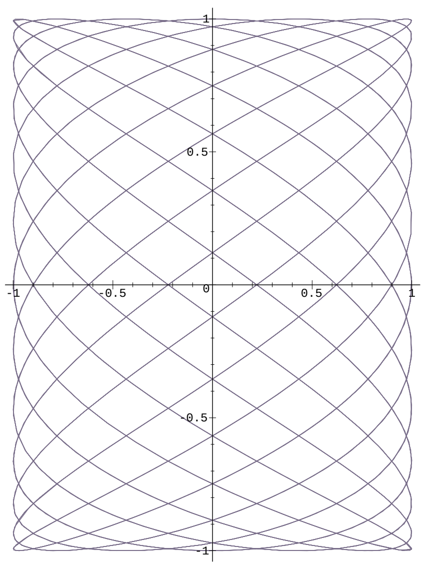
C2M5

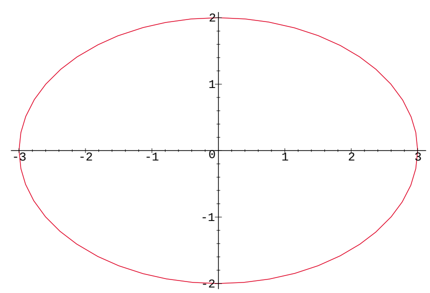
Parametric Functions

Have you ever played with a toy called *"Etch-a-Sketch"*? One hand controls the x-axis while the other controls the y-axis. It is as if you are graphing $(x(t), y(t))\,, a \le t \le b\,,$ which is exactly what happens when a function in the plane is defined parametrically. Be very careful where you place the right bracket,], when using Maple to plot parametric graphs.

Maple Example: Plot $x(t) = \sin(13t)\,,\ y(t) = \cos(7t)$ for $0 \le t \le 6\pi$ which produces a *lissajou*. The plot is on the left below. As you can see, the scaling is a little off because the "square" is two units on each side. For a little fun, increase the coefficients to say 43 and 37 and see what happens. You may also wish to increase the domain.

```
> plot([sin(13*t),cos(7*t),t=0..6*Pi],color=navy);
```





Maple Example: Ellipses are easy this way. Plot $\dfrac{x^2}{3^2} + \dfrac{y^2}{2^2} = 1$. The Maple output is above on the right. When you have $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ you may plot this by using $x(t) = a\,\cos(t)$ and $y(t) = b\,\sin(t)$ for $0 \le t \le 2\pi$.
So,

```
> plot([3*cos(t),2*sin(t),t=0..2*Pi]);
```

C2M5 Problems Use Maple to display the parametric graphs of the given functions.

1. $x = e^t,\ y = e^{2t},\ -1 \le t \le 2$
2. $x = 2\sec t,\ y = \tan t,\ -\pi/2 < t < \pi/2$
3. $x = t - \sin t,\ y = 1 - \cos t,\ 0 \le t \le 4\pi$
4. $x = \cos^3 t,\ y = \sin^3 t,\ 0 \le t \le 2\pi$