

**5.2 Exponential Growth and Decay Applications**

**Warm Up:** Label the following functions as exponential growth, exponential decay, or neither. Then give their grow/decay rate and their growth/decay factor.

$$f(x) = 3(1.79)^x$$

$$f(x) = 520(0.23)^x$$

$$f(x) = \left(\frac{7}{10}\right)^x$$

$$f(x) = 2(3.621)^x$$

**Example)** Consider a culture of 100 bacteria that is placed into a petri dish. The bacteria are expected to grow at a rate of 4.7% each hour. Write a function that gives the total amount of bacteria in the petri dish after  $x$  hours have passed. Sketch a graph of the function.

a) How many bacteria will be in the petri dish after 8 hours?

b) When can you expect to see 1300 bacteria in the petri dish?

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**Example)** You bought \$2000 worth of stocks in 2015. The value of the stocks have been decreasing by 9% per year since you bought them. Write a function that represents the value of the stock  $x$  years after you bought them in 2015.

a) What was the stock worth in 2018?

b) If you keep the stock, when will it be worth \$1200?

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### Compound Interest:

<u>Annual Compounding:</u>	<u>Compounding <math>n</math> times per year:</u>

**Example)** \$1000 is invested into an account earning 6% annual interest. How much will be in the account after 5 years?

**Example.** \$1000 is invested into an account earning 6% interest **compounded quarterly**. How much will be in the account after 5 years?

What is the  $n$  value if the interest was compounded...

Yearly:	Monthly:	Weekly:	Daily:
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What happens if you compound interest **continuously**?

**Example)** You invest \$1000 earning 6% interest **compounded continuously**. How much will you have after 5 years?

### Continuous Compounding:

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Example) At present, the Population of Gambia is about 2.05 million people. The population is growing at a rate of 3.22% compounded annually. If the population continues to grow at this rate, what will the population of Gambia be in 10 years?



What if the population was growing at a rate compounded continuously? How different would be the approximate population be?

**Example)** The value of an antique ring is said to increase by 18% each year. If the ring was purchased in 1940 for \$12, what is the value of the ring today (2022)?

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**Example)** During the economic recession which started in 2008, CNN reported that property values were declining at rates as high as 18% annually through 2012. Find the value of the properties below in 2012 if their value in 2008 was...

Home 1: \$248,940

Home 2: \$563,500

In 2014, the housing market began to rebound. If property values increased at an annual rate of 12.3%, how many years would it take before the two houses were back at their original value?

Home 1: Original Value: \$248,940

Home 2: Original Value: \$563,500

Value in 2012: \_\_\_\_\_

Value in 2012: \_\_\_\_\_

Years to Rebound: \_\_\_\_\_

Years to Rebound: \_\_\_\_\_

**Example)** A population of rhinos were introduced to a habitat in 2000. After 2 years, there were 18 rhinos in the habitat. After 7 years, there were 28 rhinos in the habitat. If the population of rhinos is said to have grown by a fixed percentage each year, at what rate is the rhino population increasing?

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