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Course Code: Mat ~~102~~ 102

Course Title: General mathematics ~~III~~ II

(I) A and C (angle between)

$$A \cdot C = |A||C| \cos \theta$$

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

$$A = 3i + 7j - 2k \quad C = 9i - 4j + 6k$$

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

$$A \cdot C = -13$$

$$|A| = \sqrt{3^2 + 7^2 + (-2)^2} = \sqrt{9 + 49 + 4} = \sqrt{62}$$

$$|C| = \sqrt{9^2 + (-4)^2 + 6^2} = \sqrt{81 + 16 + 36} = \sqrt{133}$$

$$\cos \theta = \frac{-13}{\sqrt{62} \cdot \sqrt{133}}$$

$$\cos \theta = -0.432$$

$$\cos \theta = -0.432$$

$$\theta = \cos^{-1}(-0.432)$$

$$\theta = 113.73^\circ$$

II) B and C

$$B = 1 + 3j + 7k \quad C = 9i - 4j + 6k$$

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

$$= 39$$

$$|B| = \sqrt{1^2 + 3^2 + 7^2} = \sqrt{1 + 9 + 49} = \sqrt{59}$$

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

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

$$\cos \theta = 0.4403$$

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$$\theta = 63.88^\circ$$

III The Unit Vector in the direction $(A+B+C)$

Solution

$$(3\hat{i} + 7\hat{j} - 2\hat{k}) + (1\hat{i} + 3\hat{j} + 7\hat{k}) + (9\hat{i} - 4\hat{j} + 6\hat{k})$$

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

$$e_{A+B+C} = \frac{A+B+C}{|A+B+C|}$$

$$|A+B+C| = \sqrt{13^2 + 6^2 + 11^2} = \sqrt{169 + 36 + 121} = \sqrt{326}$$

$$e_{A+B+C} = \frac{13\hat{i} + 6\hat{j} + 11\hat{k}}{\sqrt{326}}$$

$$e_{A+B+C} = \frac{13}{\sqrt{326}}\hat{i} + \frac{6}{\sqrt{326}}\hat{j} + \frac{11}{\sqrt{326}}\hat{k}$$

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

$$\frac{d\vec{r}}{dt} = 16t\hat{i} + (2t - 4)\hat{j} + \hat{k} = \text{Velocity}$$

$$\frac{d^2\vec{r}}{dt^2} = 16\hat{i} + 2\hat{j} = \text{acceleration}$$

$$\left| \frac{d^2\vec{r}}{dt^2} \right| = \sqrt{16^2 + 2^2} = \sqrt{256 + 4} = \sqrt{260} = 16.12 \text{ m}$$

$$\text{6) } \left| \frac{d^2\vec{r}}{dt^2} \right| = 16.12 \text{ m/s}^2$$

--- () () A

$$3. (A \times B) = \begin{vmatrix} i & j & k \\ 4 & 2 & -4 \\ 8 & -2 & 1 \end{vmatrix}$$

$$(A \times B) = [2 - (-4 \times -2)]i - [4 - 8 \times -4]j + [8 - (2 \times 8)]k$$

$$(2 - 8)i - (4 + 32)j + (8 - 16)k$$

$$= -6i - 36j - 8k$$

$$(A \times B) \times C \begin{vmatrix} i & j & k \\ -6 & -36 & -8 \\ 1 & 4 & -3 \end{vmatrix}$$

$$(A \times B) \times C = [(-36 \times -3) - (-8 \times 4)]i$$

$$- [(-6 \times -3) - (-8 \times 1)]j$$

$$+ [(-6 \times 4) - (-36 \times 1)]k$$

$$= [108 + 32]i - [18 + 8]j + [-24 + 36]k$$

$$+ [-24 + 36]k$$

$$(A \times B) \times C = 140i - 26j + 12k$$