CS480 Take Home Refresher Quiz on Linear Algebra

Due: Thursday, Sep. 6 at beginning of lecture

1. (a) Given points $p_1 = (1, 1, 6)$ and $p_2 = (2, 2, 6)$, solve for $v_1$ the vector from $p_1$ to $p_2$.
   (b) Given a third point $p_3 = (0, 2, 6)$, solve for $v_2$ the vector from $p_1$ to $p_3$.

2. (a) Find the value for the magnitude of $v_1$.
   (b) Find the value for the magnitude of $v_2$.

3. (a) Solve for the unit vector in the direction of $v_1$.
   (b) Solve for the unit vector in the direction of $v_2$.

4. (a) Solve for the vector (cross) product $v_1 \times v_2$.
   (b) Solve for $v_2 \times v_1$.

5. Solve for the scalar (dot) product $v_2 \cdot v_1$.

6. Which of the following are unit vectors?
   \[ \frac{1}{2}, \frac{-1}{2}, 0 \quad (0, -1, 0) \quad \frac{1}{5}(-3, 0, 4) \]

7. We are given two non-zero vectors $u, v \in \mathbb{R}^3$. Assume the angle between $u$ and $v$ satisfies $0 < \theta < \frac{\pi}{2}$. Use dot products and/or cross products of $u$ and $v$ to give expressions for:
   (a) $\cos \theta$
   (b) $\sin \theta$
   (c) A vector perpendicular to both $u$ and $v$

8. Given three square matrices $Q, R, S \in \mathbb{R}^{n \times n}$, which statements are true in general?
   (a) $Q(R + S) = QR + QS$
   (b) $QR = RQ$
   (c) $(QRS)^T = Q^T R^T S^T$
   (d) $(QRS)^{-1} = S^{-1} Q^{-1} T^{-1}$