Holistic Numerical Methods Institute
committed to bringing numerical methods to undergraduates

Multiple-Choice Test
Chapter 4.03
Binary Matrix Operations
COMPLETE SOLUTION SET

1. If $[A]=\begin{bmatrix}5 & 6\\ 7 & -3\end{bmatrix}$ and $[B]=\begin{bmatrix}2\\ -3\end{bmatrix}$

   then $[A][B]=$

   (A) $\begin{bmatrix}-8\\ 23\end{bmatrix}$

   (B) $\begin{bmatrix}10 & 12\\ 14 & 9\end{bmatrix}$

   (C) $\begin{bmatrix}-2 & 5\end{bmatrix}$

   (D) not possible

Solution

The correct answer is (A).

For

$$[A]=\begin{bmatrix}5 & 6\\ 7 & -3\end{bmatrix}$$

$$[B]=\begin{bmatrix}2\\ -3\end{bmatrix}$$

$$[C]_{m\times n}=[A]_{m\times p}[B]_{p\times n}$$

$$c_{ij}=\sum_{k=1}^{p}a_{ik}b_{kj}$$

$$c_{11}=\sum_{k=1}^{2}a_{1k}b_{k1}$$

$$=a_{11}b_{11}+a_{12}b_{12}$$

$$=(5)(2)+(6)(-3)$$

$$=-8$$

Similarly

$$c_{21}=23$$

Hence

$$[C]=\begin{bmatrix}-8\\ 23\end{bmatrix}$$

2. For the product $[A][B]$ to be possible

(A) the number of rows of $[A]$ needs to be the same as the number of columns of $[B]$

(B) the number of columns of $[A]$ needs to be the same as the number of rows of $[B]$

(C) the number of rows of $[A]$ and $[B]$ needs to be the same

(D) the number of columns of $[A]$ and $[B]$ needs to be the same

Solution

The correct answer is (B).

Matrix multiplication $[A][B]$ is defined only if the number of columns of $[A]$ is the same as the number of rows of $[B]$.

$$[C]_{m\times n} = [A]_{m\times p}[B]_{p\times n}$$

3. If

$$[A] = \begin{bmatrix} 50 & 60 \\ 20 & -30 \end{bmatrix}$$

then $6[A]$ is equal to

(A) $\begin{bmatrix} 50 & 360 \\ 120 & -180 \end{bmatrix}$

(B) $\begin{bmatrix} 300 & 60 \\ 20 & -30 \end{bmatrix}$

(C) $\begin{bmatrix} 300 & 360 \\ 120 & -180 \end{bmatrix}$

(D) $\begin{bmatrix} 56 & 66 \\ 26 & -24 \end{bmatrix}$

Solution

The correct answer is (*C*).

Given

$$[A] = \begin{bmatrix} 50 & 60 \\ 20 & -30 \end{bmatrix}$$

then

$$6[A] = 6\begin{bmatrix} 50 & 60 \\ 20 & -30 \end{bmatrix}$$

$$= \begin{bmatrix} (6)(50) & (6)(60) \\ (6)(20) & (6)(-30) \end{bmatrix}$$

$$= \begin{bmatrix} 300 & 360 \\ 120 & -180 \end{bmatrix}$$

4. $[A]$ and $[B]$ are square matrices of $n \times n$ order. Then $([A]-[B])([A]-[B])$ is equal to

(A) $[A]^2 + [B]^2 - 2[A][B]$

(B) $[A]^2 + [B]^2$

(C) $[A]^2 - [B]^2$

(D) $[A]^2 + [B]^2 - [A][B] - [B][A]$

Solution

The correct answer is (*D*).

$$([A]-[B])([A]-[B]) = ([A]-[B])[A] - ([A]-[B])[B]$$
$$= [A]^2 - [B][A] - [A][B] + [B]^2$$

Remember though, $[A][B]$ is not always equal to $[B][A]$ unless $[A][B] = [B][A]$

5. Given $[A]$ is a rectangular matrix and $c[A]=[0]$, then choose the most appropriate answer.

(A) $C=0$

(B) $C=0$ and $[A]=[0]$

(C) $C=0$ or $[A]=[0]$

(D) $C=0$ and $[A]$ is a non-zero matrix

Solution

The correct answer is (C).

Since

$$c[A]=[0]$$

then if $c=[0]$,

$$c[A]=[0]$$

no matter what $[A]$ is.

However, if

$$[A]=[0]$$

then

$$c[A]=[0]$$

too.

So either $c=0$ or $[A]=[0]$ would give $c[A]=[0]$

6. You sell Jupiter and Fickers Candy bars. The sales in January are 25 and 30 of Jupiter and Fickers, respectively. In February, the sales are 75 and 35 of Jupiter and Fickers, respectively. If a Jupiter bar costs \$2 and a Fickers bar costs \$7, then if

$$[A] = \begin{bmatrix} 25 & 30 \\ 75 & 35 \end{bmatrix}, \text{ and}$$

$$[B] = \begin{bmatrix} 2 \\ 7 \end{bmatrix},$$

the total sales amount in each month is given by

(A) $[B]\,[A]$
(B) $[A]\,[B]$
(C) $2[A]$
(D) $7[A]$

Solution

The correct answer is (B).

The sales of each month is given by $[A]\,[B]$.

$$[A][B] = \begin{bmatrix} 25 & 30 \\ 75 & 35 \end{bmatrix} \begin{bmatrix} 2 \\ 7 \end{bmatrix}$$

$$= \begin{bmatrix} 260 \\ 395 \end{bmatrix}$$