Math 1030 #16b

Exponential Modeling

GraphingExponential Functions

exponential growth

doubling time

exponential decay

half-life

The easiest way to graph exponential functions is to use points corresponding to several doubling times (or half-lives in the case of decay).

For growth:

Start at $(0,Q_0)$

Plot $(T_{double}, 2Q_0)$,

$(2T_{double}, 4Q_0)$,

$(3T_{double}, 8Q_0)$, etc.

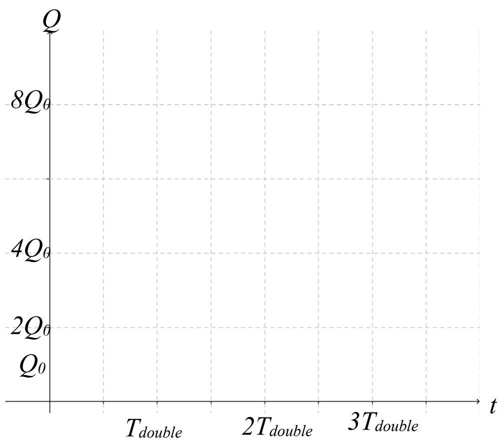
For decay:

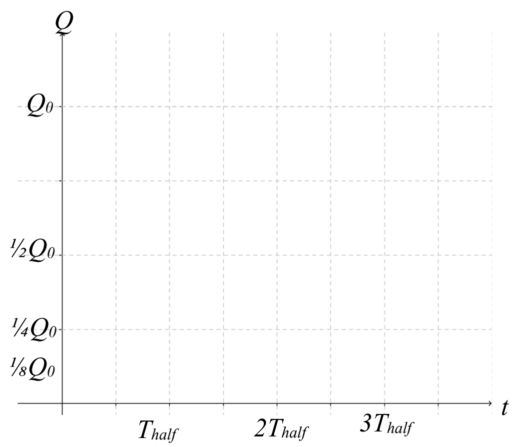
Start at $(0,Q_0)$

Plot $(T_{half}, \frac{1}{2}Q_0)$,

$(2T_{half}, \frac{1}{4}Q_0)$,

$(3T_{half}, \frac{1}{8}Q_0)$, etc.





$$T_{double} = \frac{\log_{10} 2}{\log_{10}(1+r)}$$

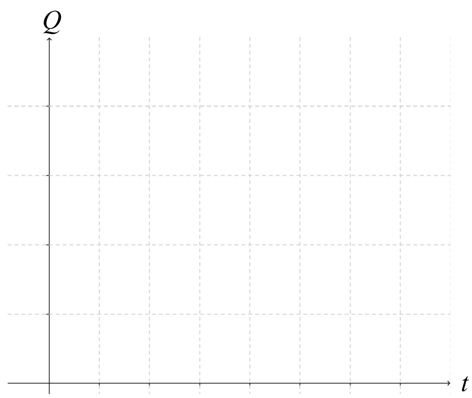
$r > 0$

$$T_{half} = -\frac{\log_{10} 2}{\log_{10}(1+r)}$$

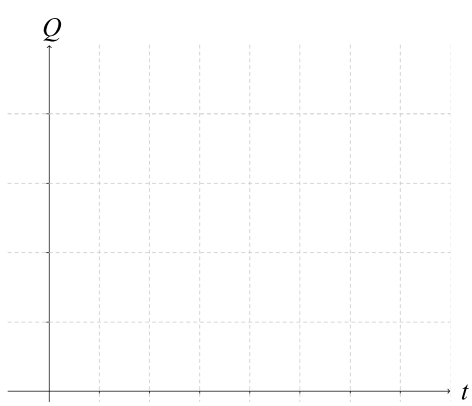
$r < 0$

EX 1: Graph the following equations from the previous lesson.

a) The growth of the population of Heber, Utah is
$Q = 20{,}000(1.15)^t$



b) The decline of the population of Cook Islands is
$Q = 11{,}000(0.97)^t$



Alternate Forms of the Exponential Function

$Q = Q_0 \times (1+r)^t$ Note: r is positive for growth and negative for decay.

$Q = Q_0 \times (2)^{t/T_{double}}$ for growth

$Q = Q_0 \times (1/2)^{t/T_{half}}$ for decay

EX 2: If the half-life of a certain Antibiotics in the bloodstream is 10-hours. If you are given a 15 mg shot at midnight, write an equation for and sketch a graph showing the amount in your bloodstream for the next 24 hours.