

ECE/AME 567

Exam 1

Dr. M. Marefat

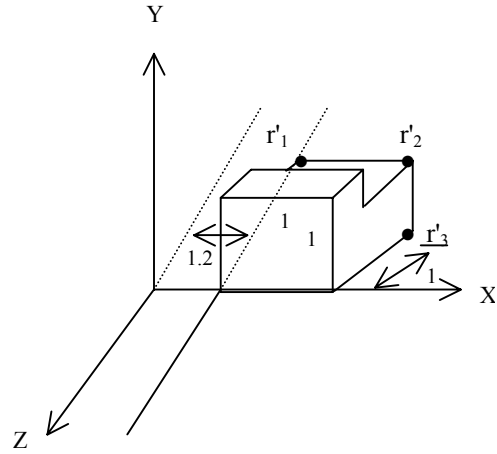
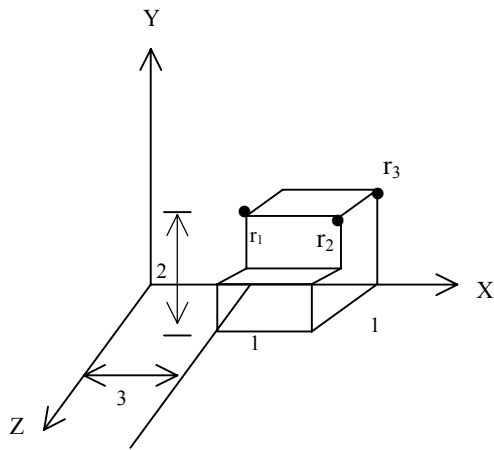
Name:

Student ID:

Time: 75 minutes.

1 sheet of paper (8.5x11) with notes allowed.

1. (30 pts) Show in matrix form a transformation needed to transform the object shown in (a) into the object shown in (b). note that r_1 , r_2 , and r_3 are transformed into r_1' , r_2' , and r_3' respectively.



2. (30 points) For the helix $r(\theta) = a\cos\theta i + a\sin\theta j + b\theta k$

Find:

- (a) The tangent
- (b) The normal
- (c) The curvature
- (d) The torsion
- (e) The binormal

3. (30 pts.) Suppose a window is defined as $(-20,20)$, $(60,60)$ in the world coordinate system. Consider a line segment whose two endpoints are given by $(-30,0)$ and $(80,40)$

(a) Find the intersection of the line segment with the appropriate window boundaries.

(b) Assume that a viewport is defined by $(10,30)$ and $(200,130)$. Find the viewport coordinates for the intersection points.

4. (10 points) Find the shortest distance between the point

$$\vec{r} = \begin{bmatrix} 8 \\ 5 \\ 10 \end{bmatrix}$$

and the plane containing the points:

$$\vec{r}_1 = \begin{bmatrix} x_1 \\ y_1 \\ z_1 \end{bmatrix}, \vec{r}_2 = \begin{bmatrix} x_2 \\ y_2 \\ z_2 \end{bmatrix}, \vec{r}_3 = \begin{bmatrix} x_3 \\ y_3 \\ z_3 \end{bmatrix}$$