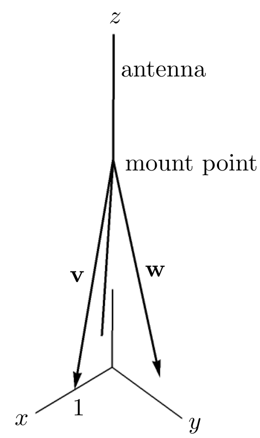
Math 2550, Exam 1 form y   Name and section: ____________________

1. (12.3.6) A vertical antenna is mounted on a tripod as indicated in the schematic drawing. The three feet of the tripod are each one meter from the origin of the x, y, z-coordinates shown and lie in the x, y-plane to form an equilateral triangle. The antenna extends vertically up along the positive z-axis from the mount point which is 5 meters above the x, y-plane.



(a) (7 points) Find the length of the legs of the tripod.

(b) (8 points) Find the cosine of the angle between **the antenna** and one of the legs.

(c) (10 points) Find the cross product of the legs indicated by vectors $\mathbf{v}$ and $\mathbf{w}$ in the drawing.

Name and section: ____________________

2. (quadric surfaces) Sketch the quadric surfaces in $\mathbb{R}^3$ associated with the relations:

   (a) (15 points) $x^2 + 16y^2 + 4z^2 = 64$

   (b) (10 points) $z = x^2 - 2y^2$

Name and section: ____________________

3. (25 points) (13.2.15) Solve the initial value problem for the vector valued function $\mathbf{r}$.

$$\begin{cases} \mathbf{r}' = (\tan t, \cos(t/2), -\sec(2t)) \\ \mathbf{r}(0) = (3, -2, 1). \end{cases}$$

Remember the indefinite integral $\int \sec\tau\, d\tau = \ln|\sec\tau + \tan\tau| + C$.

Name and section: ____________________

4. (motion along a helix) A point mass moves along a cylinder with position given as a function of time by

$$\mathbf{r}(t) = (2t, 3\cos\theta, \sin\theta)$$

where $\theta = \theta(t)$.

(a) (10 points) Find the velocity and acceleration on the mass.

(b) (10 points) Assuming $\theta(t) = t$, draw a picture of the path of the point mass.

Name and section: ____________________

5. (Bonus 10 points) (curvature) Find the curvature of the path parameterized by

$$\mathbf{r}(t) = (2t, 3\cos t, 3\sin t).$$