Question 1. For points $A(-2,2,0),\ B(0,1,-1),\ C(-1,2,-2)$ find the following

(a) [3] $\overrightarrow{AB} \times \overrightarrow{AC}$

(b) [2] The area of triangle ABC.

(c) [2] The equation of the plane containing $A,\ B$, and C.

Question 2. [4] Show the following property, $a \cdot (b \times c) = (a \times b) \cdot c$

Question 3.

(a) [5] Find parametric equations for the line of intersection of the planes $2x+2y-z=3$ and $x+2y+z=2$.

(b) [2] Find the acute angle between the two planes give in part (a).

Question 4.

(a) [3] Plot the point whose cylindrical coordinates is $(1, \pi/2, 1)$. Then find its rectangular coordinates.

(b) [3] Change the point $(1, \sqrt{3}, 2\sqrt{3})$ from rectangular to spherical coordinates.

Question 5. Write the equation $y^2 + z^2 = 4$ using the following coordinates

(a) [3] Cylindrical

(b) [3] Spherical

Question 6.

(a) [2] Find the limit $\lim_{t \to 0} \langle \frac{\sin t}{t}, e^{-t}, \frac{e^t - 1}{t} \rangle$

(b) [5] Given the parametric equation of the curve $\mathbf{r}(t) = 2\sin(t)\mathbf{i} + 2\cos(t)\mathbf{j} + \tan(t)\mathbf{k}$, find the unit tangent vector $\mathbf{T}(t)$ at the point where $t = \pi/4$.

(c) [3] Evaluate the integral

$$\int_0^1 \left(\frac{1}{1+t^2}\mathbf{i} + \frac{1}{1+t}\mathbf{j} + \mathbf{k} \right) dt$$