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MATRIC N0: 19/ENG05/016
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COURSE CODE: MAT 102

COVID-19 HOLIDAY ASSIGNMENT

1. A particle moves along a curve, $x = t^2$, $y = -5t^2 + t$, $z = t + 7$, where t is time. Find its acceleration

SOLUTION

$\vec{r} = \mathrm{x}i + \mathrm{y}j + \mathrm{z}k$

$\vec{r} = (t^2)i + (-5t^2 + t)j + (t + 7)k$

$\frac{d\vec{r}}{dt}$ = velocity = v

$\frac{d\vec{r}}{dt} = (2t)i + (-10t + 1)j + k$

$\frac{d^2\vec{r}}{dt} = (2)i + (-10)j$

$\therefore \frac{d^2\vec{r}}{dt^2}$ = Acceleration = $2i - 10j$

2. If P = $i - 9j - 4k$, Q = $8i - 3j + 6k$, R = $i - 4j - 3k$, Find (P × Q) . (R × P).

SOLUTION

(P × Q) . (R × P)

$$(P \times Q) = \begin{vmatrix} i & j & k \\ 1 & -9 & -4 \\ 8 & -3 & 6 \end{vmatrix}$$

(P × Q) = $[(-9 \times 6) - 12]i - [(6 \times 1) - (-32)]j + [(-3 \times 1) - (-72)]k$

$= [-54 - 12]i + [6 + 32]j + [-3 + 72]k$

$= -66i + 38j + 69k$

$$(R \times P) = \begin{vmatrix} i & j & k \\ 1 & -4 & -3 \\ 1 & -9 & -4 \end{vmatrix}$$

(R × P) = $[(-4 \times -4) - 27]i - [(-4 \times 1) - (-3)]j + [(-9 \times 1) - (-4)]k$

$= [16 - 27]i - [-4 + 3]j + [-9 + 4]k$

$= -11i + j - 5k$

(P × Q) . (R × P) = $[-66i + 38j + 69k] \; . \; [-11i + j - 5k]$

$= [726 + 38 - 345]$

$= 419$

∴ (P × Q) . (R × P) = 419

3. Given F = $(5\cos 7t)i - (2e^{3t})j - (4t^3)k$, find the integral of F with respect to t.

SOLUTION

$\int F dt = \int[(5\cos 7t)i - (2e^{3t})j - (4t^3)k]dt$

$= \int(5\cos 7t)i\,dt - \int(2e^{3t})j\,dt - \int(4t^3)k\;dt$

$= (5 \times \frac{1}{7}\sin 7t)i - (2 \times \frac{1}{3}e^{3t})j - (\frac{4t^4}{4})k$

$\int F dt = \int(5\cos 7t)i\,dt - \int(2e^{3t})j\,dt - \int(4t^3)k\;dt = (\frac{5}{7}\sin 7t)i - (\frac{2}{3}e^{3t})j - (t^4)k$

$\therefore \int F dt = (\frac{5}{7}\sin 7t)i - (\frac{2}{3}e^{3t})j - (t^4)k \;75k$