Chapter 1

1. (**True** | **False**) Every elementary row operation is reversible
2. (**True** | **False**) A 5×6 matrix has six rows
3. (**True** | **False**) The solution set of a linear system involving variables $x_1, \ldots, x_n$ is a list of numbers $(s_1, \ldots, s_n)$ that makes each equation in the system a true statement when the values $s_1, \ldots, s_n$ are substituted for $x_1, \ldots, x_n$ respectively
4. (**True** | **False**) Two fundamental questions about a linear system involve existence and uniqueness
5. (**True** | **False**) Elementary row operations on an augmented matrix never change the solution set of the associated linear system
6. (**True** | **False**) Two matrices are row equivalent if they have the same number of rows
7. (**True** | **False**) An inconsistent system has more than one solution
8. (**True** | **False**) Two linear systems are equivalent if they have the same solution set
9. (**True** | **False**) In some cases, a matrix may be row reduced to more than one matrix in reduced row echelon form, using different sequences of row operations
10. (**True** | **False**) The row reduction algorithm applies only to augmented matrices for a linear system
11. (**True** | **False**) A basic variable in a linear system is a variable that corresponds to a pivot column in the coefficient matrix
12. (**True** | **False**) Finding a parametric description of the solution set of a linear system is the same as *solving* the system
13. (**True** | **False**) If one row in a row echelon form of an augmented matrix is $\begin{bmatrix} 0 & 0 & 0 & 5 & 0 \end{bmatrix}$, then the associated linear system is inconsistent.
14. (**True** | **False**) The row echelon form of a matrix is unique
15. (**True** | **False**) The pivot positions in a matrix depend on whether row interchanges are used in the row reduction process
16. (**True** | **False**) Whenever a system has free variables, the solution set contains many solutions
17. (**True** | **False**) A general solution of a system is an explicit description of all solutions of the system
18. (**True** | **False**) Another notation for the vector $\begin{bmatrix} -4 \\ 3 \end{bmatrix}$ is $\begin{bmatrix} -4 & 3 \end{bmatrix}$
19. (**True** | **False**) The solution set of the linear system whose augmented matrix is $\left[\begin{array}{ccc|c} \mathbf{a}_1 & \mathbf{a}_2 & \mathbf{a}_3 & \mathbf{b} \end{array}\right]$ is the same as the solution set of the equation $x_1\,\mathbf{a}_1 + x_2\,\mathbf{a}_2 + x_3\,\mathbf{a}_3 = \mathbf{b}$
20. (**True** | **False**) Any list of five real numbers is a vector in $\mathbf{R}^5$

21. (**True** | **False**) The weights $c_1, \ldots, c_p$ in a linear combination $c_1\,\mathbf{v}_1 + \cdots + c_p\,\mathbf{v}_p$ cannot all be zero

22. (**True** | **False**) A homogeneous equation is always consistent

23. (**True** | **False**) A linear transformation is a special type of function

24. (**True** | **False**) Every transformation F is linear if and only if $F(c_1\,\mathbf{v}_1 + c_2\,\mathbf{v}_2) = c_1F(\mathbf{v}_1) + c_2F(\mathbf{v}_2)$ for all $\mathbf{v}_1$ and $\mathbf{v}_2$ in the domain of T for all scalars c_1 and c_2

25. (**True** | **False**) If $F : \mathbf{R}^n \to \mathbf{R}^m$ is a linear transformation and if $\mathbf{c}$ is in $\mathbf{R}^m$, then a uniqueness question is "Is $\mathbf{c}$ in in the range of T?"

26. (**True** | **False**) A linear transformation $F : \mathbf{R}^n \to \mathbf{R}^m$ is completely determined by its effect on the columns of the $n \times n$ identity matrix

27. (**True** | **False**) When two linear transformations are performed one after another, the combined effect may not always be a linear transformation

28. (**True** | **False**) A mapping $F : \mathbf{R}^n \to \mathbf{R}^m$ is onto $\mathbf{R}^m$ if every vector $\mathbf{x}$ in $\mathbf{R}^n$ maps onto some vector in $\mathbf{R}^m$

29. (**True** | **False**) A mapping $F : \mathbf{R}^n \to \mathbf{R}^m$ is one-to-one if each vector in $\mathbf{R}^n$ maps onto a unique vector in $\mathbf{R}^m$

30. (**True** | **False**) Every matrix is row equivalent to a unique matrix in row echelon form.

31. (**True** | **False**) Any system of n linear equations in n variables has at most n solutions.

32. (**True** | **False**) If a system of linear equations has two different solutions, it must have infinitely many solutions.

33. (**True** | **False**) If a system of linear equations has no free variables, then it has a unique solution.

34. (**True** | **False**) If matrices A and B are row equivalent, they have the same reduced row echelon form.

35. (**True** | **False**) If an $n \times n$ matrix A has n pivot positions, then the reduced row echelon form of A is the $n \times n$ identity matrix.

36. (**True** | **False**) If 3×3 matrices A and B each have three pivot positions, then A can be transformed into B by elementary row operations.

37. (**True** | **False**) If $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$, are nonzero vectors in $\mathbf{R}^2$, then $\mathbf{w}$ is a linear combination of $\mathbf{u}$ and $\mathbf{v}$.

38. (**True** | **False**) If $\mathbf{w}$ is a linear combination of $\mathbf{u}$ and $\mathbf{v}$ in $\mathbf{R}^n$, then $\mathbf{u}$ is a linear combination of $\mathbf{v}$ and $\mathbf{w}$.

39. (**True** | **False**) A linear transformation is a function.

40. (**True** | **False**) The range of a linear transformation is a vector space.

41. (**True** | **False**) Let A be an $m \times n$ matrix. On a computer, row operations can change the apparent rank of a matrix.

42. (**True** | **False**) The rank of a matrix equals the number of nonzero rows.

43. (**True** | **False**) If B is obtained from a matrix A by several elementary row operations, then rank $B =$ rank A.