Tutorials and worked examples for simulation, curve fitting, statistical analysis, and plotting.
http://www.simfit.org.uk

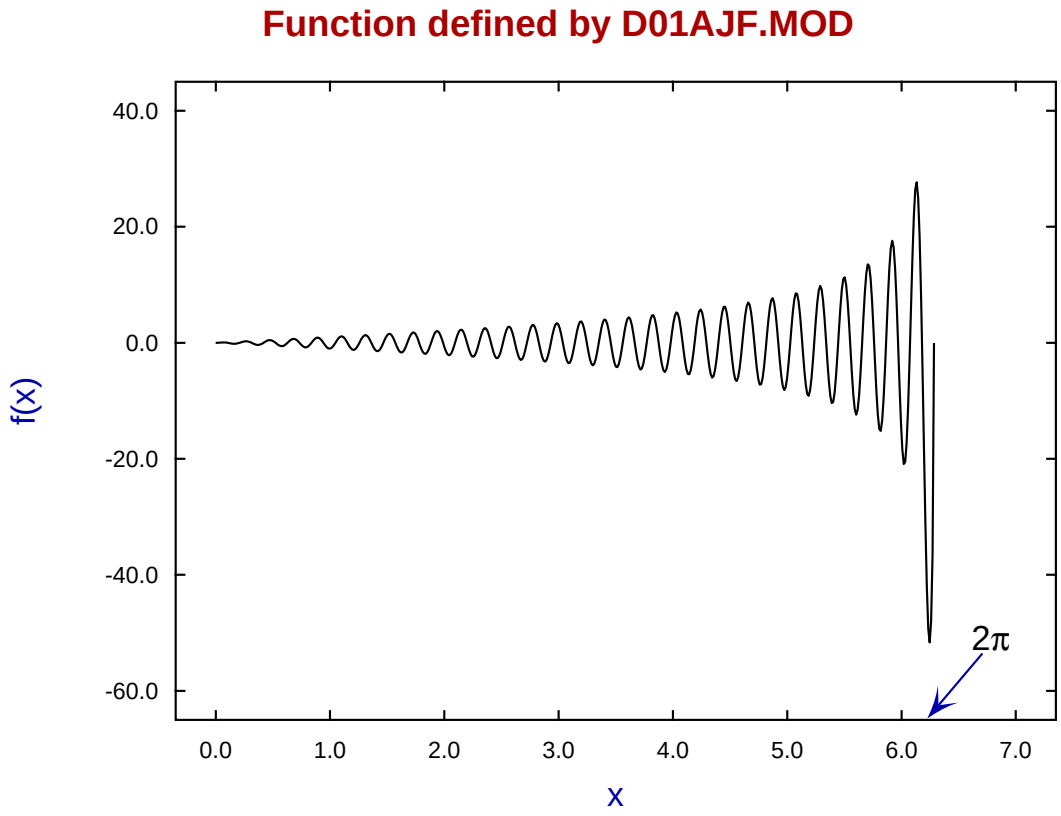
The Simpson method for estimating an area between two end points is satisfactory for smooth well-behaved functions. However, for complicated functions, adaptive numerical quadrature is required where the method used takes account of the rate of change of the function.

So, to integrate a function, it is necessary to define the function along with the range of integration and parameters to control the number of Simpson rule divisions as well as a tolerance factor for numerical quadrature, as demonstrated in the next worked example.

From the main SIMFIT menu select [A/Z] then open the SIMFIT program **usermod**, choose to integrate a function of one variable and read in the test file `d01ajf_e.mod` which defines the following function.

$$f(x) = \frac{x \sin(30x)}{\sqrt{\left(1 - \left(\frac{x}{2\pi}\right)^2\right)}}$$

The next plot for this function over the range 0 to 6.283153 (i.e. $< 2\pi$) indicates that this will be a very difficult function integrate and that adaptive quadrature will be required. Note that the range of plotting and integration must not actually include the pole at $x = 2\pi$.



Integration by the Simpson rule	
Number of Simpson divisions	100
Area by the Simpson rule	-2.2143991

Integration by adaptive quadrature	
IFAIL (from D01AJF)	0
EPSABS	0.000001
EPSREL	0.001
ABSERR	0.001926
Area by adaptive integration	-2.5432599

The definition of the function contained in test file `d01ajf_e.mod` now follows.

```
%
Example: function for d01ajf
.................................
x*sin(30*x)/sqrt{1 - (x/2pi)^2}
Note: -2pi < x < 2pi to avoid poles
.................................
Usage as follows
Select simulation and open program usermod
Select 1 function of 1 variable then read in this file
Set tolerances and limits (0 to just less than 2pi)
Select integrate 1 function of 1 variable and integrate
NAG reports -2.54326 for A=0,B=6.2832,epsabs=0,epsrel=1.e-4
Simfit agrees but with B=6.28318 to avoid the discontinuity
%
1 equation
1 variable
0 parameters
%
begin{expression}
f(1) = x*sin(30x)/sqrt[1.0 - (x/{2pi})^2]
end{expression}
%
```