

# Taylor Polynomials and HELP

In this project we want to get Derive to construct Taylor polynomials for us AND we want to see how good they are. That is, once we have found a Taylor polynomial  $P_n(x)$ , we want to compare it with the original function  $f(x)$ .

To learn about *anything* go to the Help button and (in the drop down menu) click on the Index menu button. Do so and in the entry box in the Index menu type **Taylor**.

In the window below there will be many items beginning with *Taylor*.

Highlight **Taylor polynomial approximation** by clicking on it.  
Then click on the **Display** button below.

## Learn how to use the Taylor Command

When you have done so, proceed.

**Goal:** To graph a function  $f(x)$  and to graph some Taylor polynomials  $P_n(x)$  for several values of  $n$ , and to identify where they (the  $P_n(x)$ ) begin to fail.

**Instructions:** For each of the following functions graph  $f(x)$  and  $P_n(x)$  for the indicated values of  $n$  and more. Graph each function and its polynomials on a single graph. Examine the graph to see where the polynomial graphs leave the the graphs of  $f(x)$ . Is there a **point of failure**?

$f(x)$	values for $n$	smallest point of failure
$\sin(x)$	3, 7, 19, 59	
$e^x$	3, 7,	
$\frac{1}{1+x}$	3, 7,	
$\sqrt{x+2}$	3, 7,	
$\arctan(x)$	3, 7,	

**What is a point of failure?** This is a number at which the Taylor polynomials just don't seem to work. In fact,  $\sin(x)$  and  $e^x$  don't have points of failure. However, examine  $\frac{1}{1+x}$ . Can you find a number  $n$  for which the Taylor polynomial  $P_n(x)$  and  $\frac{1}{1+x}$  are close at 2. For example, is  $P_{15}(2) \approx \frac{1}{1+2}$ ?

**Turn in.** The graphs and a table of data.