Vector Problems

Let $\vec{a} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$, $\vec{b} = \begin{pmatrix} 0 \\ -1 \\ 2 \end{pmatrix}$, $\vec{c} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$, and $\vec{d} = \begin{pmatrix} 1 \\ t \\ t^2 \end{pmatrix}$.

1. Compute
   (a) $\vec{a} + 2\vec{b}$
   (b) $||\vec{b} - \vec{d}||$
   (c) $\vec{c} \cdot \vec{d}$
   (d) the angle between $\vec{a}$ and $\vec{c}$
   (e) The line through $P(3, 2, 1)$ and parallel to $\vec{b}$.
   (f) $\vec{b} x \vec{c}$
   (g) Find a vector perpendicular to both $\vec{c}, \vec{d}$.
2. Find the vertex E in the parallelogram $ABCE$, where $A(1, 0, 0), B(0, -1, 2), C(3, 2, 1)$.
3. Find real numbers s, t such that $\vec{c} = s\vec{a} + t\vec{b}$.
4. (a) Find the equation of the line l through $A(1, 0, 1), B(0, -2, 3)$
   (b) Find the equation of the plane through A and perpendicular to l.
5. (a) Orthogonally project $\vec{b}$ onto $\vec{c}$:
   Find the decomposition $\vec{b} = \vec{b}'' + \vec{b}^{\perp}$
   (b) Orthogonally project $\vec{c}$ onto $\vec{b}$:
   Find the decomposition $\vec{c} = \vec{c}' + \vec{c}^{\perp}$
6. Find the distance of point $D(1, 0, -3)$ from the plane $2x - 3y + z - 5 = 0$. Does D lie above or below the plane?
7. Do problem 6.13 number 5 with $A(1, 0, 0), B(-3, 01), C(2, 2, 2)$.
8. Do the planes $2x - 3y + z = 5 = 0$ and $-x + y + 2z - 3 = 0$ intersect and if so, find the line of intersection.
9. Do problem 6.13 number 8 with $A(1, 0, 0), B(-3, 01), D(2, 2, 2), E(3, 1, 2)$.