12 B) LET B BE $S \times T$. WE WANT TO SHOW THAT $S = N$ AND $T = M$. IN ORDER FOR $A(BA)$ TO BE DEFINED, BA MUST BE DEFINED. HENCE T MUST EQUAL M. NOW, BA IS AN $S \times N$ MATRIX AND FOR $A(BA)$ TO EXIST WE NEED N TO EQUAL S.

15 A)
$$AB = \left[\begin{array}{c|c} \begin{bmatrix}-1 & 2\\ 0 & -3\end{bmatrix}\begin{bmatrix}2 & 1\\ -3 & 5\end{bmatrix} + \begin{bmatrix}1 & 5\\ 4 & 2\end{bmatrix}\begin{bmatrix}7 & -1\\ 0 & 3\end{bmatrix} & \begin{bmatrix}-1 & 2\\ 0 & -3\end{bmatrix}\begin{bmatrix}4\\ 2\end{bmatrix} + \begin{bmatrix}1 & 5\\ 4 & 2\end{bmatrix}\begin{bmatrix}5\\ -3\end{bmatrix} \\ \hline [1\ 5]\begin{bmatrix}2 & 1\\ -3 & 5\end{bmatrix} + [6\ 1]\begin{bmatrix}7 & -1\\ 0 & 3\end{bmatrix} & [1\ 5]\begin{bmatrix}4\\ 2\end{bmatrix} + [6\ 1]\begin{bmatrix}5\\ -3\end{bmatrix} \end{array}\right]$$

$$= \left[\begin{array}{c|c} \begin{bmatrix}-8 & 9\\ 9 & -15\end{bmatrix} + \begin{bmatrix}7 & 14\\ 28 & 2\end{bmatrix} & \begin{bmatrix}0\\ -6\end{bmatrix} + \begin{bmatrix}-10\\ 14\end{bmatrix} \\ \hline [-13\ 26] + [42\ -3] & [14] + [27] \end{array}\right] = \left[\begin{array}{cc|c} -1 & 23 & -10 \\ 37 & -13 & 8 \\ \hline 29 & 23 & 41 \end{array}\right].$$

WHICH CHECKS AGAINST THE STANDARD MULTIPLICATION.

B)
$$AB = \left[\begin{array}{c|c} [-1\ 2\ 1]\begin{bmatrix}2 & 1\\ -3 & 5\\ 7 & -1\end{bmatrix} + [5][0\ 3] & [-1\ 2\ 1]\begin{bmatrix}4\\ 2\\ 5\end{bmatrix} + [5][-3] \\ \hline \begin{bmatrix}0 & -3 & 4\\ 1 & 5 & 6\end{bmatrix}\begin{bmatrix}2 & 1\\ -3 & 5\\ 7 & -1\end{bmatrix} + \begin{bmatrix}2\\ 1\end{bmatrix}[0\ 3] & \begin{bmatrix}0 & -3 & 4\\ 1 & 5 & 6\end{bmatrix}\begin{bmatrix}4\\ 2\\ 5\end{bmatrix} + \begin{bmatrix}2\\ 1\end{bmatrix}[-3] \end{array}\right]$$

$$= \left[\begin{array}{c|c} [-1\ 8] + [0\ 15] & [5] + [-15] \\ \hline \begin{bmatrix}37 & -19\\ 29 & 20\end{bmatrix} + \begin{bmatrix}0 & 6\\ 0 & 3\end{bmatrix} & \begin{bmatrix}14\\ 44\end{bmatrix} + \begin{bmatrix}-6\\ -3\end{bmatrix} \end{array}\right] = \left[\begin{array}{c|c} [-1\ 23] & [-10] \\ \hline \begin{bmatrix}37 & -13\\ 29 & 23\end{bmatrix} & \begin{bmatrix}8\\ 41\end{bmatrix} \end{array}\right]$$

WHICH CHECKS AGAINST THE STANDARD MULTIPLICATION.