Quiz: Review of Vector Operations

1. a = (3, 7, 4) and b = (2, 9, 11), c = a + b, what is c?

   c = (3,7,4) + (2,9,11) = (3+2,7+9,4+11) = (5,16,15)

2. w = (1, -2, 3)
   a. What is the magnitude of w?

      $|\mathbf{w}| = \sqrt{(1^2 + (-2)^2 + 3^2)} = \sqrt{(1+4+9)} = \sqrt{14}$
      $|w| = 3.74$

   b. What is the unit vector of $\hat{w}$?

      $\hat{w} = w / |w| = (0.27, -0.53, 0.80)$

3. Vector a = (-6, 8) and b = (5, 12), calculate the angle θ between them?

   $a \cdot b = ax \times bx + ay \times by$
   $a \cdot b = -30 + 96$
   $a \cdot b = 66$

   $|a| = \sqrt{(36) + (64)} = \sqrt{100} = 10$
   $|b| = \sqrt{(25) + (144)} = \sqrt{169} = 13$

   $\cos^{-1} \theta = a \cdot b / |a| x |b| = 59.5^o$

4. a = (2,4,6) and b = (5, 7, 9), what is the cross product a x b?

   $c_x = a_y b_z - a_z b_y$, $c_x = 4 \times 9 - 6 \times 7 = 36 - 42 = -6$
   $c_y = a_z b_x - a_x b_z$, $c_y = 6 \times 5 - 2 \times 9 = 30 - 18 = 12$
   $c_z = a_x b_y - a_y b_x$, $cz = 2 \times 7 - 4 \times 5 = 14 - 20 = -6$

   c = (-6, 12, -6)