1. (6 points) Consider the vectors $v = (6, 2, -3)$ and $w = (-2, 2, 1)$.

(a) Find a vector normal to both, $v$ and $w$.

(b) Find the area of the parallelogram formed by $v$ and $w$.

(c) Find a vector of length one in the direction of $w$. 

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2. (6 points) Find an equation for the plane that passes through the points \((-1, 1, 1),\) \((-1, -1, 1),\) and \((0, 0, 2).\)
3. (6 points) Consider the line given by \( \mathbf{r}(t) = \langle 0, 1, 1 \rangle + \langle 1, 2, 3 \rangle t \) and the plane given by \( 2x + y - z = -1 \).

(a) Does the line intersect the plane? If yes, find the intersection point. In any case, justify your answer.

(b) Find the equation of the line, passing through the point \((0, -1, -1)\) and orthogonal to the plane given above.
4. (6 points) A particle moves in a plane with a velocity function given by the expression

\[ \mathbf{v}(t) = (3\sin(t), 2\cos(t)), \text{ for } t \geq 0. \]

(a) Find the acceleration \( \mathbf{a}(t) \) function of the particle.

(b) Find the position function \( \mathbf{r}(t) \) of the particle knowing that the initial position of
the particle is \( \mathbf{r}(0) = (-1, 1) \).