This assignment is **optional** and does not need to be handed in. Attempt all questions, write out nicely written solutions (showing all your work), and the solutions will be posted on Fri, Mar 10, 2017, at which point you can mark your own work. If you have any questions regarding differences between what you wrote and what the solution key says, please contact your professor. **At least one question from this assignment will be found on Quiz 3.**

Note: Throughout this assignment, the length of a vector $\mathbf{v}$ is denoted by $||\mathbf{v}||$ (while the book uses $|\mathbf{v}|$).

1. Let $\mathbf{u} = [1, 1, 1]$, $\mathbf{v} = [-1, 2, 5]$, $\mathbf{w} = [0, 1, 1]$. Calculate each of the following:
   (a) $(2\mathbf{u} + \mathbf{v}) \bullet (\mathbf{v} - 3\mathbf{w})$
   (b) $||\mathbf{u}|| - 2||\mathbf{v}|| + ||(-3)\mathbf{w}||$

2. Prove the associative rule for addition of vectors in $\mathbb{R}^3$

$$(\mathbf{u} + \mathbf{v}) + \mathbf{w} = \mathbf{u} + (\mathbf{v} + \mathbf{w})$$

   in the following two different ways:
   (a) by writing each of $\mathbf{u}$, $\mathbf{v}$, $\mathbf{w}$ in terms of their coordinates and simplifying both sides algebraically in coordinate form
   (b) by a geometric argument using arrow representations for $\mathbf{u}$, $\mathbf{v}$, $\mathbf{w}$

3. Find the points where the plane $3x + 2y + 5z = 30$ meets each of the x, y and z axes in $\mathbb{R}^3$. Use these "intercepts" to provide a neat sketch of the plane.

4. (a) Find an equation for the line through points $(1, 3)$ and $(5, 4)$ in parametric form.
   (b) Find an equation for the line through points $(1, 2, 3)$ and $(5, 5, 0)$ in parametric form.

5. Find all unit vectors in xyz-space that are perpendicular to the x-axis and the line through the points $(1, 2, 3)$ and $(3, -2, 1)$.

6. Find the line through $(3, 1, -2)$ that intersects and is perpendicular to the line $x = -1+t$, $y = -2 + t$, $z = -1 + t$ with $t \in \mathbb{R}$.

7. Find an equation for the plane containing the two lines of equations

$$\langle x, y, z\rangle = \langle 0, 1, 2\rangle + t_1\langle 2, 3, -1\rangle, \quad t_1 \in \mathbb{R}$$

   and

$$\langle x, y, z\rangle = \langle 2, -1, 0\rangle + t_2\langle 4, 6, -2\rangle, \quad t_2 \in \mathbb{R}.$$

8. Show that the lines $x - 3 = 4t_1$, $y - 4 = t_1$, $z - 1 = 0$ and $x + 1 = 12t_2$, $y - 7 = 6t_2$, $z - 5 = 3t_2$ with $t_1, t_2 \in \mathbb{R}$ intersect, and find the point of intersection.