Section 4.1
Exponential Functions

Compare these two functions: $f(x)=x^2$ and $f(x)=2^x$

The first one is called a ________ function: the base is a variable and the power is a number (constant)

The second one is an ________________ function: the base is a number (constant) and the power is a variable.

Exponential Functions:

$$f(x)=a^x$$
(base: a; exponent: x)

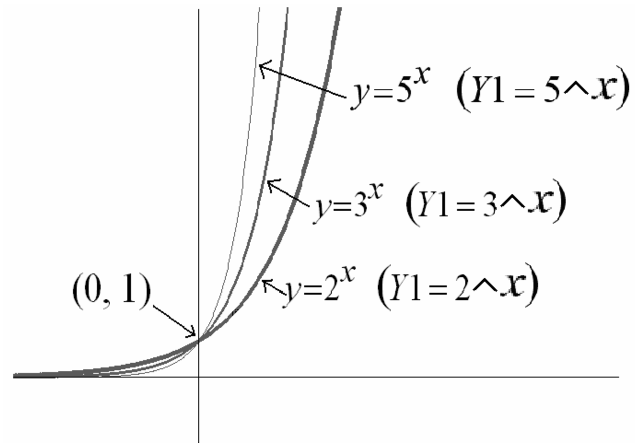
Examples of exponential functions:

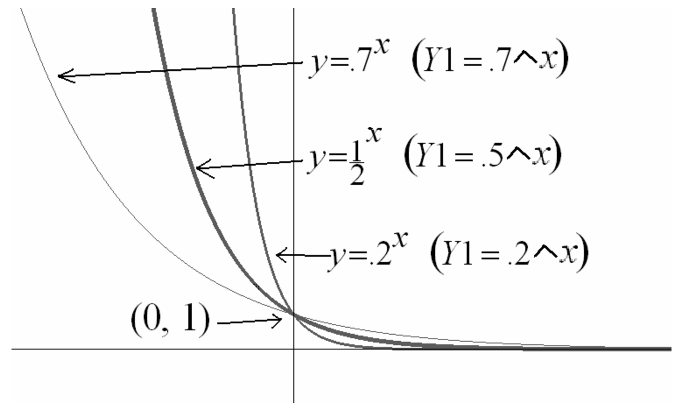
$$f(x)=3^x \qquad y=10^x \qquad f(x)=4^{x+1} \qquad y=e^x$$

<u>Properties of Exponents</u>: (p. 321)

$a^x a^y =$	$3^2 3^4 =$
$\dfrac{a^x}{a^y} =$	$\dfrac{4^5}{4^2} =$
$a^{-x} =$	$2^{-3} =$
$a^0 =$	$2^0 =$ $\left(\dfrac{1}{2}\right)^0 =$
$(ab)^x =$	$(3x)^2 =$
$(a^x)^y =$	$(4^3)^2 =$
$\left(\dfrac{a}{b}\right)^x =$	$\left(\dfrac{2}{3}\right)^2 =$

Graphs of Exponential Functions: (p.322)





<u>Applications of Exponential Functions</u>:

<u>Compound Interest</u>:

If ***P*** dollars (principal) is invested at the annual rate of ***r*** (in decimal form) for ***t*** years, the amount ***A*** in the account is given by

1. For ***n*** compounding periods per year:

2. For continuous compounding:

Example 1: $1000 is invested at 5% interest compounded monthly. How much money is in the account after 3 years?

P = _____ ***r*** = _____ ***n*** = _____ ***t*** = ____

NOTE: Calc. enter: 1000 (1 + .05/12) ^ (12*3)

Example 2: $1000 is invested at 5% interest compounded continuously. How much money is in the account after 3 years?

P = _____ ***r*** = _____ ***t*** = ____

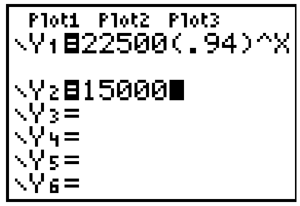
NOTE: Calc. enter: 1000 * *e* ^ (.05*3)

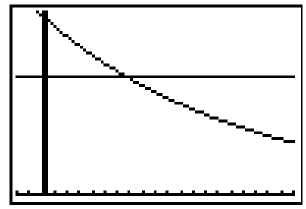
Example 3: The value, *V*, of an automobile *t* years after it is purchased is given by $V = 22500(.94)^t$.

a) What is the value of the car 4 years after it was purchased?

b) How much did the car cost new?

c) How long will it take for the car to be worth only $15,000?



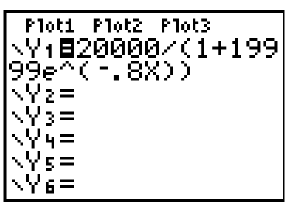


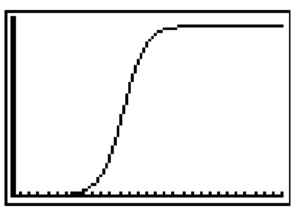
Example 4: On a college campus of 20,000 students, one student returns to campus from fall break with a contagious flu virus. Suppose the spread of the virus can be modeled by:

$$N = \frac{20000}{1 + 19999e^{-0.8t}}$$

where N is the number of students infected after t days.

a) Draw the graph (*x* = 0 to 30, *y* = 0 to 21000)





b) How many students are infected after 5 days?

c) The college will cancel classes if 50% of the students are infected - when might that occur?