

Your name:

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**Math 11 Fall 2015, Homework 2, due Wed Sep 30**

*Please show your work. No credit is given for solutions without work or justification.*

(1) Let  $\mathcal{P}$  be the plane that passes through the points

$$P = (2, -2, 0), \quad Q = (3, 0, 5), \quad R = (-1, -1, -1).$$

(a) Find the equation of the plane  $\mathcal{P}$ .

(b) Find the point  $T$  where  $\mathcal{P}$  intersects the line parametrized by

$$\mathbf{r}(t) = \langle -3, 1, 0 \rangle + t \langle 1, 1, 0 \rangle$$

(c) Write the coordinates of the point  $T$  from part (b) in spherical coordinates.

(2) Let  $\mathbf{r}(t) = \langle \sec^2(t), e^t, 2t \rangle$ .

(a) Find the general antiderivative of  $\mathbf{r}(t)$ . (*Hint:* the general antiderivative of  $\sec^2(t)$  is  $\tan(t) + C$ .)

(b) Find the specific antiderivative  $\mathbf{R}(t)$  that satisfies the initial condition  $\mathbf{R}(0) = \langle 1, 1, 1 \rangle$ .

(c) Find a parametrization for the tangent line of  $\mathbf{r}(t)$  at  $t = 0$ .

(3) Let  $\mathbf{r}(t) = \left\langle \frac{1}{5}, t^2, 2t^3 \right\rangle$ .

(a) Find the arc length of  $\mathbf{r}(t)$  from  $t = 0$  to  $t = 1$ .

(b) Find the curvature of  $\mathbf{r}(t)$  at  $t = 1$ .