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~~MAXX~~ MATRIC: NO: 19/SCI01/039

MAT102

1) A particle moves along a curve $x = 7t^2$, $y = 6t^2 - 4t$; $z = t - 5$ where t is time. Find it's velocity

Solution

$x = 7t^2$, $y = 6t^2 - 4t$ and $z = t - 5$

$r = xi + yj + zk$

$r = (7t^2)i + (6t^2 - 4t)j + (t - 5)k$

Velocity $= dr/dt$

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

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

Solution

$A = i + 2j - 4k$

$B = 2i - 3j + k$

$C = 4j - 3k$

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

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

$= i(9-4) - j(-6-0) + k(8-0)$

$= 5i + 6j + 8k$

$$A \times (B \times C) = \begin{vmatrix} i & j & k \\ 1 & 2 & -4 \\ 5 & 6 & 8 \end{vmatrix}$$

$$A \times (B \times C) = i\begin{vmatrix} 2 & -4 \\ 6 & 8 \end{vmatrix} - j\begin{vmatrix} 1 & -4 \\ 5 & 8 \end{vmatrix} + k\begin{vmatrix} 1 & 2 \\ 5 & 6 \end{vmatrix}$$

$A \times (B \times C) = i(16 + 24) - j(8 + 20) + k(10 - 6)$

$= 40i - 28j + 4k$

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

Solution

$R = 4\sin 3ti + 4e^{3t}j + 7t^3k$

$\int R = \int 4\sin 3ti + \int 4e^{3t}j + \int 7t^3 k$

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

$\int R = 4i/3(-\cos(3t)) + 4j\frac{e^{3t}}{3} + \cancel{7/4}\ 7kt^4/4$

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

4) If $A = 7i + 2j - k$; $B = 2i + j + 4k$, $C = i + j + k$, find $(A+C)\cdot(B-A)$

Solution

$A = 7i + 2j - k$

$B = 2i + j + 4k$

$C = i + j + k$

$(A+C)\cdot(B-A) = [(7i + 2j - k) + (i + j - k)] \cdot [2i + j + 4k) - (7i + 2j - k)$

$= [8i + 3j + 0k] \cdot [-5i - j + 5k]$

$= -40 - 3 + 0$

$= -43$

5) Find a unit vector tangent to the space curve $x = 6,$
$y = t^2, z = t^3$ at the point where $t = 1$

Solution

$$T = \frac{dr/dt}{|dr/dt|}$$

$$r = xi + yj + zk$$

$$r = 6i + t^2j + t^3k$$

$$dr/dt = i + 2tj + 3t^2k$$

@ $t = 1$,

$$dr/dt = i + 2tj + 3t^2k$$

$$= i + 2(1)j + 3(1)^2k$$

$$= i + 2j + 3k$$

$$\left|\frac{dr}{dt}\right|_{x=1} = \sqrt{(1)^2 + (2j)^2 + (3k)^2}$$

$$= \sqrt{1^2 + 2^2 + 3^2}$$

$$= \sqrt{1 + 4 + 9}$$

$$= \sqrt{14} = 3.74$$

Hence $T = \dfrac{i + 2j + 3k}{3.74}$

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MAT 102 Assignment.

1) If A and B are the points (5, 3) and (15, -7) respectively. Find the coordinates of the points which divides AB externally in the ratio 3:1

Solution

For external division = $\left(\dfrac{mx_2 - nx_1}{m-n}, \dfrac{my_2 - ny_1}{m-n}\right)$

Let the point be P(k, l)
with ratio 3:1

$\therefore$ $m = 3$, $n = 1$, $x_1 = 5$, $y_1 = 3$, $x_2 = 15$ and $y_2 = -7$

$$k = \left[\frac{mx_2 - nx_1}{m-n}\right] = \left[\frac{(3)(15) - (1)(5)}{3-1}\right] = \left[\frac{45-5}{2}\right] = \frac{40}{2} = 20$$

$$l = \left[\frac{my_2 - ny_1}{m-n}\right] = \left[\frac{(3)(-7) - (1)(3)}{3-1}\right] = \left[\frac{-21-3}{2}\right] = \frac{-24}{2} = -12$$

$\therefore$ P(20, -12)