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