Topic: Scalar multiplication and zero matrices

Question: Use scalar multiplication to simplify the expression.

$$4\begin{bmatrix} 5 & 2 & 1 \\ -2 & 4 & 7 \end{bmatrix}$$

Answer choices:

A $\begin{bmatrix} 9 & 6 & 5 \\ 2 & 8 & 11 \end{bmatrix}$

B $\begin{bmatrix} 20 & 8 & 4 \\ -2 & 4 & 7 \end{bmatrix}$

C $\begin{bmatrix} 5 & 2 & 1 \\ -8 & 16 & 28 \end{bmatrix}$

D $\begin{bmatrix} 20 & 8 & 4 \\ -8 & 16 & 28 \end{bmatrix}$

Solution: D

In this problem, 4 is the scalar. We distribute the scalar across every entry in the matrix, and the result of the scalar multiplication is

$$4\begin{bmatrix} 5 & 2 & 1 \\ -2 & 4 & 7 \end{bmatrix}$$

$$\begin{bmatrix} 4(5) & 4(2) & 4(1) \\ 4(-2) & 4(4) & 4(7) \end{bmatrix}$$

$$\begin{bmatrix} 20 & 8 & 4 \\ -8 & 16 & 28 \end{bmatrix}$$

Topic: Scalar multiplication and zero matrices

Question: Solve for x.

$$3\begin{bmatrix}7 & 1\\ 8 & 3\end{bmatrix} + x = -4\begin{bmatrix}0 & -5\\ -2 & 3\end{bmatrix}$$

Answer choices:

A $x = \begin{bmatrix}-21 & 17\\ -16 & -21\end{bmatrix}$

B $x = \begin{bmatrix}21 & 23\\ 32 & -3\end{bmatrix}$

C $x = \begin{bmatrix}21 & -17\\ 16 & 21\end{bmatrix}$

D $x = \begin{bmatrix}-21 & -23\\ -32 & 3\end{bmatrix}$

Solution: A

Apply the scalars to the matrices.

$$\begin{bmatrix} 3(7) & 3(1) \\ 3(8) & 3(3) \end{bmatrix} + x = \begin{bmatrix} -4(0) & -4(-5) \\ -4(-2) & -4(3) \end{bmatrix}$$

$$\begin{bmatrix} 21 & 3 \\ 24 & 9 \end{bmatrix} + x = \begin{bmatrix} 0 & 20 \\ 8 & -12 \end{bmatrix}$$

Subtract the matrix on the left from both sides of the equation in order to isolate x.

$$x = \begin{bmatrix} 0 & 20 \\ 8 & -12 \end{bmatrix} - \begin{bmatrix} 21 & 3 \\ 24 & 9 \end{bmatrix}$$

$$x = \begin{bmatrix} 0-21 & 20-3 \\ 8-24 & -12-9 \end{bmatrix}$$

$$x = \begin{bmatrix} -21 & 17 \\ -16 & -21 \end{bmatrix}$$

Topic: Scalar multiplication and zero matrices

Question: Choose the O_{4x2} matrix.

Answer choices:

A $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

B $\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$

C $\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

D $\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

Solution: B

We always name the zero matrix with a capital O. And optionally, you can add a subscript with the dimensions of the zero matrix. Since the values in a zero matrix are all zeros, just having the dimensions of the zero matrix tells you what the entire matrix looks like. So O_{4x2} is

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$