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19/ENG05/059
MECHANICS

$$1. A = 5i - 7j - 6k$$

$$B = j + 4k$$

$$C = 9i - 4j + k$$

Solution

$$i) -8(A+B)$$

$$= -8(5i - 7j - 6k + j + 4k)$$

$$= -8(5i - 6j - 2k)$$

$$= -40i + 48j + 16k$$

$$C-A = (9i - 4j + k - 5i + 7j + 6k)$$

$$= (4i + 3j + 7k)$$

$$= (-40i + 48j + 16k) \cdot (4i + 3j + 7k)$$

$$= -160i + 14j + 112k$$

$$2. x = -3t, y = t^2, z = 4t^3$$

$$\frac{dx}{dt} = -3, \quad \frac{dy}{dt} = 2t, \quad \frac{dz}{dt} = 12t^2$$

resulting:

$$12t^2i + 2tj - 3k$$

at $t=1$

$$= 12i + 2j - 3k$$

$$\text{let } U = 12i + 2j - 3k$$

$$|U| = \sqrt{12^2 + 2^2 + (-3)^2}$$

$$= \sqrt{144 + 4 + 9}$$

$$= \sqrt{157}$$

$$|U| = |U|$$

$$|U|$$

$$= \sqrt{12^2 + 2^2 - 3^2}$$

$$\sqrt{157}$$

3. Acceleration of particle

$$x = -8t^2 + 12t + 4t + t + 1$$

$$\text{Velocity} = \frac{dx}{dt} = -16t + 12t - 4 + 1 + 0$$

$$\text{Acceleration} = \frac{dv}{dt} = -16 + 2 + 0$$

$$= -14 \text{ m/s}^2$$

4. $A = i + 2j - 4k$

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

$$C = 4j - 3k$$

Find $(A \times B) \times C$

$A \times B$	i	$-j$	$+k$
	1	2	-4
	2	-3	1

$$= i[(2 \times 1) - (-4 \times 3)] - j[(1 \times 1) - (-4 \times 2)] + k[(1 \times -3) - (2 \times 2)]$$

$$= i(2 - 12) - j(1 + 8) + k(-3 - 4)$$

$$= -10i - 9j - 7k$$

$(A \times B) \times C =$

	$-10i$	$-9j$	$-7k$
	0	4	-3

$$= i[-9 \times -3 - (-7 \times 4)] - j[-10 \times -3 - (0 - 7)] + k[-10 \times 4 - (-9 \times 0)]$$

$$= i[27 + 28] - j[30 - 7] + k[-40 + 0]$$

$$= 55i - 23j - 40k$$

$$5. R = 4 \sin 3t \mathbf{i} + 4e^{3t} \mathbf{j} + 7t^3 \mathbf{k}$$

$$\int R = 4t - \cos 3t \mathbf{i} + 4t \frac{1}{3} e^{3t} \mathbf{j} + \frac{7t^4}{4} \mathbf{k}$$

at $\lim_{t \rightarrow 0}$

$$= 4\mathbf{i} - \cos 3t + 4 \frac{1}{3} e^{3t} \mathbf{j} + \frac{7}{4} t^4 \mathbf{k}$$