

# Nurqian Syllvester Chukwuka. U

Mechanics

19/EALGOS/042

maths 107

1) A Particle moves along a curve  $x = 7t^2$ ,  $y = 6t^2 - 4t$ ,  $z = t - 5$   
where  $t$  is time find its velocity

Solution

$$x = 7t^2 \quad y = 6t^2 - 4t \quad z = t - 5$$

$$r = x_i + y_j + z_k$$

$$r = (7t^2)_i + (6t^2 - 4t)_j + (t - 5)_k$$

$$\text{Velocity vector} = \frac{dr}{dt}$$

$$= 14ti + (12t - 4)j + k$$

Vector  $\vec{v} = \frac{dr}{dt}$  Assuming  $t=1$

$$= 14i + 8j + k$$

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

Solutions

$$B \times C = \begin{vmatrix} i & j & k \\ 2 & -3 & 1 \\ 4 & 0 & -3 \end{vmatrix} \quad + - +$$

$$+ -3 \times -3 = 9 \quad + (4 \times 1)j = 4j \quad = 9 + 4j = 9i + 4j$$

$$- 2 \times -3 = -6 \quad - (0 \times 1)j = 0 \quad = -6 - 0 = -6j$$

$$+ 2 \times 0 = 0 \quad + (-3 \times 4)k = -12k \quad = 0 - 12 = -12k$$

$$A \times [9i - 6j + 8k]$$

$$A \times (B+C) \begin{array}{c|cc} & i & j & k \\ \hline & 1 & 2 & 4 \\ \hline B & -6 & 8 & \end{array}$$

$$+ (8 \times 8) + (-6 \times 4) i = 16 + (-24)i = -8i$$

$$- (1 \times 8) - (13 \times 4) j = 8 - (52)j = -44j$$

$$+ (1 \times -6) + (13 \times 2) k = -6 + 26 = 20k$$

$$[-8i - 44j + 20k]$$

3) Given  $R = 4\sin 3t i + 4e^{3t} j + 7t^3 k$  find the integral of  $R$  with respect to  $t$

Solution

$$\int R dt = \int (4\sin 3t) i + (4e^{3t}) j + (7t^3) k dt$$

$$= \int (4\sin 3t) i dt + \int (4e^{3t}) j dt + \int (7t^3) k dt$$

$$= 4 \int \sin 3t i dt + 4 \int e^{3t} j dt + \int (7t^3) k dt$$

$$= \int R dt \left( \frac{-4}{3} \cos 3t \right) i + \left( \frac{4}{3} e^{3t} \right) j + \left( \frac{7t^4}{4} \right) k$$

4)  $A = 7i + 2j - k$   $B = 2i + 3j + 4k$   $C = i + j + k$

Find  $(A+C)(B-A)$

Solution

$$A+C \begin{array}{c|cc} & i & j & k \\ \hline & 7 & 2 & 1 \\ \hline + & 1 & 1 & 1 \\ \hline \end{array}$$

$$+ (2+1) + (1+1) i = 3+2 = 5i$$

$$- (7+1) + (1+1) j = 8-2 = 6j$$

$$+ (1+1) + (1+2) k = 2+3 = 5k$$



$$B-A \begin{vmatrix} i & j & k \\ 2 & 1 & 4 \\ 7 & 2 & 1 \end{vmatrix}$$

$$(1-1) + (2-4)i = 0 + -2 = -2i$$

$$(2-1) - (7-4)j = 1 - 3 = -2j$$

$$(2-2) + (7-1)k = 0 + 6 = 6k$$

$$(A+C) \times (B-A) \begin{vmatrix} i & j & k \\ 2 & 6 & 4 \\ -2 & -2 & 6 \end{vmatrix}$$

$$(6+6) + (-2 \times 4)i = 12 + (-8) = 4i$$

$$(2+6) - (-2+4)j = 8 - 2 = 6j$$

$$(2+2) + (-2+6)k = 4 + 4 = 8k$$

$$= 4i$$

$$= 6j$$

$$= 8k$$

$$4i + 6j + 8k$$