

## **Introduction to Exponential Functions Class Work**

🦋 **Objective:** *You will be able to solve problems involving exponential growth/decay.*

---

★ **Consider each situation, and answer the questions that follow.**

### **Situation 1: 24<sup>TH</sup> BIRTHDAY STORY...**

A: Consider my gifts as the first round of giving. If all went according to plan, how many “smiles” would have been given after the second round of giving? What about after the third round? The fourth round?

B: How many “rounds of giving” would it take for over 10,000 “smiles” to be given?

C: (We will come back to write, graph, and analyze a function to model this situation!)

**Situation 2: VALUE OF A CAR**

A new Acura is valued at \$39,000, but its value depreciates 3.8% per year.

A: How much will the car be worth 2 years from now? What about 4 years from now? 6 years from now?

B: How many years will it take for the value of the car to reach \$24,500?

C: (We will come back to write, graph, and analyze a function to model this situation!)

**Situation 3: EARNING INTEREST**

An investor deposited \$2,000 in an account that earns 1% interest every two years.


A: How much will the investor's initial deposit be worth after 6 years?

B: What is the average rate of change of the worth of the initial deposit from 6 years to 8 years? Is this average rate of change the same or different from the average rate of change between zero years and six years? Explain.

C: (We will come back to write, graph, and analyze a function to model this situation!)

◆ Exponential Growth Equation:

◆ Exponential Decay Equation:

 **Exponential Growth & Decay Practice:** Write an equation to model each situation. Answer each question that follows. Also graph each function on your calculator. **Complete all work on a separate sheet of paper.**

1. A scientist has a sample of bacteria that initially contains 2 million microbes. After observing the population, he finds that the number of microbes triples every 15 minutes for three hours.

- Write a function  $P(t)$ , where  $P$  is the population of microbes after  $t$  minutes.
- How many microbes will there be after one hour?
- How long will it take for the population to reach at least 20 million but not exceed 21 million?
- What is the domain of the function?

2. An antique item was purchased in 2011 for \$450, and was appraised as having a value that would increase by 8% each year.

- Write a function  $V(t)$  to represent that value,  $V$ , of the item after  $t$  years since its appraisal.
- By how much money did the value of the item increase in the first year?
- What is the value of the item currently?
- By what percent did the value of the item increase over the first three years?
- Does the rate of change of the value of the item increase, decrease, or maintain over time?

3. A certain element helps in determining the age of fossils that are less than 100,000 years old. Every 3,220 years, the mass of the element is reduced by half.

- Write a function  $M(x)$  for the mass of the element at age  $x$ . Use  $v$  to represent the initial mass.

b. Now, recall:  $\left(\frac{1}{x}\right)^n =$

Rewrite your function using a negative exponent.

- At what age will the mass of the element in a fossil be one-fourth of the original amount?
- What is the domain of the function?
- Is the graph of the function linear or nonlinear? Is the graph of the function increasing or decreasing?

4. When Paula was born, her parents gave her an account with \$10,000. Every five years, they take out two-thirds of the money in the account to invest in stock for Paula.
- Write a function  $A(x)$  to represent the amount of money in the account when Paula is  $x$  years old. (Write the function once using a positive exponent, and write an equivalent function using a negative exponent.)
  - How much money will Paula have invested in stock when she is 20 years old?
  - How much money will be left in Paula's account when she is 25 years old?
  - Does the rate of change in the amount of money left in the account increase or decrease over time?
  - When there are less than \$10 left in the account, Paula's parents must close the account and will therefore give whatever is left over to Paula. How old will Paula be when this happens, and how much money will she receive?
5. A company donates annually to a local animal shelter. Each year, they increase the amount of the donation by 8%. The total amount donated by the company after five years is \$1322.40.
- Determine the initial donation, to the nearest dollar.
  - If the company had rather donated \$1000 to start, but increased by 7% per year, would their yearly average donation be higher or lower over the first 10 years? Thoroughly support your answer.

**\*Write down any important idea related to exponential growth/decay, and/or any question(s) you have regarding exponential growth/decay.**