1/i)

$$A = \begin{bmatrix} 2 & 1 & 2 \\ 4 & 0 & 1 \\ 1 & -1 & 2 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 2 & 0 \\ 3 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

$$AB = \begin{bmatrix} (2\times1)+(1\times3)+(2\times0) & (2\times2)+(1\times1)+(2\times1) & (2\times0)+(1\times1)+(2\times1) \\ (4\times1)+(0\times3)+(1\times0) & (4\times2)+(0\times1)+(1\times1) & (4\times0)+(0\times1)+(1\times1) \\ (1\times1)+(-1\times3)+(2\times0) & (1\times2)+(-1\times1)+(2\times1) & (1\times0)+(-1\times1)+(2\times1) \end{bmatrix}$$

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

$$AB = \begin{bmatrix} 5 & 7 & 3 \\ 4 & 9 & 1 \\ -2 & 3 & 1 \end{bmatrix}$$

i) ii)

$$A=\begin{bmatrix}2&1&2\\4&0&1\\1&-1&2\end{bmatrix} \quad B=\begin{bmatrix}1&2&0\\3&1&1\\0&1&1\end{bmatrix}$$

$$A-B=\begin{bmatrix}2-1&1-2&2-0\\4-3&0-1&1-1\\1-0&-1-1&2-1\end{bmatrix}$$

$$A-B=\begin{bmatrix}1&-1&2\\1&-1&0\\1&-2&1\end{bmatrix}$$

iii)

$$A+B=\begin{bmatrix}2+1&1+2&2+0\\4+3&0+1&1+1\\1+0&1+1&2+1\end{bmatrix} \quad A+B=\begin{bmatrix}3&3&2\\7&1&2\\1&0&3\end{bmatrix}$$

iv)

$$B^T=\begin{bmatrix}1&3&0\\2&1&1\\0&1&1\end{bmatrix}$$

2a/

$a = (2, 1, 3)$ $\quad b = (3, 2, -3)$

$a \times b = ((1 \times -3) - (3 \times 2), (3 \times 3) - (-3 \times 2), (2 \times 2) - (1 \times 3))$

$\downarrow$

$-3 - 6, \quad 9 - -6, \quad 4 - 3$

$\downarrow$

$a \times b = \underline{-9, 15, 1}$

2b/

$\underline{45^{\circ}}$

3a) $c = (2, 5, 0)$ $d = (4, 3, 0)$

$c \cdot d = (2 \times 4), (5 \times 3), (0 \times 0)$

$c \cdot d = 8, 15, 0 \rightarrow 8 + 15 = \underline{23}$

3b) $|c| = \sqrt{2^2 + 5^2} = \sqrt{29} = \underline{5.385}$

$|d| = \sqrt{4^2 + 3^2} = \sqrt{25} = \underline{5}$

3c) $c = 2/5.385,\ 5/5.385,\ 0/5.385$

3d) $\phi = \cos^{-1}\left(\frac{23}{10.385}\right)$

4)

$$a = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 3 & 1 \\ 3 & 2 & -1 \end{bmatrix}$$

$$1 \begin{bmatrix} 3 & 1 \\ 2 & -1 \end{bmatrix} \qquad 3 \begin{bmatrix} 2 & 1 \\ 1 & -1 \end{bmatrix} \qquad 2 \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$$

$3 \times -1 = -3$ $\quad 2 \times -1 = -2$ $\quad 2 \times 2 = 4$

$1 \times 2 = 2$ $\quad 1 \times 1 = 1$ $\quad 3 \times 1 = 3$

$= 1(-3-2) - 3(-2-1) - 2(4-3) \rightarrow -5 - -9 - 2$

$4 - 2 = \underline{2}$

5, $1x + 3y + 2z = 4$

$2x + 3y + 1z = 2$ → $2x + 5y + 1z = 0$

$1x + 2y - 1z = -4$ $\quad 2x + 3y + 1z = 2$

$2y = -2 \rightarrow \underline{y = -1}$

$2x + 5y + 1z = 0$

-5

$2x + 1z = 5$

$\underline{x = 1,\ z = 3}$ →

$1 + -3 + 6 = 4$ ✓

$2 + -3 + 3 = 2$ ✓

$1 + -2 - 3 = -4$ ✓

$\underline{y = -1}$ $\quad \underline{x = 1}$ $\quad \underline{z = 3}$

6) $\frac{(x+2)}{2} + \frac{(x-1)}{3} = \frac{(2x-2)}{6}$

$\downarrow$

$2(x+2) + 3(x-1) = 6(2x-2)$

$(2x+4) + (3x-3) = (12x-12)$

$5x+1 = 12x-12$

$7x - 12 = 1$

$7x = -11$

$\underline{x = -\frac{11}{7}}$

6) ii)

$$2x^2 - x - 6 = 0$$

$$2x^2 - x = 6$$

$$\downarrow$$

$$2^2 = 4 \times 2 = 8 - 2 = 6$$

$$\underline{x = 2}$$