

Name _____

Algebra II Lesson 8-2

Properties of Exponential Functions

Let's take a look at how the coefficients affect the parent function (more on translations):

Graph the following

How does the coefficient change the look of the parent function?

$$y = 2^x$$

$$y = (.3)2^x$$

little coefficient gets bigger

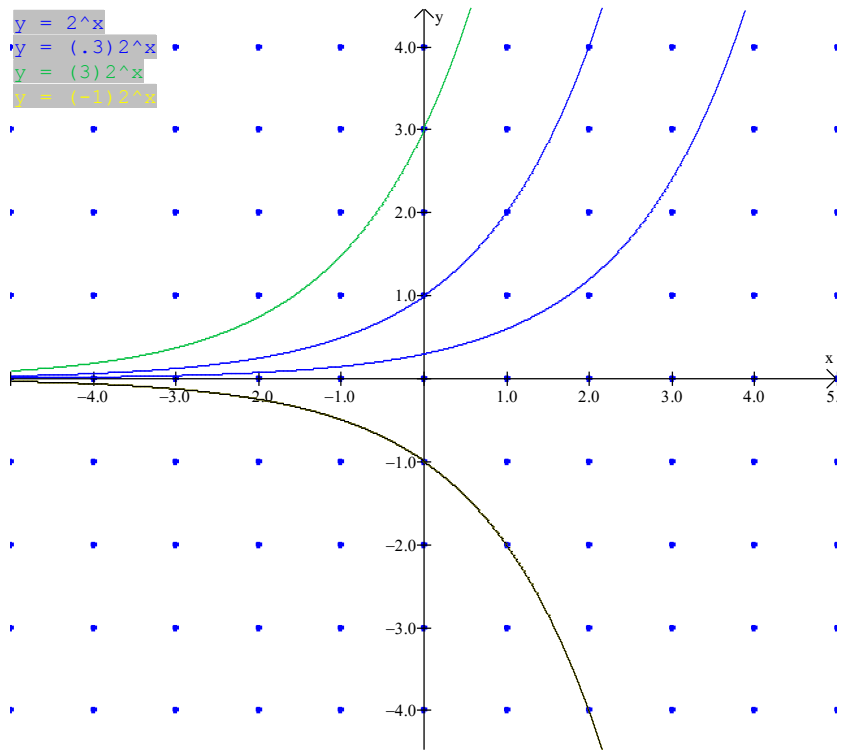
$$y = (3)2^x$$

big coefficient gets thinner

$$y = (-1)2^x$$

negative flips across x-axis

****remember you are expected to make a "T" table with x and y values on it along with usage of calculator for solving these problems.**



Graph, what are the horizontal asymptotes?

$$y = 3^x$$

Asymptote $y=0$

$$y = (3)^{x+1}$$

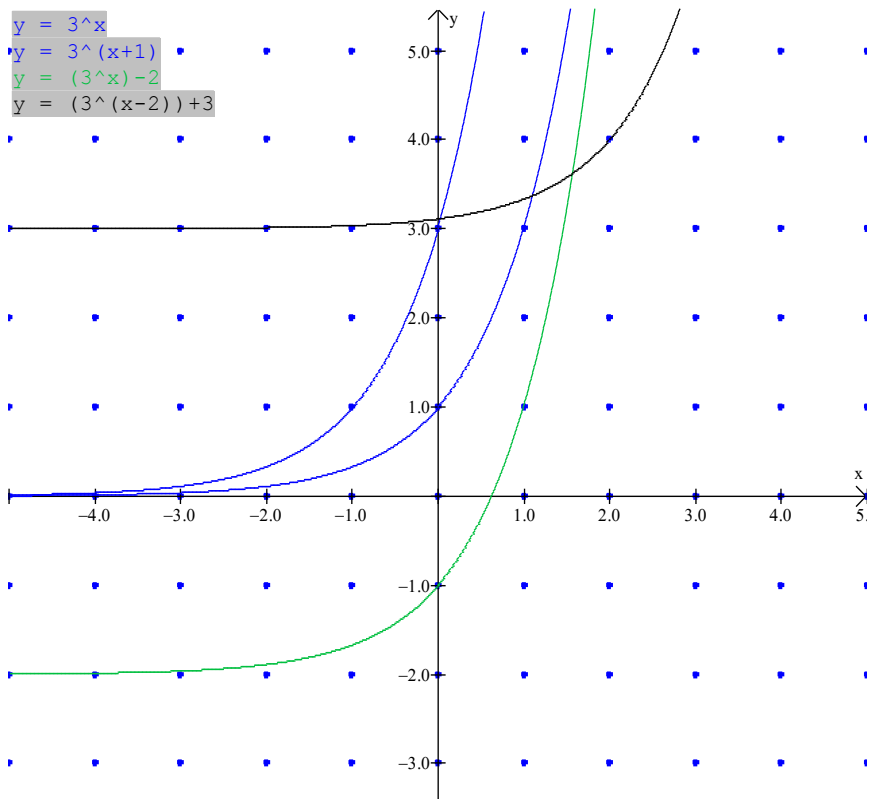
shifts left 1 unit
asymptote $y=0$

$$y = (3)^x - 2$$

down 2 units
Asymptote $y=-2$

$$y = (3)^{x-2} + 3$$

right 2 and up 3
asymptote $y=3$



The number e

Like π , e is a widely used constant, and both numbers are irrational numbers.

$$\pi \approx 3.14159\dots$$

$$e \approx 2.71828\dots$$

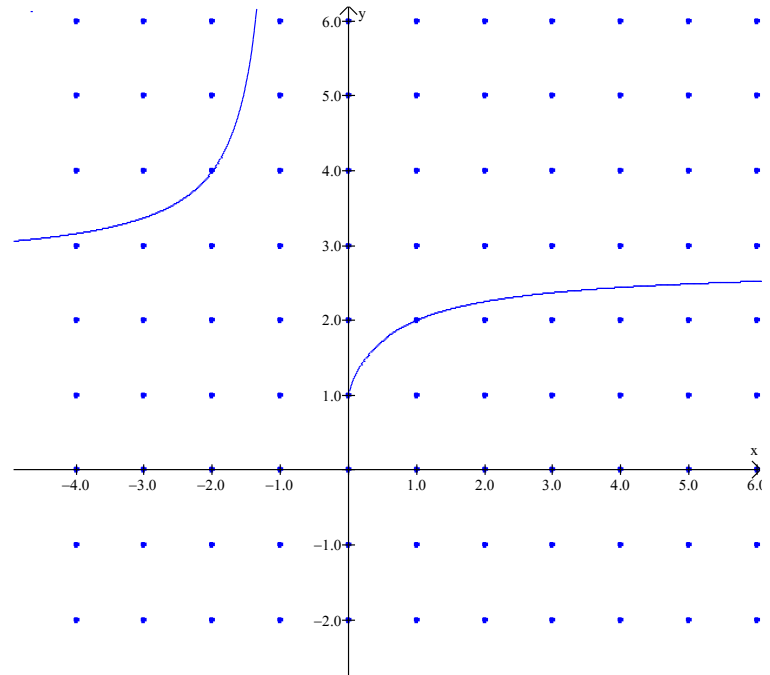
The constant π is used in applications involving circles, while e is found in applications involving growth and decay. Why do we call this value “ e ”? It is in honor of its discoverer, Leonard Euler (1701-1783), a Swiss mathematician. Euler noticed that living things and many mathematical quantities grew or decayed at a constant rate of 2.718. Thus the word “natural” was attached to this type of exponent. The number 2.718 is found when we graph the exponential function $y = (1 + \frac{1}{x})^x$. What is the asymptote?

$$y = (1 + \frac{1}{x})^x$$

What is the asymptote?

Looking at the table or extending the graph out we will find that the horizontal asymptote is $y = 2.71828$

(Notice that there also is a vertical asymptote as x cannot be equal to 0.)



We can evaluate e^x just as we evaluate any other exponential function. To evaluate e^6 , to 4 decimal places: hit **2nd e^x**, type 6 ENTER ANS=403.2488

In finances, e is used in calculating interest earned. Most often interest earned on investments and loans is continuously compounded. Our exponential function form $y = ab^x$ can now be written as:

$$A = Pe^{rt}, \text{ where:}$$

A= amount (final)

P=Principal amount

r=rate of interest (annual)

t=time in years

Example: How much money will you have if you invest \$2000 for 3 years. with an annual interest rate of 5.1%? $P=2000$, $r=.051$, and $t=3$ so enter into our equation---

NOTE on e and natural logarithms. We will be looking at logarithms in the upcoming sections. Please note that as we had inverse functions we also have in inverse of e – the **natural logarithm**. When given a problem that requires you to solve for the time or interest rate, take the natural log of both sides (this is the inverse):

$$2x = xe^{.08t} \quad \text{first note that the } x\text{'s cancel out}$$

$$\ln 2 = \ln e^{.08t} \quad \text{take } \ln \text{ of each side}$$

$$.6931 = .08t \quad \text{solve for } t \text{ by dividing through by the reciprocal of } .08$$

$$.6931 / .08 = 8.7 = t$$