

Name: Cotterell Anna Obalari 1918001035

MAT 102

Computer Science

① $A = 3\hat{i} + 7\hat{j} - 2\hat{k}$ $B = \hat{i} + 3\hat{j} + 7\hat{k}$ $C = 9\hat{i} - 4\hat{j} + 6\hat{k}$

Angle between A & C

$$\cos \theta = \frac{A \cdot C}{|A||C|}$$

$$A \cdot C = (3\hat{i} + 7\hat{j} - 2\hat{k}) \cdot (9\hat{i} - 4\hat{j} + 6\hat{k})$$

$$A \cdot C = 27 - 28 - 12 = -13$$

$$|A| = \sqrt{3^2 + 7^2 + (-2)^2} = \sqrt{9 + 49 + 4}$$

$$|A| = \sqrt{69}$$

$$|C| = \sqrt{9^2 + (-4)^2 + 6^2} = \sqrt{81 + 16 + 36}$$

$$|C| = \sqrt{133}$$

$$\therefore \cos \theta = \frac{-13}{\sqrt{69} \times \sqrt{133}} = \frac{-13}{95.797}$$

$$\theta = \cos^{-1} \left(\frac{-13}{95.797} \right)$$

$$\theta = 97.8$$

Angle between B and C

$$\cos \theta = \frac{B \cdot C}{|B||C|}$$

$$B \cdot C = (\hat{i} + 3\hat{j} + 7\hat{k}) \cdot (9\hat{i} - 4\hat{j} + 6\hat{k})$$

$$B \cdot C = 9 - 12 + 42 = 39$$

$$|B| = \sqrt{1^2 + 3^2 + 7^2} = \sqrt{1 + 9 + 49}$$

$$|B| = \sqrt{59}$$

$$\cos \theta = \frac{39}{\sqrt{59} \times \sqrt{133}} = \frac{39}{88.58}$$

$$\theta = \cos^{-1} \left(\frac{39}{88.58} \right)$$

$$\theta = 63.879$$

$$\text{let } A+B+C=U$$

$$U = (3\hat{i} + \hat{j} + 9\hat{k}) + (7\hat{j} + 3\hat{j} - 4\hat{j}) + (-2\hat{k} + 7\hat{k} + 6\hat{k})$$

$$U = 13\hat{i} + 6\hat{j} + 11\hat{k}$$

$$|U| = \sqrt{13^2 + 6^2 + 11^2} = \sqrt{169 + 36 + 121}$$

$$|U| = \sqrt{326}$$

$$\hat{U} = \frac{U}{|U|} = \frac{13\hat{i} + 6\hat{j} + 11\hat{k}}{\sqrt{326}}$$

$$\textcircled{2} \quad x = 8t^2 \quad y = t^2 - 4t, \quad z = t + 1$$

$$r = x\hat{i} + y\hat{j} + z\hat{k}$$

$$\therefore r = 8t^2\hat{i} + (t^2 - 4t)\hat{j} + (t + 1)\hat{k}$$

$$v = \frac{dr}{dt} = 16t\hat{i} + (2t - 4)\hat{j} + (1)\hat{k}$$

$$a = \frac{dv}{dt} = 16\hat{i} + 2\hat{j} + 0\hat{k}$$

$$\left| \frac{d^2r}{dt^2} \right|_{t=1} = \sqrt{16^2 + 2^2 + 0^2}$$

$$= \sqrt{256 + 4}$$

$$= \sqrt{260} = 2\sqrt{65}$$

$$= 16.1245 \text{ m/s}^2$$

$$\textcircled{3} \quad A = 4\hat{i} + 2\hat{j} - 4\hat{k}, \quad B = 8\hat{i} - 2\hat{j} + \hat{k}, \quad C = \hat{i} + 4\hat{j} - 3\hat{k}$$

$$A \times B = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & 2 & -4 \\ 8 & -2 & 1 \end{vmatrix}$$

$$= \hat{i}(2 - 8) - \hat{j}(4 + 32) + \hat{k}(-8 - 16)$$

$$= -6\hat{i} - 36\hat{j} - 24\hat{k}$$

$$(A \times B) \times C = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -6 & -36 & -24 \\ 1 & 4 & -3 \end{vmatrix}$$

$$= \hat{i} (108 + 96) - \hat{j} (18 + 24) + \hat{k} (-24 + 36)$$

$$= 204 \hat{i} - 42 \hat{j} + 12 \hat{k}$$