Coordinate Algebra EOC (GSE) Quiz Answer Key

Functions - (MGSE9-12.F.LE.1c) Growth And Decay

Student Name: _____ Date: _____

Teacher Name: THUYNGA DAO Score: _____

1) A new car depreciates in value by 12% for the first 6 years after the car is purchased. Does this model growth or decay and is the percent of growth or decay a constant?

A) grows by a constant percent
B) decays by a constant percent
C) grows by percent that varies
D) decays by percent that varies

Explanation:
Since the car is depreciating in value, the value of the car decreases every year; it is a decay. While the amount of money the car depreciates by is not a constant, the percent is a constant. The function **decays by a constant percent**.

2)

Year	1960	1975	1990	2005	2020 (est.)
Population P(t)	200,000	240,000	288,000	345,600	414,720

Which type of function is represented by the table?

A) Cubic
B) Exponential
C) Linear
D) Quadratic

Explanation:
Exponential Each population value is 20% greater than the previous one. $P(t) = 200(1.2)^t$

3) A city was founded at the beginning of 1990 with a population of 55,000, and since then, the growth in its population has been exponential, increasing at x percent per year. If the city's population at the beginning of 2000 was 108,193, at what percent per year to the nearest percent is the city's population increasing?

A) 1%
B) 4%
C) 7%
D) 10%

Explanation:
: Since the city's population at the beginning of 1990 was 55,000 and at the beginning of 2000 was 108,193, and since the population is increasing at x percent per year, $(55{,}000)(1 + x)^{10} = 108{,}193$. If both sides of the equation are divided by 55,000, it becomes $(1 + x)^{10} = 1.96714545...$, and if the tenth root is taken from both sides of the equation, it becomes $x \approx 0.07$. Since the city's population is increasing at x percent per year, its yearly increase is **7%**.

4)

Bacteria Growth

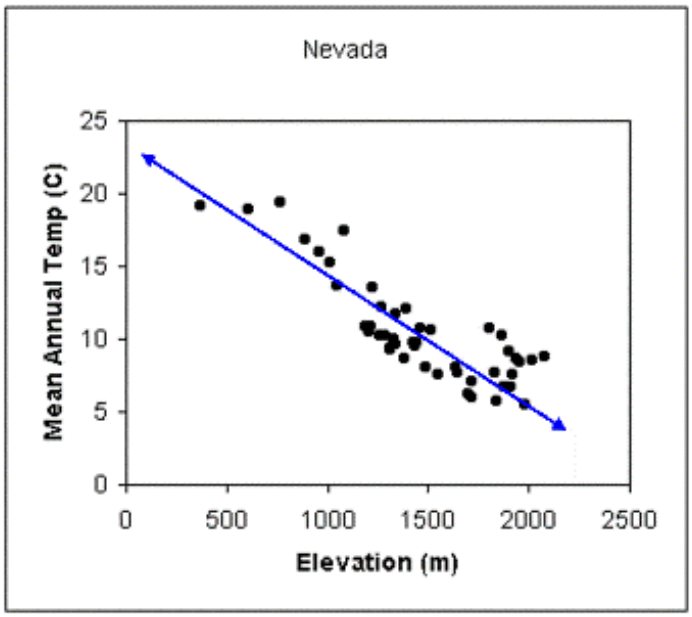
hours	number of bacteria
2	4.5

6	22.781
12	259.493

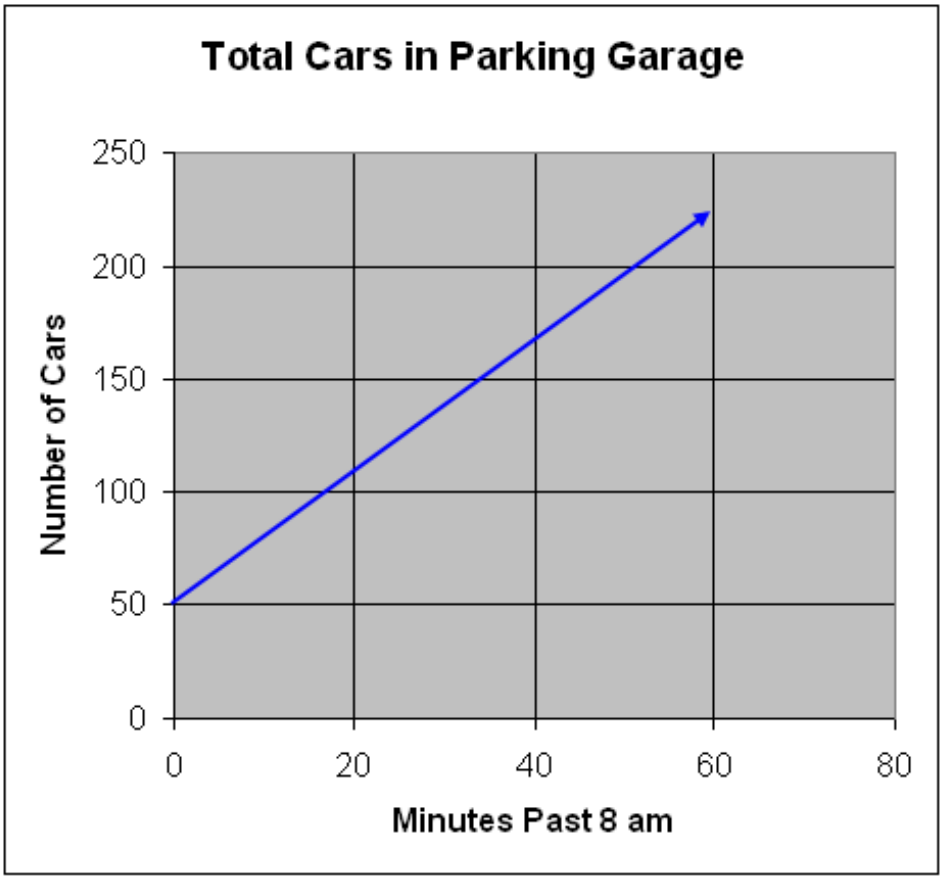
The growth of bacteria in a pond is shown in the table.

Which graph shows a rate of change that is similar to the rate of change of the bacteria?

A)



B)



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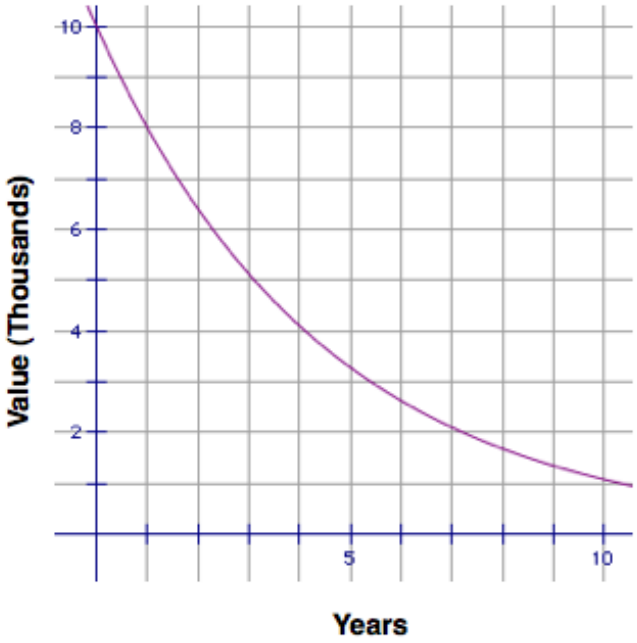
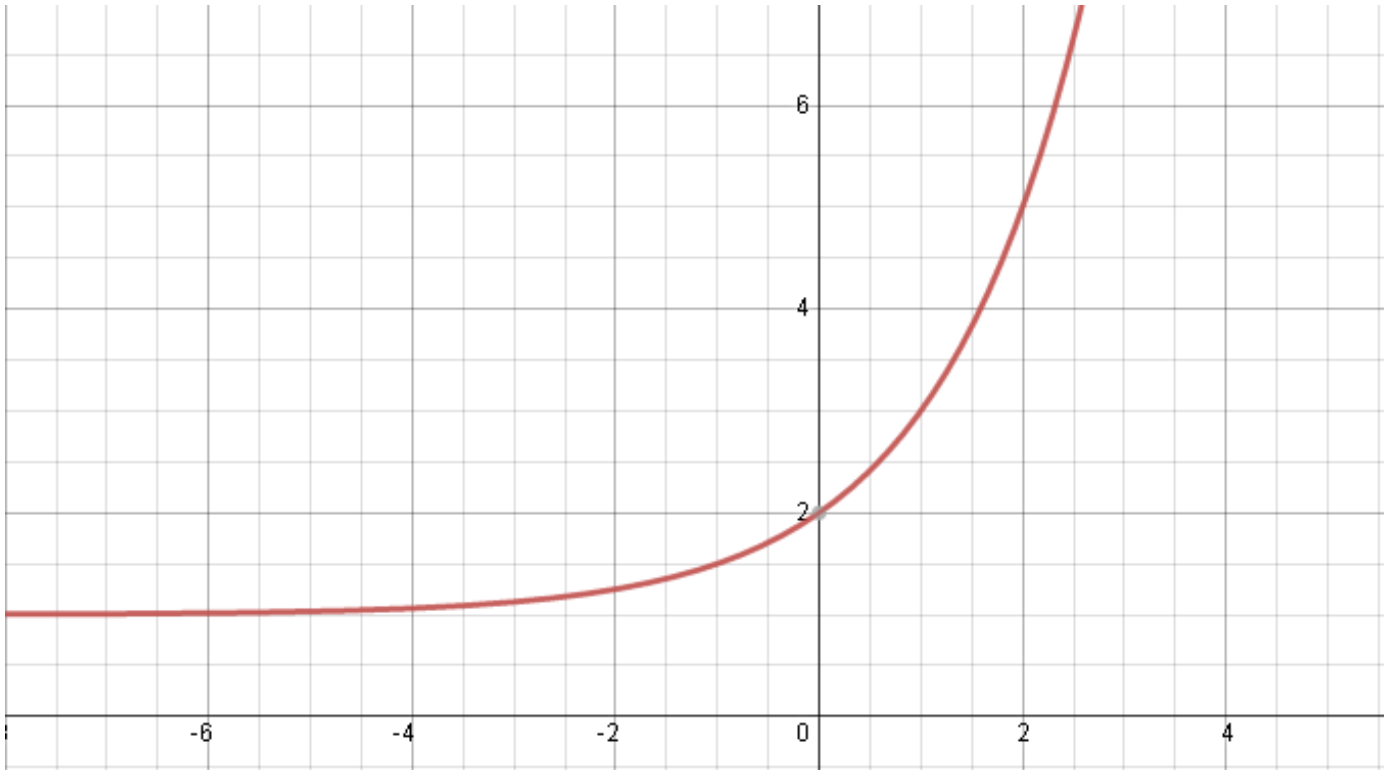
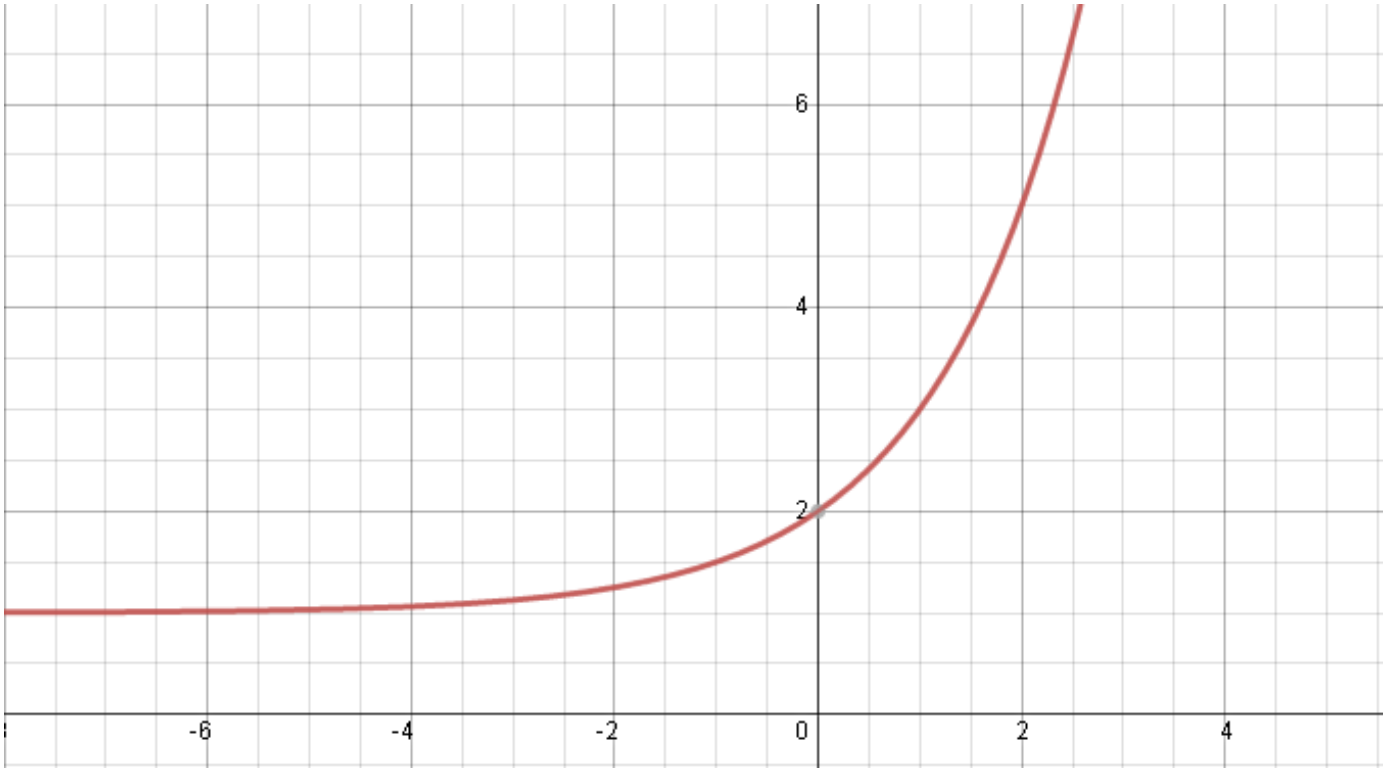


D)



Explanation:
The bacteria are growing so you know the graph must have a positive rate of change. The bacteria are not growing at a constant rate but rather constant percent rate. Therefore, an exponential growth function would have a similar rate.



5) The mass of a radioactive element decays at rate given by $m(t) = m_0e^{-rt}$, where m(t) is the mass at any time t, m_0 is the initial mass, and r is the rate of decay.

Uranium-240 has a rate of decay of .0491593745. What is the mass of U-240 left after 10 hours, if the initial mass is 50 grams?

A) 28.54387 g
B) 30.58254 g
C) 32.14286 g
D) 32.68034 g

Explanation:
30.58254 g Substitute 50 for m_0, .0491593745 for r and 10 for t and solve.

6)

Growth of money

Month	Money
1	$500
2	$525
3	$551.25
4	$578.81

The table shows the relationship between the amount of money in a bank account at the end of each month. Determine whether it's a growth or decay and whether it grows or decays by a constant percent.

A) decays by percent that varies
B) decays by a constant percent
C) grows by percent that varies
D) grows by a constant percent

Explanation:
Since the money is increasing, the function is growing. It is growing by 5%. The function **grows by a constant percent**.

7)

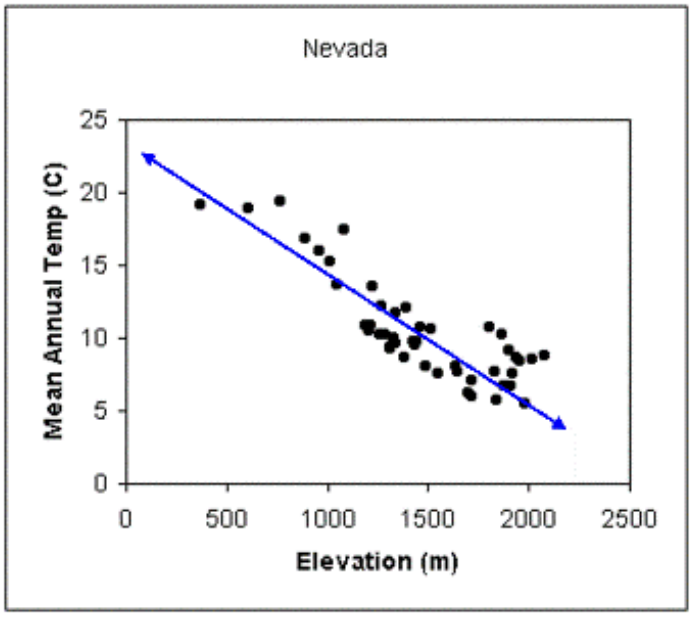
Exponential Decay

hour	Number of Bacteria
2	250
4	62.5
8	3.91
10	0.97

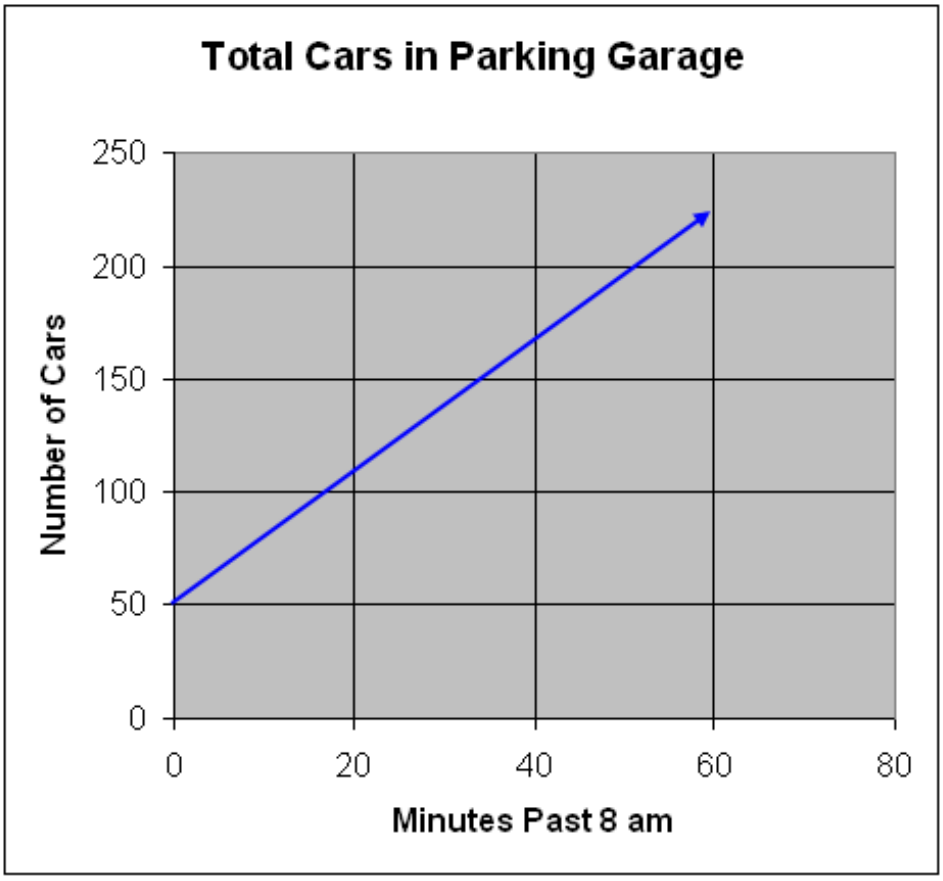
The population change of bacteria in a pond is shown in the table.

Which graph shows a rate of change that is similar to the rate of change of the bacteria?

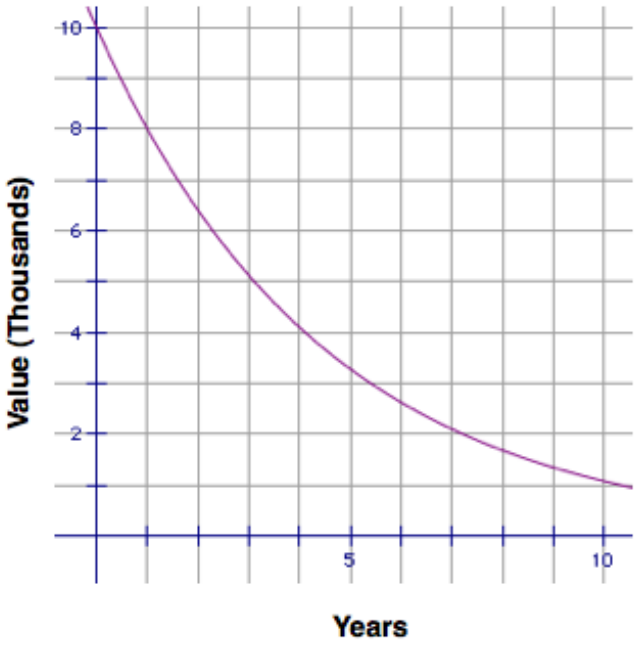
A)



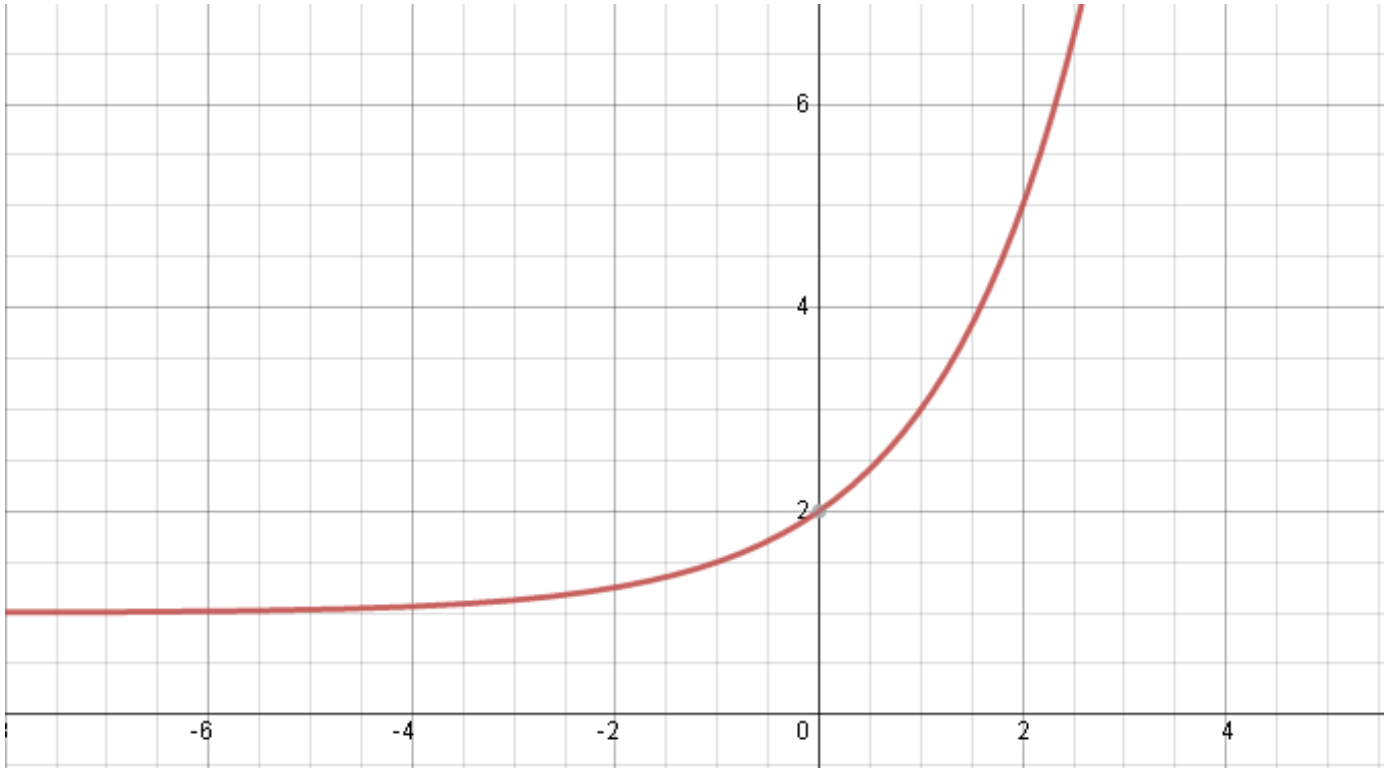
B)


Total Cars in Parking Garage
Number of Cars
250
200
150
100
50
0
0
20
40
60
80
Minutes Past 8 am

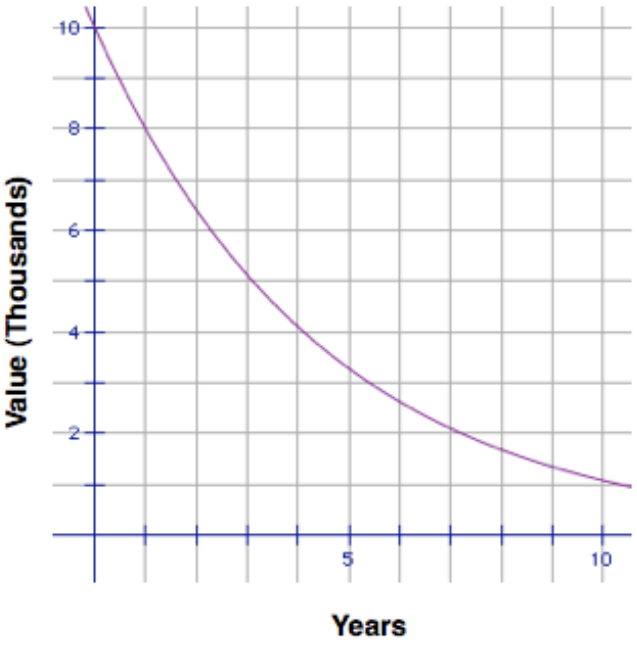
C)


Value (Thousands)
10
8
6
4
2
5
10
Years

D)



Explanation:
The bacteria are decreasing so you know the graph must have a negative rate of change. The bacteria are not decaying at a constant rate but rather a constant percent rate. Therefore, an exponential decay function would have a similar rate.



8)

Money in Savings Account

Month	Amount in account ($)
2	106.09
5	115.93
7	122.99

36	289.83

Marco invested $100 in a savings account and did not add to it again. Interest is added every month and his balance for several months is shown in the table.

Denise bought a car for $15,000 and sees that the rate that the amount owed is decreasing at 3 times the amount that Marco is saving. How much will she have left to pay after 36 months?

A) $0.00
B) $0.02
C) $503.02
D) $510.41

Explanation:
A growth function can be modeled by $y = a(1 + r)^x$. Use a system of equations to solve for the growth rate and you find the interest rate for his savings account is 3%. Therefore the decay rate for Denise's car payment must be 9%. To see how much she owes after 36 months evaluate $y = 15000(1 - .09)^{36}$ = **$503.02**

9)

Year	1960	1975	1990	2005	2020 (est.)
Population P(t)	200,000	240,000	288,000	345,600	414,720

According to the data, what would the population be in 2010? [Note: The function is $P(t) = (200)(1.01223)^t$.

A) 367,274
B) 367,987
C) 368,254
D) 368,640

Explanation:
367,274 The function is exponential: $P(t) = (200)(1.01223)^t$ where if 1960 is represented by t = 0 then 2010 would be t = 50. Plug in 50 for t to get the answer.

10) The 1997 a value of an object was $5000. In 2012, it was worth $9500. The annual percent growth has been constant. What is the annual percent growth?

A) 1.37%
B) 2.37%
C) 3.37%
D) 4.37%

Explanation:
4.37% is correct. $9500=5000(1+r)^{15}$; $1.9=(1+r)^{15}$; $1.9^{1/15}= 1+r$; r=4.37%

11) A hot-air balloon was decommissioned after a successful flight by letting the 3000 m^3 of air in it leak out. The loss in the volume of air in the balloon was exponential, decreasing at x percent per minute. If there was 1626 m^3 of air in the balloon 15 minutes after it began to be decommissioned, at what percent per minute to the nearest percent did the balloon lose air?

A) 1%
B) 2%
C) 3%
D) 4%

Explanation:
Since the volume of air in the hot-air ballon decreased from 3000 m^3 to 1626 m^3 in 15 minutes, and since the volume of air in the balloon decreased at x percent per minute, $(3000)(1 - x)^{15} = 1626$. If both sides of the equation are divided by 3000, it becomes $(1 - x)^{15} = 0.542$, and if the 15th root is taken of both sides, it becomes $1 - x \approx 0.96$. Finally, if 1 is subtracted from both sides of the equation, it becomes $-x \approx -0.04$, and if both sides of the equation are multiplied by -1, it becomes $x \approx 0.04$. Since the volume of air in the balloon decreased at x percent per minute, the balloon's loss of air per minute was **4%**.

12) Little Miss Buffet takes all the money from her piggy bank and puts it into a savings account at her local bank. The bank promises an annual interest rate of 2.5% on the balance, compounded semiannually. How much will she have after one year if her initial deposit was $200?

A) $205.00
B) $205.01
C) $205.02
D) $205.03

Explanation:
$205.03 Use $A(t) = p(1 + r/n)^{nt}$ where A(t) is the account balance for any time (t), r is the annual interest rate, t is the time in years and n is the number of compounding periods per year.

13)

Bacteria Growth

hours	number of bacteria
2	4.5
6	22.781
12	259.493

Bacteria in a pond multiplies as shown in the table. If a fungus on a tree decays at half that rate, what is the rate of decay (round to the nearest integer)?

A) 20%
B) 25%
C) 30%
D) 40%

Explanation:
A growth function can be modeled by $y = a(1 + r)^x$. Use a system of equations to solve for the growth rate and you find the growth rate for the bacteria is 50%. Therefore the fungus decay at half that rate or **25%**.

14)

Money in Savings Account

Month	Amount in account ($)
2	106.09
5	115.93
7	122.99
36	289.83

Marco invested $100 in a savings account and did not add to it again. Interest is added every month and his balance for several months is shown in the table.

Marco notices that the interest rate on his credit card is 5.75 times the interest rate for his savings account. What is the interest rate on his credit card?

A) 0.5%
B) 3%
C) 11.50%
D) 17.25%

Explanation:
A growth function can be modeled by $y = a(1 + r)^x$. Use a system of equations to solve for the growth rate and you find the interest rate for his savings account is 3%. Therefore the interest rate for his credit card is 5.75(3) = **17.25%**

15) The 1997 value of an object was $9500. In 2012, it was worth $5000. The annual percent of decay has been constant. What is the annual percent of decay?

A) 1.19%
B) 2.19%
C) 3.19%
D) 4.19%

Explanation:
4.19% is correct. $5000=9500(1-r)^{15}$; $0.5263=(1-r)^{15}$; $0.5263^{1/15}= 1-r$; r=4.19%