Worksheet: Scalar Multiplication of Matrices

Q1: Given the matrix

$$A = \begin{bmatrix} 8 & -3 \\ 1 & -2 \end{bmatrix},$$

Question Video

what is $2A$?

A $\begin{bmatrix} 16 & -6 \\ 2 & -4 \end{bmatrix}$

B $\begin{bmatrix} 10 & -1 \\ 3 & 1 \end{bmatrix}$

C $\begin{bmatrix} 64 & 9 \\ 1 & 4 \end{bmatrix}$

D $\begin{bmatrix} 8 & -3 \\ 1 & -2 \end{bmatrix}$

E $\begin{bmatrix} 16 & -3 \\ 2 & -2 \end{bmatrix}$

Q2: Given that $\mathbf{A} = \langle -1, -8 \rangle$, find $3\mathbf{A}$.

A $\langle -24, -3 \rangle$

B $\langle -3, -8 \rangle$

C $\langle -1, -24 \rangle$

D $\langle -3, -24 \rangle$

Q3: Using the properties of determinants, find the value of

$$\begin{vmatrix} 5 & 6 & 8 \\ -6 & -2 & 3 \\ -4 & -5 & -7 \end{vmatrix} + \frac{1}{9} \begin{vmatrix} 15 & 2 & -12 \\ 18 & -3 & -15 \\ 24 & -10 & -21 \end{vmatrix}.$$

A -6

B -3

C 3

D 0

Q4: Find numbers a, b, and c so that $a\begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix} + b\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + c\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -1 & 3 \end{bmatrix}$.

A $a = -1, b = 3, c = -1$

B $a = 1, b = -2, c = 1$

C $a = 1, b = 2, c = 1$

D $a = 1, b = 3, c = 1$

E $a = -1, b = 2, c = -1$

Q5: Given that

$$x \times \begin{bmatrix} -2 & 0 \\ -3 & -5 \end{bmatrix} = \begin{bmatrix} 14 & 0 \\ 21 & 35 \end{bmatrix},$$

find the value of x.

A -2

B -7

C 0

D 7

E 49

Q6: Let Z be a 2×3 matrix whose entries are all zero. If A is any 2×3 matrix, which of following is equivalent to $5A - 3Z$?

A $2A$

B $-3Z$

C $5A$

D $2ZA$

E $-2AZ$

Q7: Let $A = \begin{bmatrix} 1 & 1 \\ 10 & -2 \end{bmatrix}$ and I be the 2×2 identity matrix. Find $A - 3I$, $A + 4I$, and their product $(A - 3I)(A + 4I)$, and then use this to express A^2 as a combination of A and I.

A $\begin{bmatrix} 4 & 1 \\ 10 & 1 \end{bmatrix}, \begin{bmatrix} -3 & 1 \\ 10 & -6 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, A^2 = A + 12I.$

B $\begin{bmatrix} 4 & 1 \\ 10 & 1 \end{bmatrix}, \begin{bmatrix} -3 & 1 \\ 10 & -6 \end{bmatrix}, \begin{bmatrix} -11 & 1 \\ 10 & -14 \end{bmatrix}, A^2 = A + 12I.$

C $\begin{bmatrix} -2 & 1 \\ 10 & -5 \end{bmatrix}, \begin{bmatrix} 5 & 1 \\ 10 & 2 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, A^2 = (-1)A + 12I.$

D $\begin{bmatrix} 0 & 1 \\ 10 & -3 \end{bmatrix}, \begin{bmatrix} 5 & 1 \\ 10 & 2 \end{bmatrix}, \begin{bmatrix} 10 & 2 \\ 20 & 4 \end{bmatrix}, A^2 = (-1)A + 12I.$

E $\begin{bmatrix} -2 & 1 \\ 10 & -5 \end{bmatrix}, \begin{bmatrix} 5 & 1 \\ 10 & 2 \end{bmatrix}, \begin{bmatrix} 12 & 7 \\ 70 & -2 \end{bmatrix}, A^2 = 7A + 12I.$

Q8: Fill in the blank. Columns of an $n \times n$ matrix A are an orthonormal basis for $\mathbb{C}^n$, if and only if A is a ___ matrix.

A normal

B symmetric

C square

D unitary

Q9: Given the matrix

$$A = \begin{bmatrix} 1 & -16 & 5 \\ 2 & -4 & -3 \\ -1 & 7 & 4 \end{bmatrix},$$

what is the greatest number k for which no entry of kA is greater than 1?

A $\frac{1}{16}$

B $-\frac{1}{16}$

C $\frac{1}{25}$

D $-\frac{1}{7}$

E $\frac{1}{7}$

Q10: If $A = [2]$, what is $3A$?

A 6

B 2^3

9

C $[2^3]$

D $[6]$

Q11: Consider the matrix A. Find $9A$.

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

A $\begin{bmatrix} 18 & -1 \end{bmatrix}$

B $\begin{bmatrix} 2 & -9 \end{bmatrix}$

C $\begin{bmatrix} 11 & 8 \end{bmatrix}$

D $\begin{bmatrix} 18 & -9 \end{bmatrix}$

Q12: If $A = \begin{bmatrix} 8 & -3 & 1 \end{bmatrix}$, what is $0A$?

A $\begin{bmatrix} 0 & -3 & 0 \end{bmatrix}$

B 0

C $\begin{bmatrix} 0 & 0 & 1 \end{bmatrix}$

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

E $\begin{bmatrix} 8 & -3 & 1 \end{bmatrix}$