- If *A* is a 3 × 5 matrix and *B* is a 3 × 2 matrix, which of the following are defined?
  a) *A*−*B*
  - **b)** *AB*
  - c)  $A^T B$
  - **d)**  $B^T A$
  - **e)** *A*<sup>2</sup>
- **2.** Find all matrices *B* that satisfy

$$\begin{pmatrix} 1 & -3 \\ -3 & 5 \end{pmatrix} B = \begin{pmatrix} -3 & -11 \\ 1 & 17 \end{pmatrix}.$$

- **3.** a) If the columns of an  $n \times n$  matrix *Z* are linearly independent, is *Z* necessarily invertible? Justify your answer.
  - **b)** Solve AB = BC for A, assuming A, B, C are  $n \times n$  matrices and B is invertible. Be careful!
- **4.** True or false (justify your answer). Answer true if the statement is *always* true. Otherwise, answer false.
  - **a)** If *A* is an  $m \times n$  matrix and *B* is an  $n \times p$  matrix, then each column of *AB* is a linear combination of the columns of *A*.
  - **b)** If *A* and *B* are  $n \times n$  and both are invertible, then the inverse of *AB* is  $A^{-1}B^{-1}$ .
  - c) If  $A^T$  is not invertible, then A is not invertible.
  - **d)** If *A* is an  $n \times n$  matrix and the equation Ax = b has at least one solution for each *b* in  $\mathbb{R}^n$ , then the solution is *unique* for each *b* in  $\mathbb{R}^n$ .
  - e) If *A* and *B* are invertible  $n \times n$  matrices, then A + B is invertible and  $(A + B)^{-1} = A^{-1} + B^{-1}$ .
  - **f)** If *A* and *B* are  $n \times n$  matrices and ABx = 0 has a unique solution, then Ax = 0 has a unique solution.
- **5.** Suppose *A* is an invertible  $3 \times 3$  matrix and

$$A^{-1}e_1 = \begin{pmatrix} 4\\1\\0 \end{pmatrix}, \quad A^{-1}e_2 = \begin{pmatrix} 3\\2\\0 \end{pmatrix}, \quad A^{-1}e_3 = \begin{pmatrix} 0\\0\\1 \end{pmatrix}.$$

Find A.