Day 2 Homework - Use a graphing calculator to answer the following questions.

1. The following data represent the amount of money an investor has in an investment account each year for 10 years. She wishes to determine the effective rate of return on her investment.

| Year | Value of |
|------|--------------|
| | Account (\$) |
| 1990 | 10,000 |
| 1991 | 10,573 |
| 1992 | 11,260 |
| 1993 | 11,733 |
| 1994 | 12,424 |
| 1995 | 13,269 |
| 1996 | 13,968 |
| 1997 | 14,823 |
| 1998 | 15,297 |
| 1999 | 16,539 |

- a. Fit an exponential curve to the data given.
- b. Based on your answer in part (a), what was the effective rate of return from this account over the past 10 years?
- c. If the investor plans on retiring in 2020, what will be the predicted value of this account?
- 2. The following data show the amount of money an investor has in an investment account each year for 7 years. He wishes to determine the effective rate of return on his investment.

| Year | Value of Account (\$) |
|------|--------------------------|
| 1993 | 20,000 |
| 1994 | 21,516 |
| 1995 | 23,355 |
| 1996 | 24,885 |
| 1997 | 27,434 |
| 1998 | 30,053 |
| 1999 | 32,622 |

a. Fit the exponential model to the data given.

b. What was the effective rate of return from this account over the past 7 years?

c. If the investor plans on retiring in 2020, what will be the predicted value of this account?

 The following data represent the wind speed (mph) and wind chill factor at an air temperature of 15°F.

| Wind | Wind Chill |
|-------|------------|
| Speed | Factor |
| (mph) | |
| 5 | 12 |
| 10 | -3 |
| 15 | -11 |
| 20 | -17 |
| 25 | -22 |
| 30 | -25 |
| 35 | -27 |

- a. Find the logarithmic model for the data given.
- b. Predict the wind chill factor if wind speed is 23 mph.

Day 3 Homework:

Most cars lose value each year by a process known as *depreciation*. You may have heard before that a new car loses a large part of its value in the first 2 or 3 years and continues to lose its value, but more gradually, over time. That is because the car does not lose the same amount of value each year, it loses approximately the same percentage of its value each year.

1. Matt bought a new car at a cost of \$25,000. The car depreciates approximately 15% of its value each year. What will the car be worth in 10 years?

2. Jelisa bought a new car at a cost of \$50,000. The car depreciates approximately 25% of its value each year. What will the car be worth in 8 years?

3. The population of Whoville is currently 10,891. The mayor hopes his city will grow 6.5% each year.

a. Find a model that can predict the population in x years.

b. What is the initial population?

c. What is the rate of decay/ growth of the population?

d. In 25 years, what will be the population of Whoville?

e. When will the population double?

Day 4 Homework

- 1 to 3: Find the amount that results from each investment
- 1. \$50 invested at 6% compounded monthly after a period of 3 years.
- 2. \$300 invested at 12% compounded quarterly after a period of 1.5 years.
- 3. \$700 invested at 6% compounded daily after a period at 2 years.

4 to 6: Find the principal needed now to get each amount.

- 4. To get \$75 after 3 years at 8% compounded quarterly
- 5. To get \$800 after 3.5 years at 7% compounded monthly
- 6. To get \$300 after 4 years at 3% compounded yearly

7. Jim places \$1000 in a bank account that pays 5.6% compounded monthly. After 1 year, will he have enough money to buy a computer system that costs \$1060? If another bank will pay Jim 5.9%, compounded quarterly, is this a better deal?

8. On January 1, Kim places \$1000 in a certificate of deposit that pays 6.8%, compounded monthly and matures in 3 months. Then Kim places the \$1000 and the interest in a passbook account that pays 5.25% compounded monthly. How much does Kim have in the passbook account on May 1?

Day 4 Homework Continued

1. The number *N* of bacteria present in a culture at time *t* (in hours) obeys the function $N(t) = 1000e^{0.01t}$.

- a. After how many hours will the population equal 1500? 2000?
- b. How many bacterial are present after 24 hours?

2. A culture of bacteria obeys the law of uninhibited growth. If 500 bacteria are present initially and there are 800 after 1 hour,

- a. how many will be present in the culture after 5 hours?
- b. How long is it until there are 20,000 bacteria?

3. The population of a Midwestern city follows the exponential law. If the population decreased from 900,000 to 800,000 from 1993 to 1995, what will the population be in 2012?

Law of Uninhibited Growth (Exponential Law): $N(t) = N_0(e)^{kt}$

Day 5 Homework

1. Suppose that April has access to an investment that will pay 10% interest compounded continuously. Which is better: To be given \$1000 now so that she can take advantage of this investment opportunity or to be given \$1325 after 3 years?

2. A child's grandparents are considering buying a \$80,000 face value zero-coupon bond at birth so that she will have enough money for her college education 17 years later. If they want a rate of return of 8% compounded annually, what should they pay for the bond?

3. If Pat pays \$12,485.52 for a \$25,000 face value zero-coupon bond that matures in 8 years, what is his annual rate of return?

A zero-coupon bond is a bond that is sold now at a discount and will pay its face value at some time when it matures; no interest payments are made.

McNewton's Coffee

This activity must be completed on a separate sheet of paper. It will be collected on ______ It will count 40 points.



Your team has been called in to solve a problem encountered by a fast food restaurant. They believe that their coffee should be brewed at 170°F. However, at that temperature it is too hot to drink, and a customer who accidentally spills the coffee might receive third-degree burns.

What they need is a special container that will heat the water from 170°, brew the coffee at that temperature, then

cool it quickly to a drinkable temperature, say 140°F, and hold it there, at least keep it at or above 120°F for a reasonable period of time without further cooking. To cool down the coffee, three companies have submitted proposals with these specifications.

(a) The CentiKeeper Company has a container that will reduce the temperature of a liquid from 200°F to 100°F in 90 minutes by maintaining a constant temperature of 70°F.

(b) The TempControl Company has a container that will reduce the temperature of a liquid from 200°F to 110°F in 60 minutes by maintaining a constant temperature of 60°F.

(c) The Hot'n'Cold, Inc., has a container that will reduce the temperature of a liquid from 210°F to 90°F in 30 minutes by maintaining a constant temperature of 50°F

Your job is to make a recommendation as to which container to purchase. For this you will need Newton's Law of Cooling which follows: $u(t) = T + (u_0 - T)e^{kt}$, k < 0

In this formula, T represents the temperature of the surrounding medium, u_0 is the initial temperature of the heated object, t is the length of time in minutes, k is a negative constant, and u represents the temperature at time t.

- 1. Use Newton's Law of Cooling to find the constant k of the formula for each container
- 2. Sketch a graph of each relation
- 3. How long does it take each container to lower the coffee from 170°F to 140°F?
- 4. How long will the coffee temperature remain between 120°F and 140°F?
- 5. On the basis of this information, which company should get the contract with McNewton's? Defend your answer.

Review Sheet

1. Newton's Law of Cooling says that $u(t) = T + (u_0 - T)e^{kt}$. u(t) is the final temperature, T is the room temperature, u_0 is the initial temperature, k is a constant of cooling, and t is time. An insulated container can hold the temperature of a liquid from 175 degrees Fahrenheit to 100 degrees Fahrenheit for 90 minutes. If the temperature of the outside is 10 degrees Fahrenheit, how long until the liquid freezes (32 degrees F)? If the same container is used to hold a liquid, how long will it take the liquid to cool from 200 degrees Fahrenheit to 175 degrees Fahrenheit?

2. A tree grows at 1.2% continuously. If the tree started at 10cm, how long will it take the tree to grow to 1000cm?

3. A high school graduate receives \$750 in graduation gifts. Being a smart student, they quickly deposit all the money into a savings account that offers 4.2% APR, compounded monthly. How much money will the student have in 10 years?

4. A car is purchased for \$14,500. Each month the car depreciates at 0.98%. The owner wants to sell the car when it has lost half of its value. When should the owner sell the car

5. A deadly bacteria was placed in a pietri-dish 10 hours ago and is growing continuously. 6 hours ago, 342 bacteria existed. When a current sample is taken, 924 bacteria exist. Use this information to answer the following questions:

What is the rate of growth for the bacteria? What is the equation that will model this bacteria's growth? When will/did the sample triple?

6. Given the following function, $f(t) = 250(0.982)^t$, answer questions:

The function describes the number of insects in a given area over *t* hours.

- a. How many insects were in the area initially?
- b. What will happen to the insects in the long run?

7. Naima's parents would like to save enough money for college because they do not want to take out any loans. When Naima is born, they find a savings account that will give them 2.35% interest annually, compounded monthly. If they want \$50,000 by the time Naima is 18, how much should they deposit when she is born? After 3 years have gone by, Naima's parents find an account that gives them 2.5% interest annually, compounded continuously. How long will it now take her parents to earn \$50,000?

8. While preparing for the school musicals, students in the production noticed the lights on the stage where beginning to overheat so they quickly turned them off. If the temperature of the room started at 104 degrees Fahrenheit and started to cool at 3.6% per minute, when was the temperature of the room at 60 degrees Fahrenheit?

9. Sandra deposited \$400 into an account that yields 3.4% APR, compounded continuously. How much money will Sandra have after 7 years?

10. A population of wild beasts are being hunted and jailed at a rate of 7.6% every day. When will half the population of the beasts remain?