

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

d. Angle between \vec{A} and \vec{C}

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

$$\vec{A} \cdot \vec{C} = 27 - 28 - 12$$

$$\vec{A} \cdot \vec{C} = -13$$

$$|\vec{A}| = \sqrt{3^2 + 7^2 + 2^2} = \sqrt{62}$$

$$|\vec{C}| = \sqrt{9^2 + 4^2 + 6^2} = \sqrt{133}$$

$$\cos \theta = \frac{\vec{A} \cdot \vec{C}}{|\vec{A}||\vec{C}|} = \frac{-13}{\sqrt{62} \cdot \sqrt{133}}$$

$$\theta = \cos^{-1} \frac{-13}{\sqrt{62 \times 133}}$$

$$\theta = \cos^{-1} 0.4679$$

$$\theta = 62.7^\circ = 63^\circ$$

b. Angle between \vec{B} and \vec{C}

$$\vec{B} \cdot \vec{C} = (1 + 3\mathbf{j} + 7\mathbf{k}) \cdot (9\mathbf{i} - 4\mathbf{j} + 6\mathbf{k})$$

$$\vec{B} \cdot \vec{C} = 9 - 12 + 42$$

$$\vec{B} \cdot \vec{C} = 39$$

$$|\vec{B}| = \sqrt{1^2 + 3^2 + 7^2} = \sqrt{59}$$

$$|\vec{C}| = \sqrt{9^2 + 4^2 + 6^2} = \sqrt{131}$$

$$\cos \theta = \frac{\vec{B} \cdot \vec{C}}{|\vec{B}||\vec{C}|} = \frac{39}{\sqrt{59} \cdot \sqrt{131}}$$

$$\theta = \cos^{-1} \frac{39}{\sqrt{59 \times 131}}$$

$$\theta = \cos^{-1} 5.0467 \times 10^{-3}$$

$$\theta = 89.7^\circ \approx 90^\circ$$

C. Magna vector of $(\vec{A} + \vec{B} + \vec{C})$

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

$$\vec{A} + \vec{B} + \vec{C} = 13i + 6j + 11k$$

$$|\vec{A} + \vec{B} + \vec{C}| = \sqrt{13^2 + 6^2 + 11^2}$$

$$|\vec{A} + \vec{B} + \vec{C}| = \sqrt{326}$$

$$\vec{r} = 13i + 6j + 11k$$

$$x = 8t^2, \quad y = t^3 - 4t, \quad z = t + 1$$

$$r = 8t^2 i + (t^3 - 4t) j + (t + 1) k$$

$$\frac{dr}{dt} = v = 16t i + (3t^2 - 4) j + k$$

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

at $t=1$, modulus is

$$|a| = \sqrt{16^2 + 2^2}$$

$$|a| = 16.12 \text{ ms}^{-2}$$

3. $A = 4i + 2j - 4k$, $B = 3i - 2j + k$, $C = i + 4j - 3k$ find $(A \times B)$

$$(A \times B) = \begin{vmatrix} i & j & k \\ 4 & 2 & -4 \\ 3 & -2 & 1 \end{vmatrix}$$

$$(A \times B) = i(2 - 8) - j(4 + 32) + k(-4 - 16) \\ = -6i - 36j - 20k$$

$$(A \times B) \cdot C = \begin{vmatrix} i & j & k \\ -6 & -36 & -20 \\ 1 & 4 & -3 \end{vmatrix}$$

$$(A \times B) \cdot C = i(108 + 80) - j(18 + 20) + k(-24 + 36) \\ = 188i - 38j + 12k.$$