Exponential functions

- Functions with formulas of the type

\[ f(x) = ab^x \]

in which the input variable appears in the exponent of a constant base value \( b \)

- Parameters \( a \) and \( b \) have important interpretations:
  - \( a \) is the initial output value (\( y \)-intercept), the output for an input of 0 (typically, \( a > 0 \))
  - \( b \) is the multiplier (which must be > 0); it determines the percentage change \( b - 1 \) associated with the function

- Graphs have a characteristic shape: when \( a > 0 \), the curve always lies above the horizontal axis (outputs are always positive)

- Function is
  - always increasing towards infinity, and at a faster and faster rate (exponential growth), when \( b > 1 \) (positive percentage change);
  - constant when \( b = 1 \) (0% change);
  - always decreasing towards 0, and at a slower and slower rate (exponential decay), when \( b < 1 \) (negative percentage change)
Exponential functions are characterized numerically by the property that when input values are equally spaced, ratios of consecutive outputs are equal.

Be aware that small changes in values of exponents can have a large effect on resulting computations; take special care with rounding exponential quantities.

When modeling with an exponential function, it is best to align input data to small values.

Exponential regression provides an exponential model that “best fits” a data set which is approximately exponential.

[TI-83: STAT CALC
ExpReg <x-list>, <y-list>, <Y-variable>
produces the exponential regression model]