Complete the table to investigate the growth of a $1 investment that earns 100% annual interest over 1 year as the number of compounding periods per year, n, increases.

Compounding Schedule	n	$P(1+\frac{r}{n})^{nt}$	Value
annually			
semiannually			
quarterly			
monthly			
daily			
hourly			
every minute			
every second			

Complete the table to investigate the growth of a $1 investment that earns 100% annual interest over 1 year as the number of compounding periods per year, n, increases.

Compounding Schedule	n	$P(1+\frac{r}{n})^{nt}$	Value
annually	1	$1(1+\frac{1}{1})^{1\bullet 1}$	2
semiannually	2	$1(1+\frac{1}{2})^{2\bullet 1}$	2.25
quarterly	4	$1(1+\frac{1}{4})^{4\bullet 1}$	2.44140625
monthly	12	$1(1+\frac{1}{12})^{12\bullet 1}$	2.61303529
daily	365	$1(1+\frac{1}{365})^{365\bullet 1}$	2.714567482
hourly	8760	$1(1+\frac{1}{8760})^{8760\bullet 1}$	2.718126691
every minute	525600	$1(1+\frac{1}{525600})^{525600\bullet 1}$	2.718279215
every second	3153600	$1(1+\frac{1}{3153600})^{3153600\bullet 1}$	2.718281227

6.6 Part 1 The Natural Exponential Function

Although any positive number can be used for the base, the most important base is the number denoted by e.

e is defined as the value that $(1+\frac{1}{n})^n$ approaches as n becomes large (in calculus, this idea will be made more precise).

$e \approx 2.71828182845904523536...$

The natural exponential function is $f(x) = e^x$.

This is also often referred to as *the* exponential function.

Evaluate to five decimal places.

$e^3 \approx 20.08554$

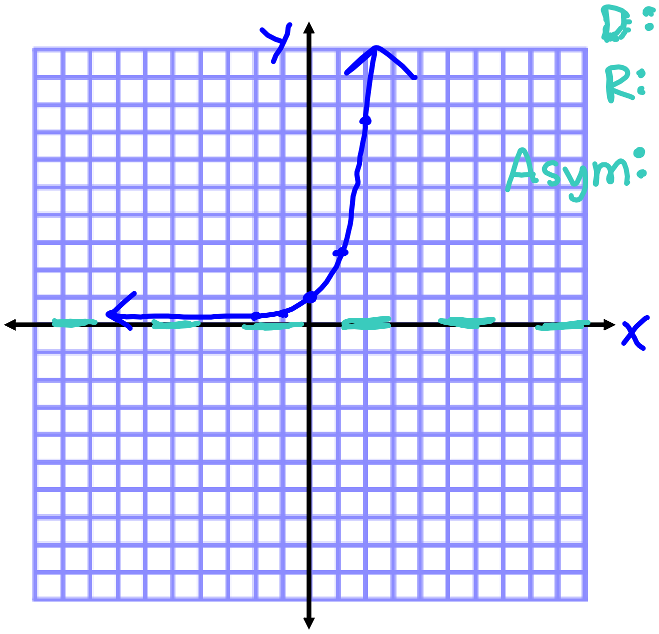
$2e^{-.53} \approx 1.17721$

$e^{4.8} \approx 121.51042$

Sketch the graph of the functions.
State the domain, range, and asymptote.

$f(x) = e^x + 0$

x	y
-2	.135
-1	.368
0	1
1	2.718
2	7.389

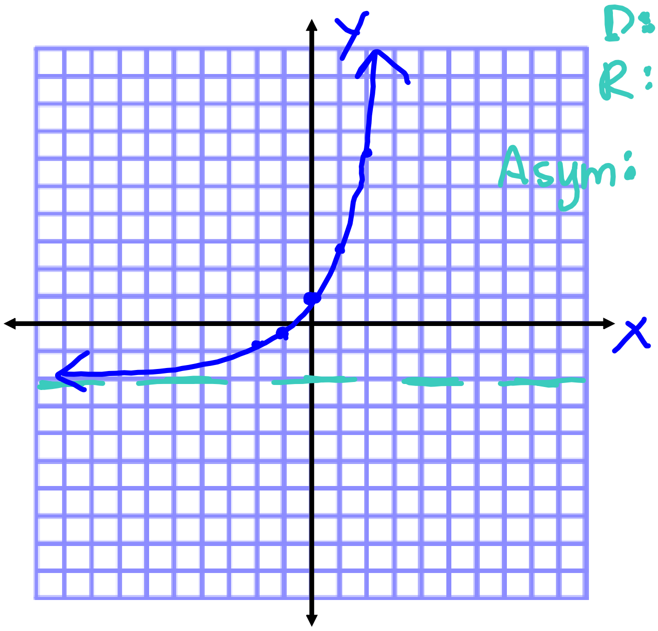


D: $\mathbb{R}$
R: $y > 0$
Asym: $y = 0$

Sketch the graph of the functions.
State the domain, range, and asymptote.

$g(x) = 3e^{.5x} - 2$

x	y
-2	-0.896
-1	-0.18
0	1
1	2.946
2	6.155



D: $\mathbb{R}$
R: $y > -2$
Asym: $y = -2$

Continuous Compound Interest

$$A(t) = Pe^{rt}$$

$A(t)$ = the amount of \$ after t years
P = the amount of \$ invested or borrowed
$e = e$
r = the percent as a decimal
t = the number of years

Example

Find the amount of interest if \$1000 is invested at a rate of 12% per year, compounded continuously. for 5 years

P

$.12 = r$

t

$$A = 1000e^{(.12)(5)}$$

$$A \approx \$\ 1822.12$$

Example

A radioactive substance decays in such a way that the amount of mass remaining after t days is given by the function $m(t) = 13e^{-0.015t}$ where $m(t)$ is measured in kg.

a) Find the mass at time $t = 0$

$$m(0) = 13e^{(-0.015)(0)} \qquad m(0) = 13 \text{ kg}$$

b) How much of the mass remains after 45 days?

$$m(45) = 13e^{(-0.015)(45)} \approx 6.619 \text{ kg}$$