**Section 3.1** (Exponential Functions)

An **exponential function** with base b can be defined as f(x) = bx 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) = 2x , g(x) = 10x , and h(x) =

You can typically evaluate exponential expressions using calculator buttons (yx) 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 approaches as n gets bigger (n).

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

Example: Approximate e2.4 and e-0.67 using your calculator.

 e2.4 = 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

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| x | f(x) = 3x | g(x) =  |
| -2 |  |  |
| -1 |  |  |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |

**Discuss pages 391 and 392 for details on exponential graph characteristics**

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

 f(x) = 3x + 2 g(x) = ex – 4 h(x) = (2)x – 3 + 5 p(x) = -ex

 f(x) is the graph of 3x 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

 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 ). Looking at the effect (pg. 395), we see that for continuous compounding our investment value will be given by



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?