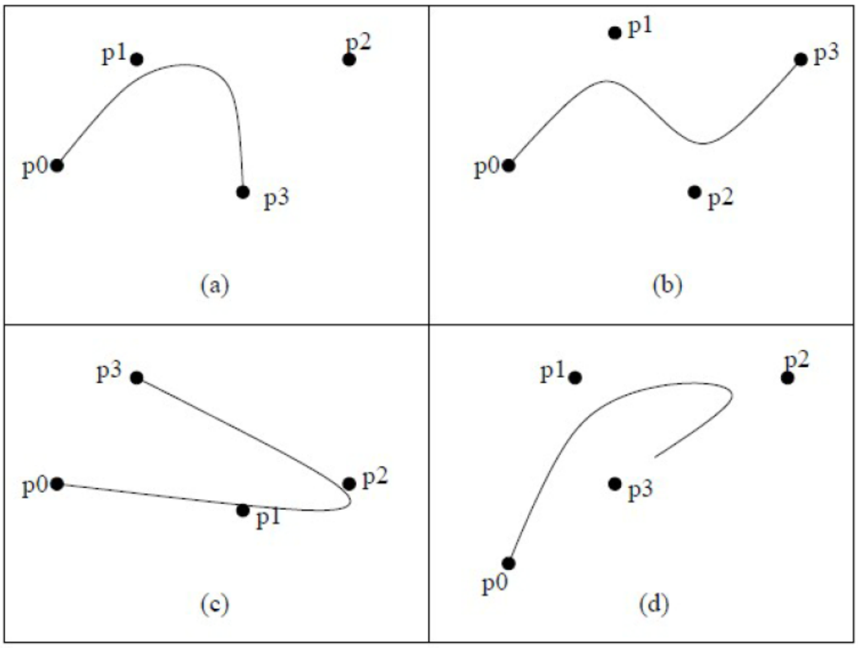
Questions

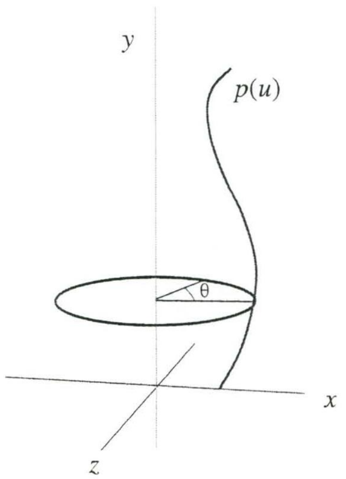
1. (a) Suppose that a quadratic Bézier curve $P(t)$ is given by $P(t) = (1-t)^2 P_0 + 2t(1-t)P_1 + t^2 P_2, t \in [0;1]$; where $P_0 = (0,0)^T$, $P_1 = (4,0)^T$ and $P_2 = (4,4)^T$. Express the curve segment of this curve $P(t)$ over the interval $t \in [0, 0.5]$ as a Bézier curve.

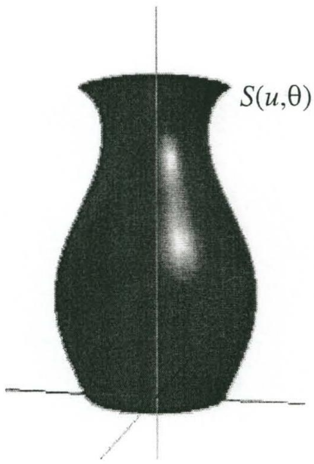
   (b) Compute the control points of the cubic Bézier curve representing a segment of the cubic curve $y = 2x^3$, $x \in [-3, 3]$.

(c) Which of the following must not be cubic Bézier curves, and why not?



2. Consider the parametric curve $p(u)$ defined on the x-y plane in the figure below. When u varies from 0.0 to 1.0, $p(u)$ moves from the lower end of the curve to the upper end. A sweeping surface $S(u, \theta)$, shown in the right figure, is formed when the curve is revolved about the y-axis. This surface has two parameters: $0 \leq u \leq 1$ and $0 \leq \theta < 2\pi$, where θ denotes the amount of revolution.





(a) Give the formulas for the x, y and z coordinates of a point on $S(u, \theta)$. You may assume that $p(u)$ is given as as $\big(x_p(u), y_p(u)\big)$.

(b) Let $p'(u) = \big(x_p'(u), y_p'(u)\big)$ be the first derivative of $p(u)$. Derive the normal of $S(u, \theta)$. (Do not normalize the normal vector in your answer.)