MATH 250 **Calculus III** **Spring 2008**

Homework 4

Due: Thurs. Feb. 28, 2008

Bézier Curves

Bézier Curves are often employed in computer aided design. These parametric curves are defined by

$$x(t) = x_0(1-t)^3 + 3x_1 t(1-t)^2 + 3x_2 t^2(1-t) + x_3 t^3$$
$$y(t) = y_0(1-t)^3 + 3y_1 t(1-t)^2 + 3y_2 t^2(1-t) + y_3 t^3$$

where the points $P_0(x_0, y_0)$, $P_1(x_1, y_1)$, $P_2(x_2, y_2)$, and $P_3(x_3, y_3)$ are called control points, and $0 \le t \le 1$ (notice that $x(0) = x_0$, $y(0) = y_0$, and $x(1) = x_3$, $y(1) = y_3$, so that the curve starts at P_0 and ends at P_3).

Use Maple to solve the following two problems:

1. Graph the Bézier curve with control points $P_0(4, 1)$, $P_1(28, 48)$, $P_2(50, 42)$, and $P_3(40, 5)$ (the points P_1 and P_2 are not on the curve), and graph the line segments $\overline{P_0P_1}$, $\overline{P_1P_2}$, and $\overline{P_2P_3}$.

2. Experiment with the control points until you find a Bézier curve that gives a reasonable representation of the letter C.

Quadratic Surfaces

3. Graph the surfaces $y = x^2 + z^2$ and $y = 1 - z^2$ on the same axes using the domain $|x| \le 1.2$, $|z| \le 1.2$ and observe the curve of intersection of both surfaces. Show (on paper) that the projection of this curve onto the xz-plane is an ellipse.