PS 1

Q1.

(a) $P_1 = (1, 6, 5)$, $P_2 = (5, 3, -7)$

$V_2 = P_2 - P_1 = (4, -3, -12)$

(b) $P_3 = (1, 6, 4)$

$V_3 = P_3 - P_1 = (0, 0, -1)$

(c) $|V_2| = \sqrt{4^2 + (-3)^2 + (-12)^2} = \sqrt{169} = 13$

$|V_3| = \sqrt{0^2 + 0^2 + (-1)^2} = \sqrt{1} = 1$

(d) set u_2, u_3 are unit vectors in the directions of V_2, V_3.

$u_2 = \frac{V_2}{|V_2|} = \left(\frac{4}{13}, \frac{-3}{13}, \frac{-12}{13}\right)$

$u_3 = \frac{V_3}{|V_3|} = (0, 0, 1)$

Q2.

(a) $V_2 \times V_3$

$= ((-3) \times (-1) - (-12) \times 0,\ (-12) \times 0 - 4 \times (-1),\ 4 \times 0 - (-3) \times 0)$

$= (3, 4, 0)$

(b) $V_3 \times V_2 = -(V_2 \times V_3) = (-3, -4, 0)$

(c) $V_3 \cdot V_2 = 0 \times 4 + 0 \times (-3) + (-1) \times (-12) = 12$

Q3.

(a) if $u \perp v$, $u \cdot v = 0$ (b) if $u \parallel v$, $u \cdot v = |u| \times |v|$

Q4. $|a| = \frac{1}{4}$ $|b| = 1$ $|c| = 1$

So, b and c are unit vectors

Q5.

(a) $\cos\theta = \frac{u \cdot v}{|u| \cdot |v|}$

(b) $\sin\theta = \frac{u \times v}{|u| \cdot |v|} \cdot \frac{|u \times v|}{u \times v} = \frac{|u \times v|}{|u| \cdot |v|}$

(c) set the vector is A,

$A = c \cdot (u \times v)$, c is a constant.

Q6.

(a) False $(QRS)^{-1} = S^{-1}R^{-1}Q^{-1}$

(b) False $QR \neq RQ$

(c) True

(d) True

Q7.

(a) Zero

(b) $A^{-1} = A^T$