Graphs of Exponential Functions

Graphs of exponential functions with positive values of a are either always increasing and concave up (showing growth), or always decreasing and concave up (showing decline).

Recall that in the formula $f(t) = ab^t$, the parameter a equals $f(0)$, or the initial amount of the quantity being modeled by the function. Graphically then, a is the y-intercept.

As $b = 1 + r$ is the growth factor, where r is the percentage rate of change, values of b larger than 1 indicate growth (and positive values of r). The larger b is, the faster the function increases. Values of b smaller than 1 indicate decay (and negative values of r). The smaller b is, the faster the function decreases.

- When $r > 0$ (and $b > 1$), we have growth, so
  - as $t \to \infty$ (as t increases), then $f(t) \to \infty$, and
  - as $t \to -\infty$ (as t decreases), then $f(t) \to 0$;
- When $r < 0$ (and $b < 1$), we have decay, so
  - as $t \to \infty$, then $f(t) \to 0$, and
  - as $t \to -\infty$, then $f(t) \to \infty$.

In both cases, the x-axis is a horizontal **asymptote** for the curve, meaning that $f(t) \to 0$ when either $t \to -\infty$ or $t \to \infty$.

Examples: p. 122-123, #1-4, 17, 33

Exponential Regression

In the same way that linear and quadratic regression formulas are used to find the best function of the corresponding type that fits a given set of data, there are statistical methods that fit an exponential function to a set of input/output data.

[TI-83: `STAT CALC ExpReg`]

Example: p. 129, #39