

Mathematics 308 — Homework 3 — due Monday, October 7

1. Use PostScript to produce a series of pictures explaining the proof of the cosine rule that uses pictures somewhat like the ones in Euclid's proof of Pythagoras' Theorem. (Look at the geometric figure in §7 of Chapter 2 of the course notes.)

2. (a) Sketch by the hand the curve $y^2 = x^2(x - 1)$, in the region $|x| \leq 3$, $|y| \leq 3$. The more careful you are, the easier you will find the rest of this exercise.

(b) Find a parametrization of this curve in the following way. The line $y = tx$ passes through the origin, together with one other point of the curve. Find a formula for this point (it will depend on t). This gives the parametrization.

(c) Make up a PostScript procedure `MyParametrization` with one argument t that returns the point as an array of two numbers. (Samples will display input and output for a few values of t .)

(d) Make up another PostScript procedure with three arguments a , b , N that builds the curve (but does not draw it) for values of t from a to b as N linear segments. Use it to draw the curve on successive pages from $t = -3$ to 3 , with $N = 4, 8, 16, 32, 64$. On each page, lay down as background a 1×1 coordinate grid in light gray. Put in the axes in black, twice the line width. Colour the graphs themselves a dark purple.

3. Make up a PostScript procedure with one argument, an array of three numbers `[A B C]`, that returns an array whose elements are themselves arrays of two numbers each. These are to be the 0, 1, or 2 points where the line intersects the unit square $|x| \leq 1$, $|y| \leq 1$. You may make the simplifying assumption that $A \geq B \geq 0$, and that $A > 0$.