Section 3.1 (Exponential Functions)

An **exponential function** with base b can be defined as $f(x) = b^x$ where b is a positive constant other than 1 and x is any real number (notice the variable x IS the exponent in this case)

Examples include $f(x) = 2^x$, $g(x) = 10^x$, and $h(x) = \left(\frac{1}{2}\right)^{x-1}$

You can typically evaluate exponential expressions using calculator buttons (y^x) or (^)

Example: It was recently discovered that at the Cookie Monster Mall in Sesame Street that the exponential function $f(x) = 40(1.6)^x$ can be used to model spending. Here, f(x) is the average amount spent (in dollars) at the mall after x hours. Learn to use your calculator functions to find the average amount of money spent after 4 hours in the Mall.

$f(4) = 40(1.6)^4 =$

Exponential functions have a wide variety of applications, and a common base in exponential applications is the number ***e***.

The number ***e*** is defined as the value that $\left(1+\frac{1}{n}\right)^n$ approaches as n gets bigger ($n\to\infty$).

The irrational number ***e***, approximately 2.72, is called the natural base, and should be available on your calculators as (e^x).

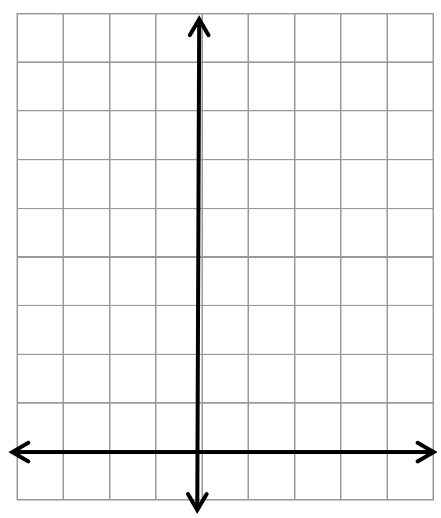
Example: Approximate $e^{2.4}$ and $e^{-0.67}$ using your calculator.

$e^{2.4} =$ $e^{-0.67} =$

Let's look at some trends in the graphs of exponential functions

Example: Graph the following on the given axes by making a table of coordinates

x	$f(x) = 3^x$	$g(x) = \left(\frac{1}{3}\right)^x$
-2		
-1		
0		
1		
2		



Discuss pages 391 and 392 for details on exponential graph characteristics

Book problems: 3,7,9,11,15,19,25,27,29,32,37,51,55,61,63

Examples: Use transformations on pg. 392 to describe the graphs of the following…

$f(x) = 3^{x+2}$ $g(x) = e^x - 4$ $h(x) = (2)^{x-3} + 5p(x) = -e^x$

f(x) is the graph of 3^x shifted to the ____________ by _________ places

g(x)

h(x)

p(x)

Examples: Graph one or more of the above examples or graph examples from the online HW

Money in savings accounts grows as a result of compound interest. Suppose you invest a sum of money (the principal) P at an annual percentage rate r compounded once per year (annually). Then the following table shows the accumulated value A of the money after so many years…

Time (years)	Value after compounding
0	A = P
1	A = (P) + (P * r) = P(1 + r)
2	$A = P(1 + r)^2$
3	$A = P(1 + r)^3$
t	$A = P(1 + r)^t$

Example: If you invested $1000 today at a rate of 2% compounded annually, at the end of 2 years, your investment would be valued at $A = 1000(1 + 0.02)^2 =$

Many savings accounts compound interest more than once a year. In general, when compound interest is paid n times per year (what is n if interest is compounded semi-annually?   ), then in each time period, the interest rate is (r/n) and there are (nt) time periods in t years. Therefore after t years, the value of the investment is given by

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$ where n is the number of compounding periods per year

Furthermore, some banks use continuous compounding where the number of compounding periods increases infinitely ($n \to \infty$). Looking at the effect (pg. 395), we see that for continuous compounding our investment value will be given by

$$A = Pe^{rt}$$

We can use these formulas to predict the value of investments

Example: Suppose Bill Gates has convinced you to invest that extra $5000 you have lying around under your mattress. You want to invest the money for 4 years (while you get your garage constructed for your new Ferrari), and you have 2 options. You can invest in an account with a rate of 8% that compounds daily or an account with a rate of 7.75% that is compounded continuously. Which should you choose?

Book problems: 3,7,9,11,15,19,25,27,29,32,37,51,55,61,63