Mathematics 1100Y – Calculus I: Calculus of one variable
TRENT UNIVERSITY, Summer 2010

Assignment #10
Lissajous curves and a bit of Maple
Due on Wednesday, 28 July, 2010.

Lissajous curves are parametric curves of the form $\begin{aligned} x &= A\cos(at) \\ y &= B\sin(bt) \end{aligned}$, where t is the parameter and A, B, a, and b are constants. (This is not the most general definition, but let's keep some things simple.) Various common curves can be realized 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 $0 \leq t \leq 2\pi$.

Lissajous curves describe complex harmonic motions and can arise, for example, 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.

Before attempting question **1** below, please read the handout *A very quick introduction to* `Maple`, which is mostly pointers to places to learn about `Maple`, and play around with `Maple` a little.

1. Use `Maple` to plot the Lissajous curves for the combinations of a and b given in the following table:

a	1	2	3	2	2	4	3	4
b	2	1	2	3	4	2	4	3

What can you deduce about the behaviour of Lissajous curves for different choices of a and b from these examples? Feel free to plot Lissajous curves for additional choices of a and b to test and/or support your deductions. *[5]*

2. Is it possible for a Lissajous curve to describe (part of) a parabola? If so, give an example; if not, explain why not. *[5]*

Note: If you can make use of `Maple` for **2**, more power to you, but you don't need to.