

Extra Project 7.3: Exponential Growth and Decay

Objective

To compare the behavior of various exponential functions.

Narrative

If you have not already done so, read Section 7.3 in the text.

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). Note that to make plots easier to read, we use the `axes=boxed` option.

Tasks

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

```
> # Project 7.3: Exponential Growth and Decay
> restart;
> plot({1,exp(x)+1,exp(2*x)+1,2*exp(x)+1,-exp(x)+1,-exp(2*x)+1,-2*exp(x)+1},
      x=-0.75..0.75,axes=boxed);
```

- b) Continue by typing the command line below into Maple. This command produces a plot of the graphs of $y = 1$ and $y = Ae^{kx} + 1$ for each of 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.

```
> plot({1,exp(-x)+1,exp(-2*x)+1,2*exp(-x)+1,-exp(-x)+1,-exp(-2*x)+1,-2*exp(-x)+1},
      x=-0.75..0.75,axes=boxed);
```

At this time, make a hard-copy of your typed input and Maple'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.

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 $y = Ae^{kx} + 1$.