Construct and compare linear and exponential models and solve problems (F.LE.1-3)

**Standard I.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 or decay by equal factors over equal intervals using tables and graphs.
- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

### Related Standards: Current Course

- I.A.SSE.1, I.F.LE.2, I.F.LE.3, I.F.LE.5, I.F.IF.3, I.F.IF.6, I.F.BF.1, I.F.BF.2

### Related Standards: Future Courses

- II.A.SSE.1, II.F.IF.3, II.F.IF.4, II.F.IF.6, II.F.IF.9, II.F.BF.1, II.F.LE.3, II.F.LE.3, II.F.LE.4, II.F.LE.5, III.A.SSE.1, III.F.IF.3, III.F.IF.4, III.F.IF.6, III.F.IF.9, III.F.BF.1, P.F.BF.1

### Support for Teachers

#### Critical Background Knowledge

- Use proportional relationships to solve percent problems (7.RP.3)
- Describe where a function is increasing or decreasing (8.F.5)
- Identify the constant rate of change (7.RP.2b, 8.EE.5, 8.F.4, 8.F.5)
- Find a percent of a quantity as a rate per 100 (6.RP.3c)

#### Academic Vocabulary

- interval, rate, factors, constant rate of change, percent rate per unit, growth, decay

#### Resources

- **Curriculum Resources:** [http://www.uen.org/core/core.do?courseNum=5600#70276](http://www.uen.org/core/core.do?courseNum=5600#70276)
I.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 a linear function and/or an arithmetic sequence given a situation, a set of ordered pairs, or a table.
- Construct an exponential function and/or a geometric sequence given a situation, ordered pairs, or a table.

Related Standards: Current Course

- I.A.SSE.1, I.F.LE.1, I.F.LE.3, I.F.LE.5, I.F.IF.2, I.F.IF.3, I.F.IF.6, I.F.BF.1, I.F.BF.2

Related Standards: Future Courses

- II.A.SSE.1, II.F.IF.3, II.F.IF.4, II.F.IF.6, II.F.IF.9, II.F.BF.1, II.F.LE.3, III.F.LE.3, III.F.LE.4, III.F.LE.5, III.A.SSE.1, III.F.IF.3, III.F.IF.4, III.F.IF.6, III.F.IF.9, III.F.BF.1, P.BF.1

Support for Teachers

Critical Background Knowledge

- Construct a function to model linear situation (8.F.4)
- Use function notation (I.F.IF.2)

Academic Vocabulary

Exponential, linear, arithmetic, geometric, sequences

Resources

Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5600#70276
Construct and compare linear and exponential models and solve problems (F.LE.1-3)

**Standard I.F.LE.3:** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly.

**Concepts and Skills to Master**
- Observe that a quantity increasing exponentially eventually exceeds a quantity increasing linearly using graphs and tables.

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**Support for Teachers**

**Critical Background Knowledge**
- Perform operations using whole number exponents (6.EE.2c)
- Identify, compare, and interpret rates of change (7.RP.2b, 8.F.2, 8.EE.5)
- Identify linear and nonlinear functions from a graph or a table (8.F.4, 8.F.5)

**Academic Vocabulary**
- Linear, exponential, increasing

**Resources**
- [Curriculum Resources](http://www.uen.org/core/core.do?courseNum=5600#70276)
Interpret expressions for functions in terms of the situation they model. (F.LE.5)

**Standard I.F.LE.5:** Interpret the parameters in a linear or exponential function in terms of a context. Limit exponential functions to those of the form \( f(x) = b^x + k \).

Concepts and Skills to Master

- Interpret the parameters in a linear function in terms of a context. Parameters include slope and y- intercept
- Interpret the parameters in an exponential function in terms of a context. Parameters include the base value and vertical shifts.

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**Support for Teachers**

**Critical Background Knowledge (Access Background Knowledge)**

- Compare proportional relationships \( y = mx \) to other linear relationships \( y = mx + b \) (7.RP.2, 8.F.3, 8.EE.5)
- Compare properties of two functions (8.F.2), interpret the equation \( y = mx + b \) (8.F.3), and interpret the rate of change and initial value (8.F.4)

**Academic Vocabulary**

parameters, base value, initial value, vertical shift

**Resources**

[Curriculum Resources](http://www.uen.org/core/core.do?courseNum=5600#70276)