

Applied Linear Algebra



1 Matrices and Gaussian Elimination

1.2 The Geometry of Linear Equations	2
Problems 1–12.....	2
Problems 13–15	3
Problems 16–23	3
1.3 Gaussian Elimination	4
1.4 Matrix Notation and Matrix Multiplication	5
1.5 Triangular Factors and Row Exchanges	6
1.6 Inverses and Transposes	7
1.7 Special Matrices and Applications	8
1 Review	9

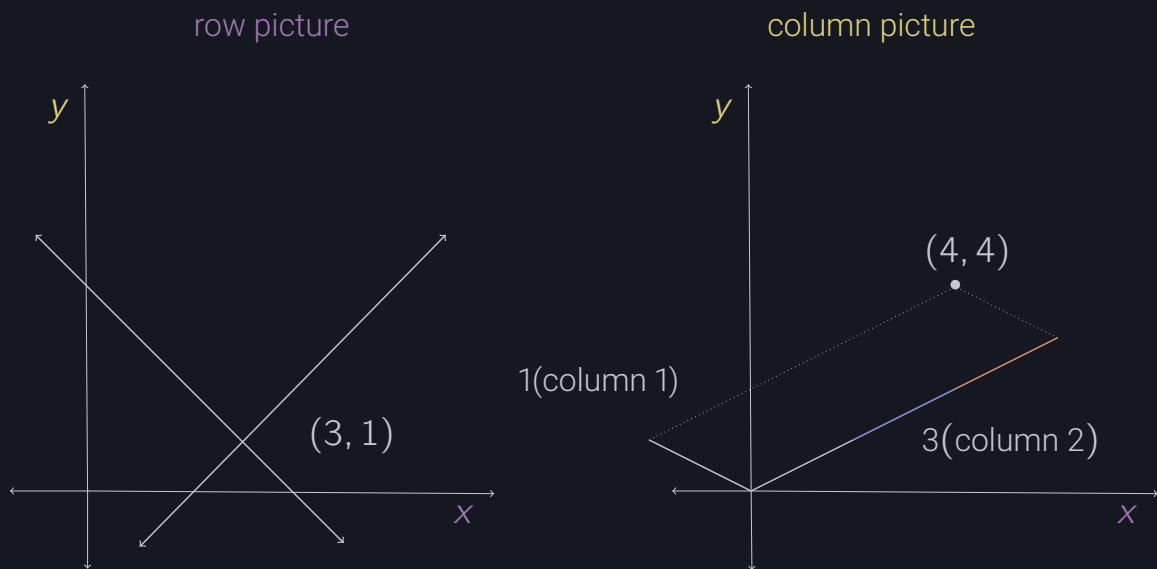
1 Matrices and Gaussian Elimination



1.2 The Geometry of Linear Equations

Problems 1–12

1. For the equations $x + y = 4$, $2x - 2y = 4$, draw the row picture (two intersecting lines) and the column picture (combination of two columns equal to the column vector $(4, 4)$ on the right side).



1.2.1

2. Solve to find a combination of the columns that equals b :

$$u - v - w = b_1$$

$$v + w = b_2$$

$$w = b_3$$

3. Describe the intersection of the three planes $u + v + w + z = 6$ and $u + w + z = 4$ and $u + w = 2$ (all in four-dimensional space).
- Is it a line or a point or an empty set?
 - What is the intersection if the fourth plane $u = -1$ is included?
 - Find a fourth equation that leaves us with no solution.

4. Sketch these three lines and decide if the equations are solvable:

$$x + 2y = 2$$

$$x - y = 2$$

$$y = 1$$

- What happens if all right-hand sides are zero?
 - Is there any nonzero choice of right-hand sides that allows the three lines to intersect at the same point?
5. Find two points on the line of intersection of the three planes $t = 0$ and $z = 0$ and $x + y + z + t = 1$ in four-dimensional space.
6. When $b = (2, 5, 7)$, find a solution (u, v, w) to equation (4) different from the solution $(1, 0, 1)$ mentioned in the text.
- 7.

Problems 13–15

◦

Problems 16–23

◦

1.3 Gaussian Elimination

1.4 Matrix Notation and Matrix Multiplication

1.5 Triangular Factors and Row Exchanges

1.6 Inverses and Transposes

1.7 Special Matrices and Applications

1 Review