

# Where Does It Fall, or Not: Exponential Functions

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The Common Core State Standards expect our students to “distinguish between situations that can be modeled with linear functions and with exponential functions.” We will explore the progression of modeling with both linear and exponential models before moving into quadratic functions in an algebra 2 course.

Presentation Format: *9-12 Session*

Grade Band Audience: *9 to 12*

## **Common Core State Standards - Functions**

“Functions presented as expressions can model many important phenomena. Two important families of functions characterized by laws of growth are linear functions, which grow at a constant rate, and exponential functions, which grow at a constant percent rate. Linear functions with a constant term of zero describe proportional relationships.

A graphing utility or computer algebra system can be used to experiment with properties of these functions and their graphs and to build computational models of functions, including recursively defined functions.”

## **Mathematical Practices**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

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## 1. Constant Rate Walk

Begin 3 feet from the motion detector and walk away at a rate of 2 feet per second.

Time	Distance
0	
1	
2	
3	
4	
10	

Time	Distance
0	3.5
1	5
2	6.5
3	8
4	9.5

Time	Distance
2	10
4	16

Time	Distance
1	3.5
4	11

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## 2. Developing Exponential Functions

- a. In 1995 it was reported that there were 60,000 centenarians in the U.S. A researcher predicted a 7% annual growth rate and claimed that the number of centenarians would reach 232,000 by the year 2015. Verify the result.

Year	Number of Centenarians
0	60,000
1	
2	
3	
4	

- b. A popular sports utility vehicle bought for \$40,000 in 2010 was predicted to depreciate at a rate of 15% each year. When will the value be half of the original price?

Year	Value
0	
1	
2	
3	
4	

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## 3. Interpreting Exponential Functions

A scientist uses a model to predict wildlife populations for both deer and bison. The results are shown. Determine the models she uses.

Year	2005	2006	2007	2008	2009	2010	2011	2012
Deer	1500	1545	1591	1639	1688	1739	1791	1845
Bison	600	570	542	514	489	464	441	419

## 4. Comparing Models

The Consumer Price Index is estimated to double from 100 to 200 in 10 years. Determine a linear model of the form  $y = bx + a$  (where  $x$  is time and  $y$  is CPI) for the relationship and explain what the parameters  $a$  and  $b$  mean. Determine an exponential model of the form  $y = ab^x$  (where  $x$  is time in years and  $y$  is CPI) for the relationship and explain what the parameters  $a$  and  $b$  mean.