

### Mathematics 308 — Homework 4 — due Monday, October 20

1. Use PostScript to draw the graph of the function  $y = x^4 - x + 1$  for values of  $x$  between  $-2$  and  $2$ , along with a coordinate grid covering the page. The origin should be in the page centre.
2. Write a complete PostScript program that makes graph paper. There should be two grid sizes, 1 mm and 1 cm. The origin should be in the centre of the page. The axes should be thick and black. The larger grid should be in black also, but thinner. The smaller grid should be in pink.
3. Define PostScript procedures `3x3-det` and `3x3-inverse` that return the determinant and inverse of a  $3 \times 3$  matrix argument. A matrix here should be an array of 3 arrays of 3 numbers, its columns. (Use these in the next problem.)
4. Define a procedure that has as argument an array of 4 2D points and returns the  $3 \times 3$  matrix that maps the points of the unit square onto them (circling counterclockwise from the lower left). Show how it works by finding explicitly the  $3 \times 3$  matrix that takes

$$\begin{aligned}(0, 0) &\mapsto (0, 0) \\(1, 0) &\mapsto (1, 0) \\(1, 1) &\mapsto (3/4, 1/2) \\(0, 1) &\mapsto (1/4, 1/2)\end{aligned}$$

You will probably want to define several utility procedures in this problem. Show using PostScript the effect on a  $10 \times 10$  grid filling the unit square.