Lgca 151 maths worksheet

|x| = magnitude of x

① $a+b = \begin{bmatrix}1\\4\\8\end{bmatrix} + \begin{bmatrix}8\\-4\\1\end{bmatrix} = \begin{bmatrix}9\\0\\9\end{bmatrix}$

② $c+b = \begin{bmatrix}2\\-2\\1\end{bmatrix} + \begin{bmatrix}8\\0\\6\end{bmatrix} = \begin{bmatrix}10\\-2\\7\end{bmatrix}$

③ $3a = 3\begin{bmatrix}1\\4\\8\end{bmatrix} = \begin{bmatrix}3(1)\\3(4)\\3(8)\end{bmatrix} = \begin{bmatrix}3\\12\\24\end{bmatrix}$

④ $-2b = -2\begin{bmatrix}8\\-4\\1\end{bmatrix} = \begin{bmatrix}-2(8)\\-2(-4)\\-2(1)\end{bmatrix} = \begin{bmatrix}-16\\8\\-2\end{bmatrix}$

⑤ $a-b = \begin{bmatrix}1\\4\\8\end{bmatrix} - \begin{bmatrix}8\\-4\\1\end{bmatrix} = \begin{bmatrix}-7\\8\\7\end{bmatrix}$

⑥ $|a| = \begin{bmatrix}1\\4\\8\end{bmatrix}^2 = \sqrt{x^2+y^2+z^2} = \sqrt{1+16+64} = \sqrt{81} = 9$

⑦ $|b| = \begin{bmatrix}8\\-4\\1\end{bmatrix}^2 = \sqrt{x^2+y^2+z^2} = \sqrt{64+16+1} = \sqrt{81} = 9$

⑧ $a.b = \begin{bmatrix}1\\4\\8\end{bmatrix}\begin{bmatrix}8\\-4\\1\end{bmatrix} = 8+-16+8 = 0 = 90°$

(9) $c \cdot d = \begin{bmatrix} 2 \\ -2 \\ 1 \end{bmatrix} \cdot \begin{bmatrix} 8 \\ 0 \\ 6 \end{bmatrix} = 16 + 0 + 6 = 22$

(10) angle $\theta = \frac{a \cdot b}{|a| \cdot |b|} = \frac{0}{x}$

$x = |a| \cdot |b| = 9 \cdot 9$

$\theta = \cos^{-1}\left(\frac{0}{9^2}\right) = \cos^{-1}(0) = 90°$ angle

(11) angle $\theta = \frac{c \cdot d}{|c| \cdot |d|} = \frac{x}{(c) \cdot |d|}$

$x = c \cdot d = 22$

$|c| = \begin{pmatrix} 2 \\ -2 \\ 1 \end{pmatrix} = \sqrt{2^2 + (-2) + 1^2} = \sqrt{4 + 4 + 1} = \sqrt{9} = 3$

$|d| = \begin{pmatrix} 8 \\ 0 \\ 6 \end{pmatrix} = \sqrt{8^2 + 0^2 + 6^2} = \sqrt{64 + 36} = \sqrt{100} = 10$

$\cos\theta = \frac{22}{3 \cdot 10} = \cos^{-1}\left(\frac{22}{30}\right) = 42.03°$

(12) $\text{proj}_d c = \frac{c \cdot d}{|d|^2} = \frac{22}{10^2} = \frac{22}{100} = 22.10^{-2} = 0.22$

(13) $e = (1-t) * c + t \cdot d$

$c = [2, -2, 1]$

$d = [8, 0, 6]$

$t = 0.8$

$e = (1-t)c + t \cdot d$

$e = (1-0.8)[2, -2, 1] + 0.8[8, 0, 6]$

$= 0.2[2, -2, 1] + 0.8[8, 0, 6]$

$= [0.4, -0.4, 0.2] + [6.4, 0, 4.8]$

$= [6.8, -0.4, 5]$

$= [6.8, -0.4, 5]$

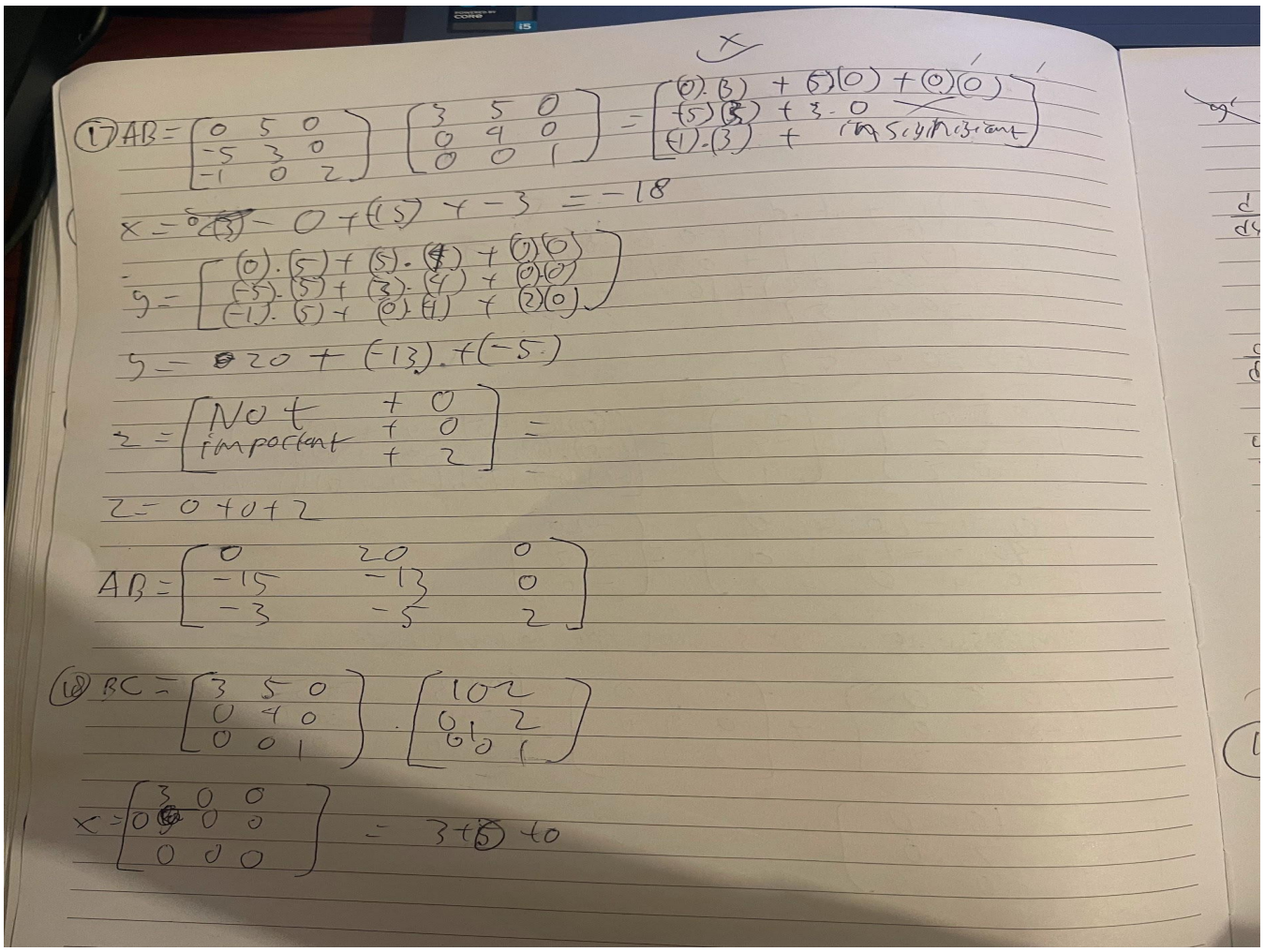
(14) $Ab = \begin{bmatrix} 0 & 5 & 0 \\ -5 & 3 & 0 \\ -1 & 0 & 2 \end{bmatrix} \cdot \begin{bmatrix} 8 \\ -4 \\ 1 \end{bmatrix} = \begin{bmatrix} (0)(8) + (5)(-4) + (0)(1) \\ (-5)(8) + (3)(-4) + (0)(1) \\ (-1)(8) + (0)(-4) + (2)(1) \end{bmatrix}$

$= \begin{bmatrix} 0 + -20 + 0 \\ -40 + -12 + 0 \\ -8 + 0 + 2 \end{bmatrix} = \begin{bmatrix} -20 \\ -52 \\ -6 \end{bmatrix}$

(15) BC = impossible. 3×3 can not be multiplied by 1×3

(16) $A + B = \begin{bmatrix} 0 & 5 & 0 \\ -5 & 3 & 0 \\ -1 & 0 & 2 \end{bmatrix} + \begin{bmatrix} 3 & 5 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0+3 & 5+5 & 0+0 \\ -5+0 & 3+4 & 0+0 \\ -1+0 & 0+0 & 2+1 \end{bmatrix}$

$= \begin{bmatrix} 3 & 10 & 0 \\ -5 & 7 & 0 \\ -1 & 0 & 3 \end{bmatrix}$



$\frac{d}{dx}(8x^4) = 8 \cdot (5(x))$

$= 8 \cdot (x^4) = 4 \cdot 8 \cdot x^3 = 32x^3$

$\frac{d}{dx}(5x^6) = 6 \cdot 5(x) = 5 \cdot 6 \cdot x^{6-1} = 30x^5$

$y = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 0 \end{bmatrix} = 0+9+0$

$z = \begin{bmatrix} (3)(2)+0(3)+0(2) \\ (5)(2)+9(2)+0(2) \\ (0)(1)+0(1)+1(1) \end{bmatrix} = 6+18+1$

$BC = \begin{bmatrix} 3 & 0 & 6 \\ 0 & 9 & 18 \\ 0 & 0 & 1 \end{bmatrix}$

(19) $\begin{matrix} 1 & 0 & 2 \\ x & y & z \end{matrix}$ $\begin{matrix} 0 & 1 & 2 \\ x & y & z \end{matrix}$ $\begin{matrix} 0 & 0 & 1 \\ x & y & z \end{matrix}$

(20) $\begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1/2 & -\sqrt{3}/2 & 0 \\ \sqrt{3}/2 & 1/2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$