

Section 4.1 Notes

Exponential Functions

1 Introduction

Definition

- The *exponential function* with base a is given by

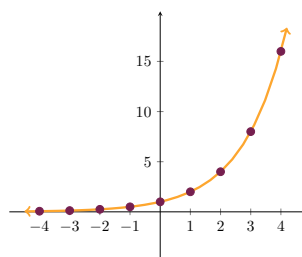
$$f(x) = a^x$$

- Here a must be positive, and also $a \neq 1$

Graphing Exponential Functions

Let's graph $y = 2^x$

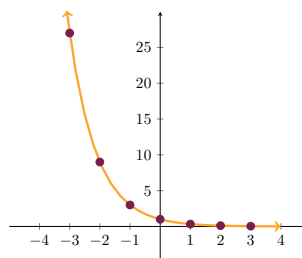
x	y
-4	$2^{-4} = \frac{1}{2^4} = \frac{1}{16}$
-3	$2^{-3} = \frac{1}{2^3} = \frac{1}{8}$
-2	$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$
-1	$2^{-1} = \frac{1}{2^1} = \frac{1}{2}$
0	$2^0 = 1$
1	$2^1 = 2$
2	$2^2 = 4$
3	$2^3 = 8$
4	$2^4 = 16$



Notice that the graph has a horizontal asymptote along the x -axis.

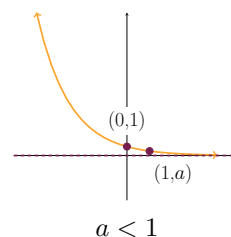
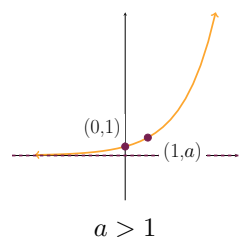
Let's graph $y = \left(\frac{1}{3}\right)^x$

x	y
-3	$\left(\frac{1}{3}\right)^{-3} = 3^3 = 27$
-2	$\left(\frac{1}{3}\right)^{-2} = 3^2 = 9$
-1	$\left(\frac{1}{3}\right)^{-1} = 3^1 = 3$
0	$\left(\frac{1}{3}\right)^0 = 1$
1	$\left(\frac{1}{3}\right)^1 = \frac{1}{3}$
2	$\left(\frac{1}{3}\right)^2 = \frac{1}{9}$
3	$\left(\frac{1}{3}\right)^3 = \frac{1}{27}$



Again, notice that the graph has a horizontal asymptote along the x -axis.

In general, there are just two basic shapes for $f(x) = a^x$:



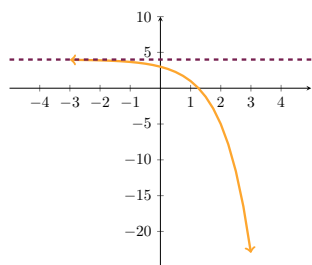
- Again, they both have horizontal asymptote along the x -axis.
- Domain: $(-\infty, \infty)$
- Range: $(0, \infty)$

2 Graphing Using Transformations

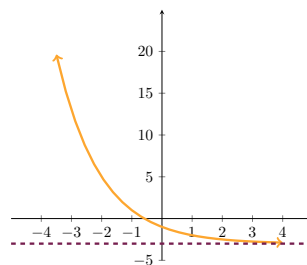
Examples

Graph the following using transformations.

1. $y = 4 - 3^x$



2. $y = 4\left(\frac{1}{2}\right)^{x+1} - 3$



3 Compound Interest

Compound Interest Formula

$$A(t) = P \left(1 + \frac{r}{n}\right)^{nt}$$

- t is the time in years
- $A(t)$ is the amount of money after t years
- P is the principal (initial) amount of money
- r is the nominal yearly interest rate.
- n is the number of times the interest is compounded per year:
 - annually - once per year
 - semiannually - twice per year
 - quarterly - four times per year
 - monthly - 12 times per year
 - daily - 365 times per year

Example

If \$500 is invested at an interest rate of 3.6% per year, compounded quarterly, find the value of the investment after 1 year.

\$518.24