

Please show all work and justify all answers on the blank pages provided.

1. If $\mathbf{A} = 3\mathbf{i} + 8\mathbf{j} - 2\mathbf{k}$, find $|\mathbf{A}|$.
2. Find equations of the line passing through the points $(-2, 3, 1)$ and $(5, 2, -1)$.
3. Find the dot product of the vectors $\mathbf{A} = 3\mathbf{i} + 8\mathbf{j} - 2\mathbf{k}$ and $\mathbf{B} = 5\mathbf{i} + \mathbf{j} + 2\mathbf{k}$.
4. Find the angle between the vectors $\mathbf{A} = -2\mathbf{i}$ and $\mathbf{B} = 3\mathbf{i} + 4\mathbf{j}$.
5. Find the component of $\mathbf{A} = 2\mathbf{i} - \mathbf{j} + \mathbf{k}$ in the direction of $\mathbf{B} = \mathbf{i} + \mathbf{j} - \mathbf{k}$ and the component of \mathbf{A} perpendicular to \mathbf{B} .
6. Find a vector that is perpendicular to the vectors $\mathbf{A} = 3\mathbf{i} - \mathbf{j}$ and $\mathbf{B} = \mathbf{i} + \mathbf{j} - 4\mathbf{k}$.
7. Find the distance between the planes $x + 2y - z = 1$ and $2x + y + z = 0$.
8. Find $\mathbf{F}'(t)$ if $\mathbf{F}(t) = e^{2t}\mathbf{i} - \cos 3t\mathbf{j} + \ln t\mathbf{k}$.

9. For the curve

$$x = \sin t - t \cos t \quad y = \cos t + t \sin t \quad z = t^2$$

find the unit tangent vector, $\mathbf{T}(t)$.

10. **True or False.** Determine if the following statement is true or false. If it is true, give a proof. If it is false, give a counter example.

$$\mathbf{A} \times \mathbf{B} = \mathbf{A} \times \mathbf{C} \text{ if and only if } \mathbf{B} = \mathbf{C}.$$

11. If \mathbf{A} and \mathbf{B} are vectors, show that $|\mathbf{A} - \mathbf{B}| \geq |\mathbf{A}| - |\mathbf{B}|$.