Exponential Functions

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Objective

To compare the behavior of various exponential functions.

Narrative

In this project you will use the **Plot** command to plot several functions on one set of coordinate axes. These functions are important since they arise in applications that involve exponential growth (applications such as population growth) and decay (applications such as radioactive decay and Newton's Law of Cooling).

Tasks

1. Type the command lines below into Mathematica in the order in which they are listed. These commands produce graphs of $y = \ln x$, $y = \exp x$, and $y = x$ to illustrate the inverse relationship of ln and exp.

```
In[1]:= (* Your name, today´s date *)
In[2]:= (* Exponential Functions *)
In[3]:= Plot[{Log[x], Exp[x], x}, {x,0,4}, AspectRatio -> 1]
```

2. Continue by typing the command lines below into Mathematica in the order in which they are listed. These commands produce plots of the graphs of several exponential functions. The command that includes the option "**AspectRatio->1**" more accurately illustrates the actual range of values for e^x, e^{2x}, and $2e^x$.

```
In[4]:= Plot[{Exp[x], Exp[2x], 2Exp[x]}, {x,-2,2}]
In[5]:= Plot[{Exp[x], Exp[2x], 2Exp[x]}, {x,-2,2}, AspectRatio->1]
In[6]:= Plot[{Exp[-x], Exp[-2x], 2Exp[-x]}, {x,-1,3}]
In[7]:= Plot[{1, 1+Exp[-x], 1-Exp[-x]}, {x,-1,3}]
```

At this point, make a hard-copy of your typed input and Mathematica's responses (both text and graphics). Then:

3. Label by hand each of the curves in each of the graphics you created in Tasks 1 and 2. (For example, label the graph of $y = e^x$ by "$y = e^x$".)

Your lab report will be a hard-copy of your typed input and Mathematica's responses (both text and hand-labeled graphics).

Comments

You might find it instructive to repeat this project using bases such as 1/2, 2, and 10 rather than e, and comparing the results. You can define the log base 2 function **Log2** by using the fact that $\log_2 x = \ln x / \ln 2$: **Log2[x_] := Log[x]/Log[2]**.