Exponential Growth Decay Worksheet

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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

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.

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

Hint: Consider how each process affects quantities 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?

2. What does e represent?

3. What does k represent?

4. What does t represent?

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.

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

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.

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

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.

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.

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.

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.

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.

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

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.

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.