

Matrix Algebra Worksheet 1

1.
 - (a) Write a 2×4 matrix.
 - (b) Write a 4×2 matrix.
 - (c) Multiply the two matrices that you just wrote.
 - (d) Write two matrices that you can't multiply.
 - (e) Write two matrices that you can multiply in one order but not in the other order.
 - (f) Write a matrix that is equal to its transpose.
 - (g) Write a square matrix that is not invertible.
 - (h) Write a square matrix that is invertible.
 - (i) Write 2×2 matrices A, B, C such that $AB = AC$ but $B \neq C$.
 - (j) Write 2×2 matrices A and B such that $AB \neq BA$.
 - (k) Write a diagonal matrix.
 - (l) Write an upper triangular matrix.
 - (m) Write a system of linear equations with infinitely many solutions.
 - (n) Write a system of linear equations with exactly one solution.
 - (o) Write a system of linear equations with no solution.

2. True or false:

- (a) The following matrix is diagonal

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

- (b) The following matrix is upper triangular

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

- (c) If the determinant of a square matrix is not zero, then the matrix is invertible.
- (d) If the coefficient matrix is not invertible then a system of linear equations cannot have a solution.

3. Find all solutions of the following system of linear equations.

$$\begin{aligned} 4x_2 + 8x_3 &= 12 \\ x_1 - x_2 + 3x_3 &= -1 \\ 3x_1 - 2x_2 + 5x_3 &= 6 \end{aligned}$$