iii) The unit vector in the direction of $(\bar{A}+\bar{B}+\bar{C})$

Solution

Given. $\bar{A} = 3i+7j-2k$, $\bar{B} = i+3j+7k$, $\bar{C} = 9i-4j+6k$

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

$= 13i+6j+11k$

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

$= 18.06$

$e_{A+B+C} = \frac{13i+6j+11k}{18.06} = \frac{13i}{18.06} + \frac{6j}{18.06} + \frac{11k}{18.06}$

2) A particle moves along a curve, $x = t^2$, $y = t^2-4t$, $z = t+1$, where t is time. Find the Modulus of acceleration at $t=1$

Solution

When $x = t^2$, $y = t^2-4t$, $z = t+1$

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

Since t = time,

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

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

∴ The Modulus of the its acceleration at $t = 1 = \sqrt{256+4} = \sqrt{260}$

$= 2\sqrt{65}$

3.) If $A = 4i+2j-4k$, $B = 8i-2j+k$, $C = i+4j-3k$, find the vector triple product $(A \times B) \times C$

Solution

$A = 4i+2j-4k$, $B = 8i-2j+k$, $C = i+4j-3k$ ~~find~~

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

$= i\begin{vmatrix} 2 & -4 \\ -2 & 1 \end{vmatrix} - j\begin{vmatrix} 4 & -4 \\ 8 & 1 \end{vmatrix} + k\begin{vmatrix} 4 & 2 \\ 8 & -2 \end{vmatrix}$

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

$= i(-6) - j(36) + k(-24)$

$A \times B = -6i - 36j - 24k$

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

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

$= i(108+96) - j(18+24) + k(-24+36)$

$= i(204) - j(42) + k(12)$

$= 204i - 42j + 12k$ //

NAME: ADARI ELIJAH ENEOH. MATRIC NO: 191ENG01007

DEPARTMENT: AERONAUTICAL & ASTRONAUTICAL ENGINEERING

COURSE CODE: MAT 102 ; ASSIGNMENT FOR DAY EVENING GROUP

1) If $A = 3i+7j-2k$, $B = i+3j+7k$, $C = 9i-4j+6k$, find the angle between

i) A and B

Solution

Given $\bar{A} = 3i+7j-2k$, and $\bar{B} = i+3j+7k$

$\bar{A} \cdot \bar{B} = (3i+7j-2k) \cdot (i+3j+7k)$

$= 3+21-14 = 16$

$\cos\theta = \frac{\bar{A} \cdot \bar{B}}{|A||B|}$

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

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

$\cos\theta = \frac{A \cdot B}{|A||B|} = \frac{16}{\sqrt{62}\times\sqrt{59}} = \frac{16}{60.45} = 0.2645$

$\theta = \cos^{-1} 0.2645 = 74.66^\circ$ // 74.66° is the $\angle$ btw them

ii) B and C

Solution

Given $\bar{B} = i+3j+7k$ and $\bar{C} = 9i-4j+6k$

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

$= 9-12+42 = 39$

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

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

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

$\theta = \cos^{-1}\frac{\bar{B} \cdot \bar{C}}{|B||C|} = \cos^{-1}\frac{39}{\sqrt{59}\times\sqrt{133}} = \cos^{-1} 0.4402$

$\theta = 63.88^\circ$. 62.88° is the angle between $\bar{B}$ and $\bar{C}$