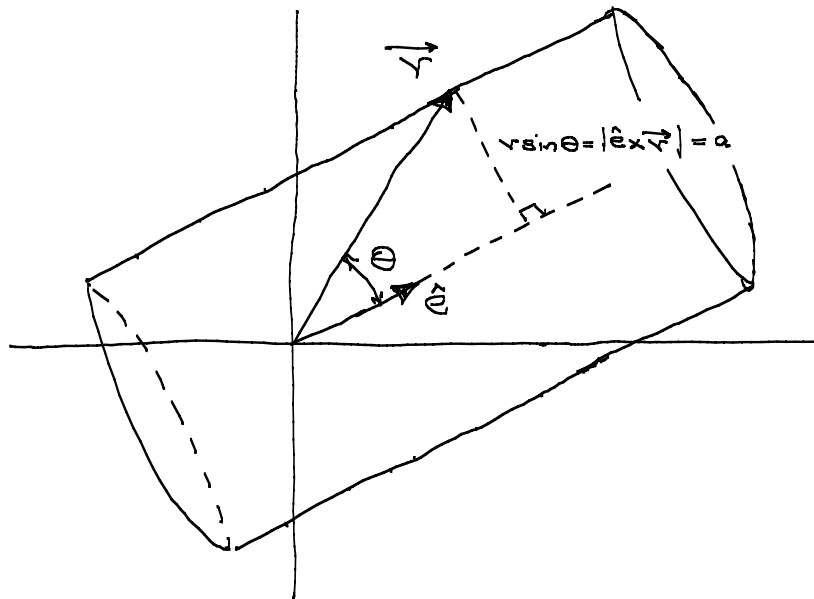


Homework Assignment #4
(50 points)

Due Thursday, September 22
(at lecture)

4.5 (10 points) Challenge problem. A right circular cylinder that has radius a and axis of symmetry along unit vector $\hat{\mathbf{e}}$ is defined by the equation $|\hat{\mathbf{e}} \times \mathbf{r}| = a$, as shown in the drawing below (this equation assumes that the axis of symmetry runs through the origin).



- (a) Find the axis of symmetry and the radius of the cylinder that is defined by

$$x^2 + y^2 + z^2 - xy - yz - zx = 9 .$$

- (b) Calculate the the unit outward normal vector $\hat{\mathbf{n}}$ at the point $\mathbf{R} = 4\hat{\mathbf{x}} + \hat{\mathbf{y}} + \hat{\mathbf{z}}$ on the cylinder.
 (c) Show that the angle between the position vector \mathbf{R} and $\hat{\mathbf{n}}$ is $\cos^{-1}(1/\sqrt{3})$.
 (d) What is the equation of the plane tangent to the cylinder's surface at \mathbf{R} ?