Problem 1. (4 points) Give a smooth parametrization of the quarter circle in the xy plane with endpoints (1,0) and (0,-1), and center the origin. (Remember to show the parametrization is smooth.)

$$r(t) = (cos\ \pi t, -sin\ \pi t),\ 0 \le t \le \frac{1}{2}.$$
$$r'(t) = (-\pi\ sin\ \pi t, -\pi\ cos\ \pi t)$$

$r'(t)$ is continuous and never equals zero.

Problem 2. Consider the curve $r(t) = \frac{1}{3}(1+t)^{\frac{3}{2}}\boldsymbol{i} + \frac{1}{3}(1-t)^{\frac{3}{2}}\boldsymbol{j} + \frac{1}{2}t\boldsymbol{k}$ for $-1 \le t \le 1$.

(a) (3 points) Find the velocity vector.

$$r'(t) = \frac{1}{2}(1+t)^{\frac{1}{2}}\boldsymbol{i} + \frac{1}{2}(1-t)^{\frac{1}{2}}\boldsymbol{j} + \frac{1}{2}\boldsymbol{k}$$

(b) (3 points) Find the length.

$$L = \int_{-1}^{1} \frac{1}{2}\sqrt{(1+t) + (1-t) + 1} = \int_{-1}^{1} \frac{1}{2}\sqrt{3} = \sqrt{3}$$