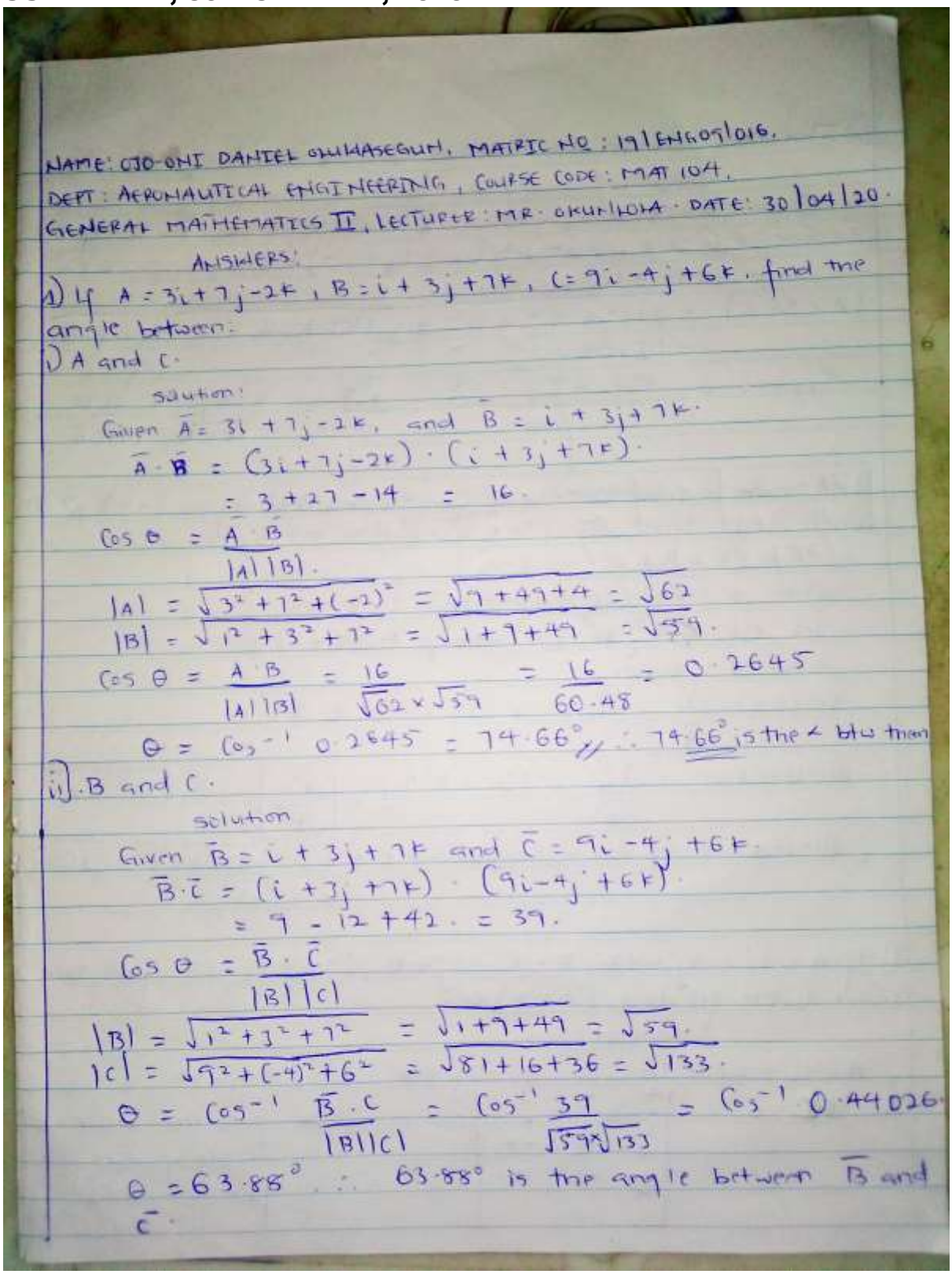
**NAME: OJO-ONI DANIEL OLUWASEGUN, MATRIC NO.; 19/ENG09/016, DEPARTMMENT; AERONAUTICAL ENGINEERING, COURSE, MAT 102 GENERAL MATHEMATICS II, LECTURER; MR. OKUNLOLA, DATE SUBMITTED; 30TH OF APRIL, 2020.**



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DEPT: AERONAUTICAL ENGINEERING, COURSE CODE: MAT 104,
GENERAL MATHEMATICS II, LECTURER: MR. OKUNLOLA. DATE: 30/04/20.

ANSWERS:

1) If $A = 3i + 7j - 2k$, $B = i + 3j + 7k$, $C = 9i - 4j + 6k$. find the angle between.

i) A and C.

solution:

Given $\bar{A} = 3i + 7j - 2k$, and $\bar{B} = i + 3j + 7k$.

$\bar{A} \cdot \bar{B} = (3i + 7j - 2k) \cdot (i + 3j + 7k)$.

$= 3 + 21 - 14 = 16$.

$\cos\theta = \dfrac{\bar{A} \cdot \bar{B}}{|A||B|}$.

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

$|B| = \sqrt{1^2 + 3^2 + 7^2} = \sqrt{1 + 9 + 49} = \sqrt{59}$.

$\cos\theta = \dfrac{A \cdot B}{|A||B|} = \dfrac{16}{\sqrt{62} \times \sqrt{59}} = \dfrac{16}{60.48} = 0.2645$

$\theta = \cos^{-1} 0.2645 = 74.66°$ // $\therefore$ 74.66° is the $\angle$ btw them

ii) B and C.

solution

Given $\bar{B} = i + 3j + 7k$ and $\bar{C} = 9i - 4j + 6k$.

$\bar{B} \cdot \bar{C} = (i + 3j + 7k) \cdot (9i - 4j + 6k)$.

$= 9 - 12 + 42 = 39$.

$\cos\theta = \dfrac{\bar{B} \cdot \bar{C}}{|B||C|}$

$|B| = \sqrt{1^2 + 3^2 + 7^2} = \sqrt{1 + 9 + 49} = \sqrt{59}$.

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

$\theta = \cos^{-1} \dfrac{\bar{B} \cdot C}{|B||C|} = \cos^{-1} \dfrac{39}{\sqrt{59} \times \sqrt{133}} = \cos^{-1} 0.44026$

$\theta = 63.88°$ $\therefore$ 63.88° is the angle between $\bar{B}$ and $\bar{C}$.

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(ii) The Unit Vector in the direction of $(\bar{A}+\bar{B}+\bar{C})$

Solution.

Given: $\bar{A} = 3i+7j-2k$, $\bar{B} = i+3j+7k$, $\bar{C} = 9i-4j+6k$.

$(\bar{A}+\bar{B}+\bar{C}) = (3i+7j-2k)+(i+3j+7k)+(9i-4j+6k)$.

$= 13i+6j+11k$.

$|A+B+C| = \sqrt{13^2+6^2+11^2} = \sqrt{169+36+121} = \sqrt{326}$.

$= 18.06$.

$\hat{e}_{A+B+C} = \frac{13i+6j+11k}{18.06} = \frac{13}{18.06}i + \frac{6j}{18.06} + \frac{11k}{18.06}$.

2] A particle moves along a curve, $x = 8t^2$, $y = t^2-4t$, $z = t+1$ where t is time. Find the modulus of acceleration at $t=1$.

Solution.

when $x = 8t^2$, $y = t^2-4t$, $z = t+1$.

let $r = 8t^2_i + (t^2-4t)_j + (t+1)_k$.

since t = time.

Velocity $= \frac{dr}{dt} = 16t_i + (2t-4)_j + k$.

Acceleration $= \frac{d^2r}{dt^2} = 16i + 2j$, $\left|\frac{d^2r}{dt^2}\right|_{t=1} = \sqrt{16^2+2^2}$.

∴ The modulus of its acceleration at $t = 1 = \sqrt{256+4} = \sqrt{260}$.

$= 2\sqrt{65}$. //

3] If $A = 4i+2j-4k$, $B = 8i-2j+k$, $C = i+4j-3k$, find the Vector triple product $(A \times B) \times C$.

Solution.

$A = 4i+2j-4k$, $B = 8i-2j+k$, $C = i+4j-3k$,

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

to find the Vector Triple product. first find $A \times B$!

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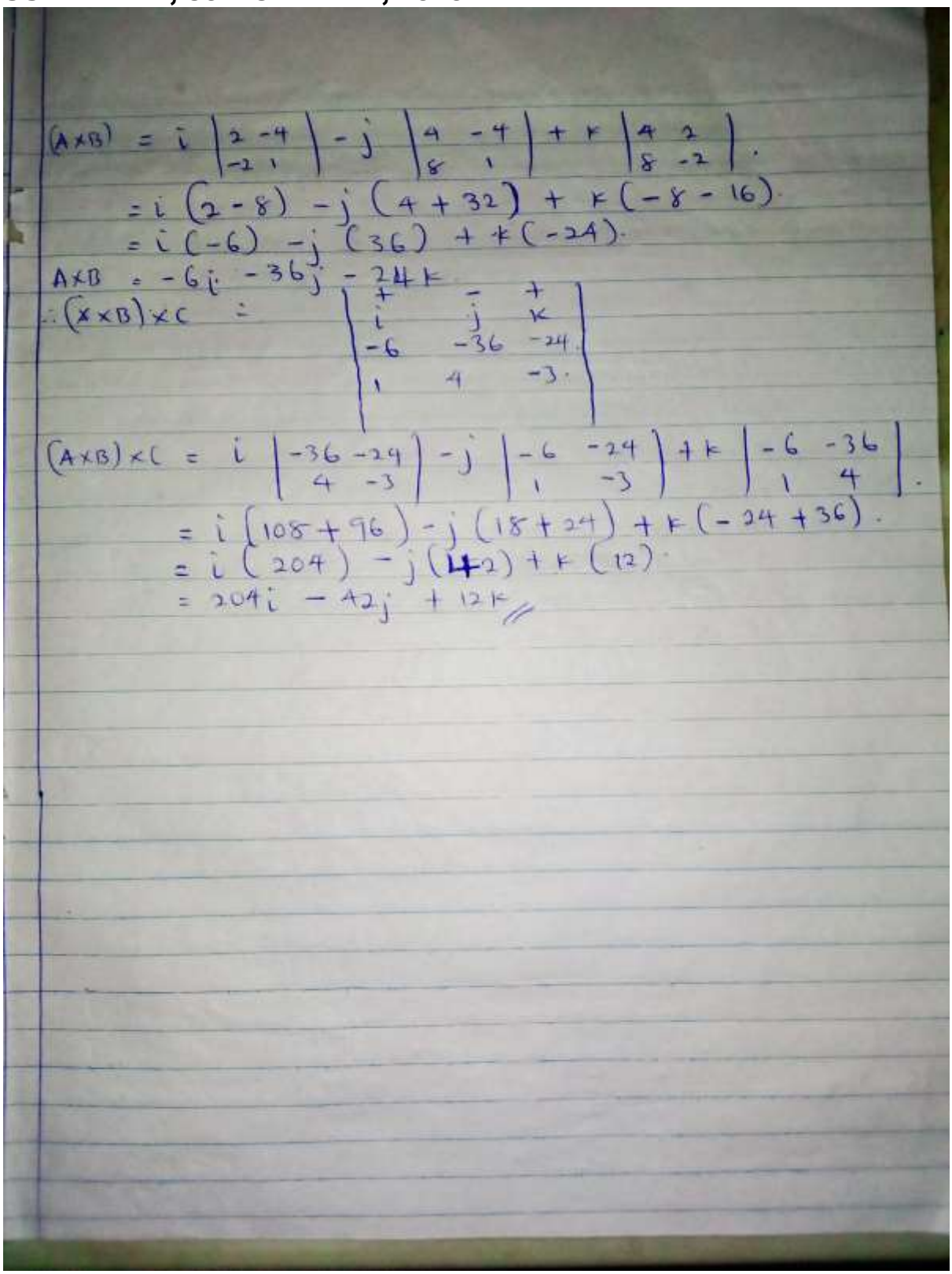

$$(A\times B) = i\begin{vmatrix} 2 & -4 \\ -2 & 1 \end{vmatrix} - j\begin{vmatrix} 4 & -4 \\ 8 & 1 \end{vmatrix} + k\begin{vmatrix} 4 & 2 \\ 8 & -2 \end{vmatrix}.$$

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

$$= i(-6) - j(36) + k(-24).$$

$$A\times B = -6i - 36j - 24k$$

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

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

$$= i(108+96) - j(18+24) + k(-24+36).$$

$$= i(204) - j(42) + k(12).$$

$$= 204i - 42j + 12k$$