

Solutions for Introduction to Linear Algebra 5th
- Gilbert Strang
Chapter 1

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Contents

Chapter 1

Problem Set 1.1 _____ Page 2 _____

Chapter 2

Problem Set 1.2 _____ Page 3 _____

Chapter 1

Problem Set 1.1

Question 1: Describe geometrically (line, plane or all of \mathbb{R}^3) all linear combinations of

a. $\begin{bmatrix} 2 & 3 \\ 4 & 4 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ and $\begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix}$ b. $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ and $\begin{bmatrix} 0 \\ 2 \\ 3 \end{bmatrix}$ c. $\begin{bmatrix} 2 \\ 0 \\ 0 \end{bmatrix}$ and $\begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix}$ and $\begin{bmatrix} 2 \\ 2 \\ 3 \end{bmatrix}$

Solution:

a.

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} * 3 = \begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix}$$

, line

Question 2: 5

Solution:

$$\mathbf{u} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \mathbf{v} = \begin{bmatrix} -3 \\ 1 \\ -2 \end{bmatrix}, \mathbf{w} = \begin{bmatrix} 2 \\ -3 \\ -1 \end{bmatrix}$$

$$\mathbf{u} + \mathbf{v} + \mathbf{w} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$2\mathbf{u} + 2\mathbf{v} + \mathbf{w} = \begin{bmatrix} -2 \\ 3 \\ 1 \end{bmatrix}$$

c and d:

$$\begin{bmatrix} 2 \\ -3 \\ -1 \end{bmatrix} = c \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} + d \begin{bmatrix} -3 \\ 1 \\ -2 \end{bmatrix}$$
$$c = -1, d = -1$$

Chapter 2

Problem Set 1.2

Question 1: 1

$$\mathbf{u} \cdot \mathbf{v} = \begin{bmatrix} -2.4 \\ 2.4 \end{bmatrix}$$

$$\begin{aligned} \mathbf{u} \cdot (\mathbf{v} + \mathbf{w}) &= \\ &= \begin{bmatrix} -0.6 \\ 0.8 \end{bmatrix} \cdot \begin{bmatrix} 5 \\ 5 \end{bmatrix} \\ &= \begin{bmatrix} -3 \\ 4 \end{bmatrix} \end{aligned}$$

Question 2: 2

$$\begin{aligned} \|\mathbf{u}\| &= \sqrt{\mathbf{u} \cdot \mathbf{u}} \\ &= \sqrt{(-0.6 * -0.6) + (0.8 * 0.8)} \\ &= \sqrt{0.36 + 0.64} \\ &= 1 \end{aligned}$$

$$\|\mathbf{v}\| = \sqrt{(4 * 4) + (3 * 3)} = 5$$