Derive™ Tutorial Four

Trigonometric Functions

Evaluating Trigonometric Functions

You can evaluate trigonometric functions exactly for some domain values. Be sure you are in the Algebra window. For example, Author $\cos\left(\frac{\pi}{6}\right)$ by typing cos(and then clicking on π in the mathematics constants and operators toolbar at the bottom right of the screen. Complete the expression and press Enter. Now Simplify the expression by clicking on the = icon to the left of the Entry line. The result is $\frac{\sqrt{3}}{2}$, the exact function value. In some cases, the function is undefined. For example, Author $\tan\left(\frac{\pi}{2}\right)$ and Simplify (press the = icon). The result is $\pm\infty$ which is, of course, not a real number since this expression is undefined in the domain of real numbers.

Graphing Trigonometric Functions

You can graph the tangent function to see what is happening near $\frac{\pi}{2}$. To do this, Author $\tan(x)$, click on the 2D-Plot icon at the right of the Icon menu bar, delete all plots, if any, and reset the Graph window using the Set>Plot Range command. Now click on the 2D-Plot icon toward the middle of the screen. You may be able to see that there is an asymptote at $x = \frac{\pi}{2}$ and other places. You can adjust the Graph window using the Set>Plot Range>Minimum/Maximum command. In the Minimum/maximum window, enter -10 and 10 in the first two boxes, and press OK. A graph of the tangent function appears. To draw in the asymptotes at $\frac{\pi}{2}$ and $-\frac{\pi}{2}$, Author $x = \frac{\pi}{2}$ in the Entry line in the Graph window and click on the 2D-Plot icon. A vertical line appears at $\frac{\pi}{2}$. You can plot the asymptote at $-\frac{\pi}{2}$ in the same way.

Graphing the Standard Sinusoidal Functions

You can see the changes in the graphs of the standard sinusoidal function using the animation feature of Derive. To do this, in the Graph window Author $a*\sin(t)$, be sure to include the times sign (*). Use the Insert>Slider Bar command. In the Slider Bar dialog box, enter lower case *a* for the Variable, 5 for the Maximum Value, and 8 for the Interval value. Then check the Update plot while sliding box. Click on OK, delete all graphs and then click on the 2D-Plot icon. Once the graph is displayed, use the cursor to move the slider to see the effect increasing the value of *a* has on the graph.

You have seen how the amplitude (*a*) changes the graph of the sine function. You can do the same thing for the frequency parameter *b.* To do this, first delete the graph and then close the Slider Bar. In the Graph window, Author $\sin(bt)$. Then create a new Slider Bar by using the Insert>Slider Bar command. In the Slider Bar dialog box, enter lower case *b* for the Variable, 5 for the Maximum Value, and 8 for the Interval value. Then check the Update plot while sliding box. Click on OK and then click on the 2D-Plot icon. Once the graph is displayed, move the slider to see the effect increasing the value of *b* has on the graph.

You can see the effect of the parameter *c* in $\sin(t + c)$ and of the parameter *d* in $\sin(t) + d$ using the Slider Bar. You can use several slider bars at the same time to see the effect of all the parameters in $a\sin(bt + c) + d$. Be sure to use lower case letters for the parameters *a, b, c,*and *d.*

Solving Trigonometric Equations

You can solve trigonometric equations with Derive as well. Return to the Algebra window by clicking on the rightmost icon on the Icon menu bar. Author the equation 2cos^2(x)-cos(x)-1=0. Use the command

Solve>Expression and in the dialog box, click on Algebraically and Real. Then click on Solve. Six values of x are displayed with the logical operator (v) between them. The positive values and 0 are the solutions in the interval $0 \le x < 2\pi$.

