Mathematics 1101Y – Calculus I: functions and calculus of one variable
TRENT UNIVERSITY, 2010–2011

Assignment #2
Plotting in `Maple` and some parametric curves
Due on Friday, 8 October, 2011.

Before attempting questions **1** & **2** below, please read the handout *A very quick start with* `Maple` and play around with `Maple` a little. You might also want to glance through parts of *Getting started with* `Maple 10` by Gilberto E. Urroz, especially those concerned with plotting curves, and perhaps keep it handy as a reference. You can find a link to this document on the MATH 1101Y web page.

1. Use `Maple` to plot the curves $y = 1 - x^2$, $-1 \leq x \leq 1$, and $x = 1 - y^2$, $-1 \leq y \leq 1$. Please submit a printout of your worksheet(s) as your solution. *[2]*

One way to describe or define a curve in two dimensions is by way of *parametric equations,* $x = f(t)$ and $y = g(t)$, where the x and y coordinates of points on the curve are simultaneously specified by plugging a third variable, called the *parameter* (in this case t), into functions $f(t)$ and $g(t)$. This approach can come in handy for situations where it is impossible to describe all of a curve as the graph of a function of x (or of y) and arises pretty naturally in various physics problems. (Think of specifying, say, the position (x, y) of a moving particle at time t.) We will see more of parametric curves later on in Chapter 10 of the textbook.

Lissajous curves are parametric curves of the form $x = A\cos(at)$ and $y = B\sin(bt)$, where t is the parameter and A, B, a, and b are constants. (This is not quite the most general definition, but let's keep some things simple!) Various common curves can be described as Lissajous curves. For example, if $a = b \neq 0$, then one gets an ellipse; if also $A = B$, a circle. In what follows we will assume, unless stated otherwise, that $A = B = 1$, that a and b are both positive integers, and that $0 \leq t \leq 2\pi$.

2. Use `Maple` to plot the Lissajous curves for the following combinations of a and b,

a	1	2	3	4
b	1	1	2	2

.

Please submit a printout of your worksheet(s) as your solution. *[4]*

3. Which combinations of a and b appear to give the same the graphs as one of those you obtained in **1**? *[2]*

4. Explain why these combinations do give the same graph as one you obtained in **1**. *[2]*

For the curious, Lissajous curves describe complex harmonic motions and arise, among other applications, in problems in orbital mechanics and in signal processing. They are named after Jules Antoine Lissajous, a French mathematician who studied them extensively in the mid-19th Century, though they had received some attention earlier.