

19/ENG05/031

JAMES ONYERACHI NATHANIEL

MECHANICAL ENGINEERING

MAT 102

$$\textcircled{1} \quad A = 3i + 7j - 2k \quad B = i + 5j + 7k \quad C = 9i - 4j + 6k$$

Angle between A &amp; C

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

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

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

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

$$\cos \theta = \frac{-13}{\sqrt{62} \sqrt{133}} \quad \theta = \cos^{-1} \left( \frac{-13}{\sqrt{62} \sqrt{133}} \right)$$

$$\theta = 98.2307$$

A &amp; B

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

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

$$|B| = \sqrt{1^2 + 5^2 + 7^2} = \sqrt{1 + 25 + 49} = \sqrt{75}$$

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

$$\cos \theta = \frac{39}{\sqrt{75} \sqrt{133}} = 0.4463$$

$$\theta = 63.5793$$

$$A + B + C = 13i + 6j + 11k$$

$$u = \frac{v}{|v|}$$

$$u = A + B + C$$

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

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



$$\textcircled{2} \quad r = 8t^2 y = t^2 \cdot 9t = 9t^3$$

acceleration =  $\frac{d^2r}{dt^2}$

$$r = 8t^2 i + (t^2 \cdot 12) j + (9t^3) k$$

$$\frac{dr}{dt} = 16t i + (2 \cdot 12) j + 27t^2 k$$

$$= 16t i + 24 j + 27t^2 k$$

$$\left| \frac{dr}{dt} \right|_{t=1} = \sqrt{16^2 + 24^2 + 0}$$

$$= \sqrt{256 + 576}$$

$$= \sqrt{832}$$

$$= 2\sqrt{65}$$

$$= 16 \cdot 1245 \text{ m/s}^2$$

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

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

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

$$= -6i - 36j - 24k$$

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

$$= i(108 + 16) - j(18 + 24) + k(24 + 36)$$

$$= 124i - 42j + 60k$$