Exponential Growth and Decay

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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. a) Type the command lines below into Mathematica in the order in which they are listed. These commands produce plots of the graphs of $y = 1$ and $y = Ae^{kx} + 1$ for the following combinations of A and k:

A	1	1	2	-1	-1	-2
k	1	2	1	1	2	1

over the interval $[-0.75, 0.75]$ on one set of axes.

```
In[1]:= (* Your name, today´s date *)
In[2]:= (* Exponential Growth and Decay *)
In[3]:= Plot[{1, Exp[x]+1, Exp[2x]+1, 2Exp[x]+1, -Exp[x]+1, -Exp[2x]+1, -2Exp[x]+1},
          {x,-0.75,0.75}]
```

b) Continue by typing the command line below into Mathematica. This command produces a plot of the graphs of $y = 1$ and $y = Ae^{kx} + 1$ for the following combinations of A and k:

A	1	1	2	-1	-1	-2
k	-1	-2	-1	-1	-2	-1

over the interval $[-0.75, 0.75]$ on one set of axes.

```
In[4]:= Plot[{1, Exp[-x]+1, Exp[-2x]+1, 2Exp[-x]+1, -Exp[-x]+1, -Exp[-2x]+1, -2Exp[-x]+1},
          {x,-0.75,0.75}]
```

At this time, make a hard-copy of your typed input and Mathematica's responses. Then:

2. a) Label by hand each of the graphs you created in part (a) of Task 1: label the graph of $y = e^x + 1$ by "$y = e^x + 1$", for example.

b) Label by hand each of the graphs you created in part (b) of Task 1: label the graph of $y = e^{-x} + 1$ by "$y = e^{-x} + 1$", for example.

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

Comments

You might find it instructive to repeat this project using $f(x) = A\ 2^{kx} + 1$ and $f(x) = A\ 0.5^{kx} + 1$ rather than $y = Ae^{kx} + 1$.