Exponential Growth Decay Worksheet Questions and Answers PDF

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Part 1: Building a Foundation

What is the base of the natural logarithm used in exponential growth and decay formulas?

Hint: Think about the mathematical constant that is often used in calculus.

- ◯ A) 2
- ◯ B) 10
- ◯ **C) e ✓**
- ◯ D) π

> The base of the natural logarithm is e.

Which of the following are characteristics of exponential growth?

Hint: Consider how quantities change over time in exponential scenarios.

- ☐ **A) The quantity increases over time. ✓**
- ☐ B) The rate of change is constant.
- ☐ **C) The rate of change is proportional to the current value. ✓**
- ☐ D) The quantity decreases over time.

> Exponential growth is characterized by increasing quantities and a rate of change that is proportional to the current value.

Explain the difference between exponential growth and exponential decay in your own words.

Hint: Consider how each process affects quantities over time.

Exponential growth refers to an increase in quantity over time, while exponential decay refers to a decrease in quantity over time.

List the variables in the exponential growth formula N(t) = N0 × e^(kt) and briefly describe what each represents.

Hint: Think about the components of the formula and their meanings.

1. What does N0 represent?

Initial quantity.

2. What does e represent?

Base of the natural logarithm.

3. What does k represent?

Growth rate.

4. What does t represent?

Time.

N0 is the initial quantity, e is the base of the natural logarithm, k is the growth rate, and t is time.

Part 2: Comprehension and Application

Which of the following scenarios best represents exponential decay?

Hint: Think about processes that involve a decrease over time.

- ◯ A) A population of bacteria doubling every hour.
- ◯ **B) The cooling of a hot cup of coffee over time. ✓**
- ◯ C) The growth of an investment account with compound interest.
- ◯ D) The number of people attending a concert.

The cooling of a hot cup of coffee over time is an example of exponential decay.

Which factors influence the rate of exponential growth?

Hint: Consider what variables might affect growth in a given scenario.

- ☐ **A) Initial quantity ✓**
- ☐ **B) Growth rate ✓**
- ☐ **C) Time ✓**
- ☐ D) Half-life

The initial quantity, growth rate, and time all influence the rate of exponential growth.

Describe how the graph of an exponential decay function differs from that of an exponential growth function.

Hint: Think about the shape and direction of the graphs.

The graph of exponential decay decreases over time, while the graph of exponential growth increases over time.

If a population of 1000 bacteria grows exponentially at a rate of 5% per hour, what will the population be after 3 hours?

Hint: Use the exponential growth formula to calculate the population.

- ◯ A) 1050
- ◯ B) 1157
- ◯ **C) 1161 ✓**
- ◯ D) 1500

The population will be approximately 1161 after 3 hours.

Which of the following real-world situations can be modeled using exponential decay?

Hint: Think about processes that involve a decrease over time.

- ☐ **A) The depreciation of a car's value over time. ✓**
- ☐ B) The increase in a bank account balance with compound interest.
- ☐ C) The spread of a viral video on social media.
- ☐ **D) The half-life of a radioactive substance. ✓**

The depreciation of a car's value over time and the half-life of a radioactive substance are examples of exponential decay.

Calculate the doubling time for an investment that grows at an annual rate of 7%. Show your work.

Hint: Use the rule of 70 to estimate the doubling time.

The doubling time can be calculated using the formula 70/r, where r is the growth rate.

Part 3: Analysis, Evaluation, and Creation

What happens to the graph of an exponential growth function if the growth rate k is increased?

Hint: Consider how the steepness of the graph changes.

- ◯ **A) The graph becomes steeper. ✓**
- ◯ B) The graph becomes flatter.
- ◯ C) The graph shifts downward.
- ◯ D) The graph shifts upward.

> The graph becomes steeper as the growth rate k increases.

Analyze the following statements and identify which are true for both exponential growth and decay.

Hint: Consider the properties of both types of functions.

- ☐ **A) The initial quantity affects the outcome. ✓**
- ☐ B) The rate of change is constant.
- ☐ **C) The function can be represented by a curve. ✓**
- ☐ D) The process is reversible.

> The initial quantity affects the outcome and the function can be represented by a curve for both exponential growth and decay.

Compare and contrast the effects of changing the initial quantity N0 in both exponential growth and decay models.

Hint: Think about how the initial quantity influences the outcome.

> **Changing N0 affects the starting point of both models, leading to different outcomes in growth and decay.**

Which factor is most critical in determining whether a process is modeled by exponential growth or decay?

Hint: Consider what fundamentally distinguishes growth from decay.

- ◯ A) Initial quantity
- ◯ B) Time
- ◯ **C) Rate of change ✓**
- ◯ D) Final quantity

> The rate of change is the most critical factor in determining whether a process is modeled by exponential growth or decay.

Evaluate the following scenarios and determine which would require a modification of the exponential model.

Hint: Think about situations where the assumptions of the model may not hold.

- ☐ **A) A population that reaches a carrying capacity. ✓**
- ☐ **B) A substance that stops decaying after a certain time. ✓**
- ☐ **C) A bank account with a changing interest rate. ✓**
- ☐ **D) A disease that spreads faster as more people become infected. ✓**

> A population that reaches a carrying capacity and a disease that spreads faster as more people become infected would require modifications to the exponential model.

Design a real-world scenario where exponential growth could transition into exponential decay. Explain the factors that would cause this transition.

Hint: Consider situations where growth is followed by a decline.

> **A scenario could involve a population that grows rapidly until resources become limited, leading to a decline in population.**