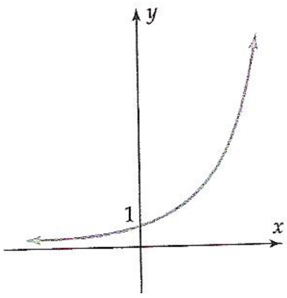
The Exponential Function $f(x) = a^x \ (a > 1)$

When $a > 1$, the graph of $f(x) = a^x$ has the shape shown here and the pr erties listed below.

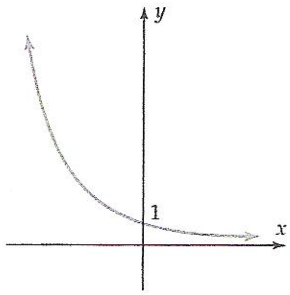


The graph is above the x-axis.
The y-intercept is 1.
$f(x)$ is an increasing function.

The negative x-axis is a horizontal asymptote.
The larger the base a, the more steep the graph rises to the right.

The Exponential Function $f(x) = a^x \ (0 < a < 1)$

When $0 < a < 1$, the graph of $f(x) = a^x$ has the shape shown here and the properties listed below.



Handout for Section 5.2

The graph is above the x-axis.
The y-intercept is 1.
$f(x)$ is a decreasing function.

The positive x-axis is a horizontal asymptote.
The closer the base a is to 0, the more steeply the graph falls to the right.

Exponential Growth

Exponential growth can be described by a function of the form

$$f(x) = Pa^x,$$

where $f(x)$ is the quantity at time x, P is the initial quantity (when $x = 0$) and $a > 1$ is the factor by which the quantity changes when x increases by 1.

If the quantity is growing at the rate r per time period, then $a = 1 + r$, and

$$f(x) = Pa^x = P(1 + r)^x.$$

Exponential Decay

Exponential decay can be described by a function of the form

$$f(x) = Pa^x,$$

where $f(x)$ is the quantity at time x, P is the initial quantity (when x and $0 < a < 1$. Here, a is the factor by which the quantity changes x increases by 1.

If the quantity is decaying at the rate r per time period, then $a = 1 -$

$$f(x) = Pa^x = P(1 - r)^x.$$

Radioactive Decay

The mass $M(x)$ of a radioactive element at time x is given by

$$M(x) = c(.5^{x/h}),$$

where c is the original mass and h is the half-life of the element.