85)^t$



After about 11.3 days, there will be fewer than 321 bacteria.

d. $f(x) = 2,032(0.15)^t$



After about 0.97days, there will be fewer than 321 bacteria.

____ 7. A radioactive isotope has a half-life of 8 days. Which equation represents the time t, in days, it takes until p percent of the initial amount of the isotope remains?

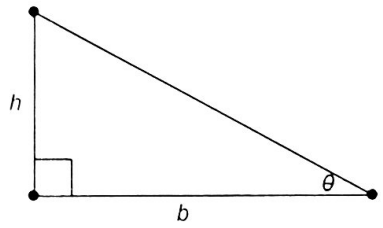
a. $p = 8\left(\frac{1}{2}\right)^{\frac{t}{100}}$

b. $p = 100\left(\frac{1}{2}\right)^{\frac{t}{8}}$

c. $p = 100(8)^{2t}$

d. $p = \frac{1}{2}(8)^{\frac{t}{100}}$

____ 8. The right triangle shown has base b, height h, an acute angle θ, and area A. Which of the following equations gives A in terms of b and θ?



a. $A = \dfrac{b^2 \tan \theta}{2}$

b. $A = \dfrac{b^2 \cos \theta}{2}$

c. $A = \dfrac{b^2 \sin \theta}{2}$

d. $A = 2b^2 \tan \theta$

____ 9. Which of the following equations represents the amount A in a bank account that pays 1.2% interest compounded annually t years after \$2000 is deposited into the account?

a. $A = 2000 + 1.2t$
b. $A = 2000 + 1.012t$
c. $A = 2000(1.2)^t$
d. $A = 2000(1.012)^t$

____ 10. A beverage company is designing a cylindrical can for which the height is triple the radius. If the company wants the can to be between 300 and 400 cubic centimeters in volume, which of the following radius values satisfies this constraint? (Use 3.14 for π.)

a. 2.5 cm
b. 3.25 cm
c. 3.75 cm
d. 4.5 cm

____ 11. The formula for converting degrees Celsius (C) to degrees Fahrenheit (F) is $F = \frac{9}{5}C + 32$. A chemistry student knows that the temperature in degrees Kelvin (K) is 273.15 degrees greater than in degrees Celsius, so the formula to convert degrees Kelvin to degrees Fahrenheit is $F = \frac{9}{5}(K - 273.15) + 32$. What formula can you use to convert degrees Fahrenheit to degrees Kelvin?

a. $K = \dfrac{5}{9}(F - 32) + 273.15$

b. $K = \dfrac{9}{5}(F + 273.15) - 32$

c. $K = \dfrac{5(F + 32)}{9} + 273.15$

d. $K = \dfrac{9}{5}F - 459.67$

Short Answer

12. What is the inverse of $f(x) = \frac{1}{x+1}$? Don't forget your inverse notation!

13. The width (in meters) of a rectangle is 3 more than twice its length. The area is 35 square meters. What is the length of the rectangle?

14. The perimeter of a rectangular rose garden is 140 m and the area is 1200 m^2. Find the length and the width of the rose garden.

15. The volume, V, of a tank varies directly with its height, h. A tank 12 feet high holds 300 cubic feet. Write an equation relating V and h.

16. Solve the following problem. If extra information is given, identify it.

    Sharon earned $460 in simple interest on an investment of $6200. Some of the money earned an interest rate of 5%, and the rest earned 8%. Her average rate of interest was 7.4%. How much did she invest at each rate?

17. The radioactive element Polonium-210 has a half-life of about 138 days. This means that approximately 0.5% of a mass of Polonium-210 will decay every day. Write an equation for the approximate remaining mass m of 50 grams of Polonium-210 after t days.