

Q1) Parametrize the curve  $y^2 = x^2 + x^3$  and use the parametrization to show that  $(0,0)$  is a point of self intersection.

Find two tangent lines at  $(0,0)$ .

Q2) Let  $k$  be any continuous function . Show that there is a plane curve with  $k$  as its curvature function by parametrizing the curve with arc length.

Q3) Parametrize the curve  $\alpha(t) = (a\cos(t), a\sin(t), bt)$  by arc length and compute its torsion and curvature.

Q4) Definition: A curve is a cylindrical helix if its unit tangent field makes a constant angle with a fixed direction. Show that this is so if and only if  $\kappa/\tau$  is a constant.