Quiz 1-Solutions

MAC 2313

Spring 2006

Show all of your work for full credit.

1. Given \( \mathbf{a} = \langle s, 2s, 3s \rangle \) and \( \mathbf{b} = \langle t, -t, 5t \rangle \), find \( \mathbf{a} \cdot \mathbf{b} \).

\[
\mathbf{a} \cdot \mathbf{b} = st - 2st + 15st = 14st
\]

2. State whether each expression is meaningful. If not, explain why. If so, state whether it is a vector or scalar

(a) \( \mathbf{a} \cdot (\mathbf{b} \times \mathbf{c}) \)
   Meaningful, scalar quantity

(b) \( \mathbf{a} \times (\mathbf{b} \cdot \mathbf{c}) \)
   Meaningless - you cannot cross a scalar and a vector

3. Find the equation of the plane through the point \((-2, 8, 10)\) and perpendicular to the line \(x = 1 + t, y = 2t, z = 4 - 3t\).

For a plane you need a point and a normal direction. The point is obvious. The direction of the line is orthogonal (i.e. normal) to the plane we are looking for. So a normal direction is \(\langle 1, 2, -3 \rangle\) (coefficients of \(t\) in the parametric equations for the components of the line.

Then the equation of the plane comes from

\[
0 = \mathbf{n} \cdot \mathbf{r}
\]

\[
0 = \langle 1, 2, -3 \rangle \cdot \langle x + 2, y - 8, z - 10 \rangle
\]

\[
0 = (x + 2) + 2(y - 8) - 3(z - 10)
\]