MIT 18.06SC - Problem Set 1.1

Q 1.1) Let $x_1 = x$, $x_2 = y$, $x_3 = z$

$$x \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} + y \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} + z \begin{bmatrix} 7 \\ 8 \\ 9 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$x + 4y + 7z = 0$ — (i)
$2x + 5y + 8z = 0$ — (ii)
$3x + 6y + 9z = 0$ — (iii)

$2x + 8y + 14z = 0$ — $2 \times$ (i)
$- 2x + 5y + 8z = 0$ — (ii)
$0 + 3y + 6z = 0$

Let $y = -2$ and $z = 1$

$3(-2) + 6(1) = 0$

$x + 4y + 7z = 0$
$x = -4y - 7z$
$x = -4(-2) - 7(1)$
$x = 1$

$x = 1$, $y = -2$, $z = 1$
$x_1 = 1$, $x_2 = -2$, $x_3 = 1$

~~Since~~ The vectors are dependent because there exist values for x_1, x_2 and x_3 such that $x_1 w_1 + x_2 w_2 + x_3 w_3 =$ ~~zero vec~~ $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

The three vectors lie in a plane

Q1.2) $\begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 4 & 1 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}$

$$= 3\begin{bmatrix} 1 \\ 2 \\ 4 \end{bmatrix} - 2\begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix} + 1\begin{bmatrix} 0 \\ 3 \\ 1\cancel{0} \end{bmatrix}$$

$$= \begin{bmatrix} 3 \\ 6 \\ 12 \end{bmatrix} - \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix} + \begin{bmatrix} 0 \\ 3 \\ 1\cancel{0} \end{bmatrix}$$

$$= \begin{bmatrix} -1 \\ 9 \\ 11\cancel{0} \end{bmatrix}$$

~~Q1.3) True, A x B is possible because they~~ ~~A have the same number of number~~ ~~of columns ~~rows~~ in A equals the number of~~ ~~rows ~~columns~~ in B, and because the~~ ~~product AB will have the same numbers~~ ~~of rows as A and~~

1.3) True. The product AB is possible because the number of columns in A equals the number of rows in B; ~~and since~~ The product AB will have the same number of rows as A and the same number of columns as B, so A will be a 3X3 matrice