Core Content

Cluster Title: Construct and compare linear, ~~quadratic,~~ and exponential models and solve problems.

Standard F.LE.1: Distinguish between situations that can be modeled with linear functions and with exponential functions.
  a. Prove that linear functions grow by equal differences over equal intervals; exponential functions grow by equal factors over equal intervals.
  b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
  c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Concepts and Skills to Master
• Justify the fact that linear functions grow by equal difference over equal intervals using tables and graphs. • Justify the fact that exponential functions grow by equal factors over equal intervals using tables and graphs. • Recognize situations that can be modeled linearly or exponentially and describe the rate of change per unit as constant or the growth factor as a constant percent.

Supports for Teachers

Critical Background Knowledge	
• Knowledge of percent	
Academic Vocabulary	
Interval, rate, factors, constant rate of change, percent rate per unit	
Suggested Instructional Strategies	**Resources**
• Model and explore a variety of linear and exponential functions, analyzing what makes them change.	*Focus on Functions* professional development
Sample Formative Assessment Tasks	
Skill-based Task An accountant has two ways of depreciating equipment. One way is to depreciate by a fixed amount each year. The other way is to depreciate by a fixed percentage each year. Which depreciation method is linear? Which depreciation method is exponential?	**Problem Task** Create a story that demonstrates one quantity changing at a constant rate per unit interval relative to another.

Core Content

Cluster Title: Construct and compare linear, ~~quadratic,~~ and exponential models and solve problems.
Standard F.LE.2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
Concepts and Skills to Master
- Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph.   - Construct linear and exponential functions, including arithmetic and geometric sequences, given the description of a relationship.   - Construct linear functions, including arithmetic sequences, given input-output pairs, including those in a table.

Supports for Teachers

Critical Background Knowledge	
- Arithmetic and geometric sequences - Function notation	
Academic Vocabulary	
Exponential, linear, arithmetic, geometric, sequences, relationship, input-output, function	
Suggested Instructional Strategies	**Resources**
Match various representations of the same function.	Exponential functions: www.regentsprep.org/regents/math/algtrig/ATP8b/examplesexponentialfunction.htm
Sample Formative Assessment Tasks	
Skill-based Task - Write a linear function that passes through (1,5) and (2,15). - Write an exponential function that passes through (1,5) and (2,15).	**Problem Task** Write a function that models the population of Smithville, a town that in 2003 was estimated to have 35,000 people that increases by 2.4% every year. Describe a reasonable way to use your function to predict future population in Smithville.

Core Content

Cluster Title: Construct and compare linear, ~~quadratic,~~ and exponential models and solve problems.
Standard F.LE.3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly~~, quadratically, or (more generally) as a polynomial function.~~
Concepts and Skills to Master
• Observe that a quantity increasing exponentially eventually exceeds a quantity increasing linearly using graphs and tables.

Supports for Teachers

Critical Background Knowledge	
• Identify linear and exponential functions • Graph linear and exponential functions • Rate of change	
Academic Vocabulary	
Linear, exponential, factor, difference	
Suggested Instructional Strategies	**Resources**
• This standard should be taught in conjunction with others in this cluster.	*Making it Happen* (NCTM)
Sample Formative Assessment Tasks	
Skill-based Task Which increases faster, $f(x) = 3x$ or $g(x) = 3^x$? Justify your answer.	**Problem Task** What's the better deal, earning $1000 a day for the rest of your life or earning $.01 the first day, and doubling it every day for the rest of your life? How do you know? Do you think an 80-year-old would make the same choice? Should she?

I.2.Function. Linear and Exponential Models

Core Content

Cluster Title: Interpret expressions for functions in terms of the situation they model.
Standard F.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
Concepts and Skills to Master
• Interpret the slope and *x*- and *y*-intercepts in a linear function in terms of a context.
• Interpret the base value and vertical shifts in an exponential function of the form $f(x) = b^x + k$ where *b* is an integer and *k* can equal zero.
• Interpret the base value and initial value in an exponential function of the form $f(x) = ab^x$ where *b* is an integer and *a* can be any positive integer, including 1.

Supports for Teachers

Critical Background Knowledge	
• Familiarity with linear and exponential functions	
Academic Vocabulary	
Linear, exponential, parameters	
Suggested Instructional Strategies	**Resources**
• Use applets or graphing technology to explore the effect of changing the slope and *y*-intercept of a linear equation. • Use applets or graphing technology to explore the effect of changing the base value and constant of an exponential function. • Describe parameters in terms of their context in a story.	www.illuminations.NCTM.org • Function Matching
Sample Formative Assessment Tasks	
Skill-based Task You put $500 under your mattress and also deposit $500 in a bank with a 3% annual interest. Write an equation that represents the total amount of money you have at time *t*. Show how the base and vertical shift are displayed in the explicit form of the function.	**Problem Task** Annie is picking apples with her sister. The number of apples in her basket is described by *n* = 22*t* + 12, where t is the number of minutes Annie spends picking apples. What do the numbers 22 and 12 tell you about Annie's apple picking?

I.2.Function. Linear and Exponential Models