Section 9.4 Problems

1. Calculate the determinant for the following matrices:

\[
\begin{vmatrix}
-6 & 9 \\
1 & 1 \\
\end{vmatrix}
\]
\[
\begin{vmatrix}
1 & 2 & 1 \\
4 & -3 & 0 \\
1 & 0 & 1 \\
\end{vmatrix}
\]
\[
\begin{vmatrix}
1 & 2 & 3 \\
2 & 4 & 6 \\
-3 & -4 & 2 \\
\end{vmatrix}
\]

2. Let \( \vec{u} = (-2, 5, 10) \) and \( \vec{v} = (-6, -3, 5) \). Compute \( \vec{u} \times \vec{v} \) and then verify that it is orthogonal to both \( \vec{u} \) and \( \vec{v} \).

3. Calculate the cross product assuming that

\[
\vec{u} \times \vec{v} = \langle 1, 1, 0 \rangle , \quad \vec{u} \times \vec{w} = \langle 0, 3, 1 \rangle , \quad \vec{v} \times \vec{w} = \langle 2, -1, 1 \rangle
\]

(a) \( \vec{v} \times \vec{u} \)
(b) \( \vec{w} \times (\vec{u} + \vec{v}) \)
(c) \( (3\vec{u} + 4\vec{w}) \times \vec{w} \)
(d) \( (\vec{u} - 2\vec{v}) \times (\vec{u} + 2\vec{v}) \)

4. Find the two unit vectors orthogonal to both \( \vec{a} = \langle 3, 1, 1 \rangle \) and \( \vec{b} = \langle -1, 2, 1 \rangle \).

5. What are the possible angles between two unit vector \( \vec{a} \) and \( \vec{b} \) if \( |\vec{a} \times \vec{b}| = \frac{1}{2} \).

6. Find the area of the triangle defined by the points (1, 2), (3, 4), and (-2, 2).

7. Find the area of the quadrilateral defined by the points (2, 4, 4), (3, 1, 6), (2, 8, 0), and (7, 3, 1).

8. A force with magnitude 20N is applied to a wrench as shown below. What are the magnitude and direction of the torque? Express torque as a vector.