

Exponential Function

Growth and Decay  
FunctionTransformations of  
Exponential FunctionsCompound Continuously  
FunctionCompound Interest  
Function

$$y = ab^x$$

$$A(t) = a(1+r)^t$$

$$y = ab^{x-h} + k$$

$$y = Pe^{rt}$$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Decide which of the above equations we need to use to answer the questions below. Answer every question.

- Every time Pinocchio lies his nose grows about 20% of its size. Originally his nose is 2 inches long. Write an equation that models the situation.

How long will his nose be after he tells 20 lies?

How many lies would he have to tell before his nose is longer than 3 ft?

- Using the parent function  $y = 2^x$ , write the equation of an exponential function that is flipped over the x-axis, shifted 3 to the right and 4 down.
- Scrooge invests \$500. He found a bank that would pay him 4% interest, compounded quarterly. If he deposits the whole \$500 and does not deposit or withdraw any other amount, how much money would he have after 4 years?

How long would it take him to double his money?

- Jiminy Cricket is 3 ft away from his house when it starts to rain. As more rain falls Jiminy can't jump as far. On his first jumps 1.5 ft or half the distance to his house. Each jump after that, Jiminy can only jump half the distance of his previous jump. Write an equation that models this situation.

How far will he be from his house after 10 jumps?

Will he ever make it to our house? Why or why not?

- You tell a secret to your best friend. Right now two people know the secret. In a high school it is estimated that each person will tell 2 other people a secret. Your best friend tells 2 other friends this secret, of course warning them not to tell anyone. Now, 4 people know the secret. Those two people now tell 2 more people. If this pattern continues, how many people will be told the secret on the 10<sup>th</sup> such passing of the secret?
- Due to a severe drought, a population of lions is decreasing at a rate of 3.5% per year. Scientists have noticed 80 lions in the area. After how many years will this population of 80 lions drop below 15 lions if this rate decrease continues?

How many lions will be left after 4 years?

7. As of 2018 the world population is 7.616 billion people and is growing at a rate of 1.1% per year.
- Write an equation to model the population growth, where  $P(t)$  is population in billions of people and  $t$  is time in years.
  - What is the predicted population for 2050?
  - As of 2018 we have an excess of natural resources and are able to support a population of about 9 billion people. However, natural resources are being depleted at about 1% per year. When will we no longer have enough natural resources to support the growing population?
8. Olaf drinks a soda that contains 120 mg of caffeine. Each hour, the caffeine in his system decreases by about 12%. How long until he has 10 mg of caffeine?

In 4 hours how much caffeine will he have in his system?

9. Since January 1980, the population of Arondale has grown according to the mathematical model  $y = 720,500(1.022)^x$ , where  $x$  is the number of years since January 1980.

Explain what the numbers 720,500 and 1.022 represent in this model.

What would the population be in 2000 if the growth continues at the same rate?

When would you predict the population of Arondale reach 1,000,000.

10. Your new computer costs \$1500 but it depreciates in value by 18% each year. Write an equation that would indicate the value of the computer after  $x$  years.

How much will your computer be worth in 6 years.

11. Which of the following shows exponential growth. Circle all that apply.

$$y = 5(2)^x \quad y = 100(.5)^x \quad y = 20(1 + 0.025)^x \quad y = 40(1 - 0.4)^x \quad y = -.5(7)^x$$

12. Which is more: being given one million dollars, or one penny the first day, double that penny the next day, then double the previous day's penny and so on for a month? Show your work.

7. As of 2018 the world population is 7.616 billion people and is growing at a rate of 1.1% per year.
- a) Write an equation to model the population growth, where  $P(t)$  is population in billions of people and  $t$  is time in years.

$$P(t) = 7.616(1 + 0.011)^t$$

- b) What is the predicted population for 2050?

$$P(32) = 7.616(1 + 0.011)^{32} = 10.908 \text{ billion people}$$

- c) As of 2018 we have an excess of natural resources and are able to support a population of about 9 billion people. However, natural resources are being depleted at about 1% per year. When will we no longer have enough natural resources to support the growing population?

$$y = 9(1 - 0.01)^t \quad t = 7.955 \text{ in 2025}$$

8. Olaf drinks a soda that contains 120 mg of caffeine. Each hour, the caffeine in his system decreases by about 12%. How long until he has 10 mg of caffeine?

$$y = 120(1 - 0.12)^t \quad t = 19.44 \text{ hours}$$

In 4 hours how much caffeine will he have in his system?

$$71.96 \text{ mg}$$

9. Since January 1980, the population of Arondale has grown according to the mathematical model  $y = 720,500(1.022)^x$ , where  $x$  is the number of years since January 1980.

Explain what the numbers 720,500 and 1.022 represent in this model.

↓ population in 1980      ← growth factor  
2.2% growth

What would the population be in 2000 if the growth continues at the same rate?

$$1,113,402 \text{ people}$$

When would you predict the population of Arondale reach 1,000,000.

$$1995$$

10. Your new computer costs \$1500 but it depreciates in value by 18% each year. Write an equation that would indicate the value of the computer after  $x$  years.

$$y = 1500(1 - 0.18)^x$$

How much will your computer be worth in 6 years.

$$\$456.01$$

11. Which of the following shows exponential growth. Circle all that apply.

$$y = 5(2)^x$$

$$y = 100(.5)^x$$

$$y = 20(1 + 0.025)^x$$

$$y = 40(1 - 0.4)^x$$

$$y = -5(7)^x$$

12. Which is more: being given one million dollars, or one penny the first day, double that penny the next day, then double the previous day's penny and so on for a month? Show your work.

$$y = .01(2)^{30} = 10,737,418.24 > 1,000,000$$

↑  
more

Algebra 2 H

Exponential Functions Word Problem Practice

Name:

Period:

Exponential Function

Growth and Decay Function

Transformations of Exponential Functions

Compound Continuously Function

Compound Interest Function

$$y = ab^x$$

$$A(t) = a(1+r)^t$$

$$y = ab^{x-h} + k$$

$$y = Pe^{rt}$$

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

Decide which of the above equations we need to use to answer the questions below. Answer every question.

1. Every time Pinocchio lies his nose grows about 20% of its size. Originally his nose is 2 inches long. Write an equation that models the situation.

$$y = 2(1.2)^x$$

How long will his nose be after he tells 20 lies?

76.68 inches

How many lies would he have to tell before his nose is longer than 3 ft?

20 lies

2. Using the parent function  $y = 2^x$ , write the equation of an exponential function that is flipped over the x-axis, shifted 3 to the right and 4 down.

$$y = -2^{x-3} - 4$$

3. Scrooge invests \$500. He found a bank that would pay him 4% interest, compounded quarterly. If he deposits the whole \$500 and does not deposit or withdraw any other amount, how much money would he have after 4 years?

$$y = 500 \left(1 + \frac{0.04}{4}\right)^{4 \cdot 4}$$

\$586.30

How long would it take him to double his money?

about 17 years

4. Jiminy Cricket is 3 ft away from his house when it starts to rain. As more rain falls Jiminy can't jump as far. On his first jumps 1.5 ft or half the distance to his house. Each jump after that, Jiminy can only jump half the distance of his previous jump. Write an equation that models this situation.

$$y = 3\left(\frac{1}{2}\right)^x$$

How far will he be from his house after 10 jumps?

.0029 ft

Will he ever make it to our house? Why or why not?

NO, there will always be a halfway point so the distance will never be 0.

5. You tell a secret to your best friend. Right now two people know the secret. In a high school it is estimated that each person will tell 2 other people a secret. Your best friend tells 2 other friends this secret, of course warning them not to tell anyone. Now, 4 people know the secret. Those two people now tell 2 more people. If this pattern continues, how many people will be told the secret on the 10<sup>th</sup> such passing of the secret?

$$y = 2 \cdot 2^x$$

$$y = 2 \cdot 2^{10} = 2048 \text{ people}$$

6. Due to a severe drought, a population of lions is decreasing at a rate of 3.5% per year. Scientists have noticed 80 lions in the area. After how many years will this population of 80 lions drop below 15 lions if this rate decrease continues?

$$t = 46.99 \text{ years about}$$

$$15 = 80(1 - .035)^t$$

47 years

How many lions will be left after 4 years?

about 69 lions