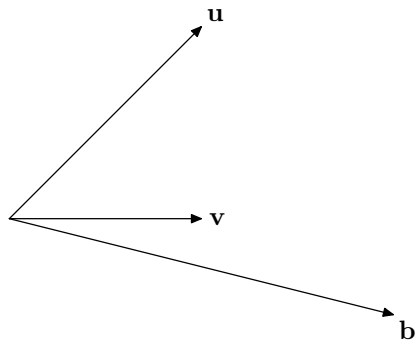


College of the Redwoods  
Mathematics Department  
Math 45—Linear Algebra

Quiz #1—Linear Algebra

David Arnold

EXERCISE 1. Show (geometrically) how vector  $\mathbf{b}$  can be written as a linear combination of vectors  $\mathbf{u}$  and  $\mathbf{v}$ .



EXERCISE 2. Write the system

$$\begin{aligned} 2x + 3y - z &= 0 \\ x + 2y + z &= 4 \\ y - 2z &= 2 \end{aligned}$$

as a matrix equation.

EXERCISE 3. Multiply.

(a)  $\begin{pmatrix} 2 & -2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} =$

(b)  $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} (4 \ 5 \ 6) =$

EXERCISE 4. What  $2 \times 2$  matrix reflects every vector in the plane across the line  $y = x$ ?

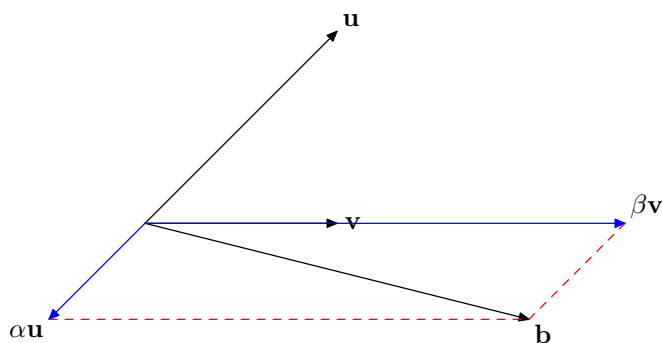
EXERCISE 5. What is the matrix  $A$  that is created by the following Matlab commands?

```
>> x=(1:2:5) '
>> A=[x,x.^2,x.^3]
```

## Solutions to Exercises

**Exercise 1.** Using the parallelogram method for adding vectors, note that

$$\mathbf{b} = \alpha\mathbf{u} + \beta\mathbf{v}.$$



Exercise 1

**Exercise 2.**

$$\begin{pmatrix} 2 & 3 & -1 \\ 1 & 2 & 1 \\ 0 & 1 & -2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 0 \\ 4 \\ 2 \end{pmatrix}$$

Exercise 2

**Exercise 3(a)**

$$\begin{pmatrix} 2 & -2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 & -2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$$

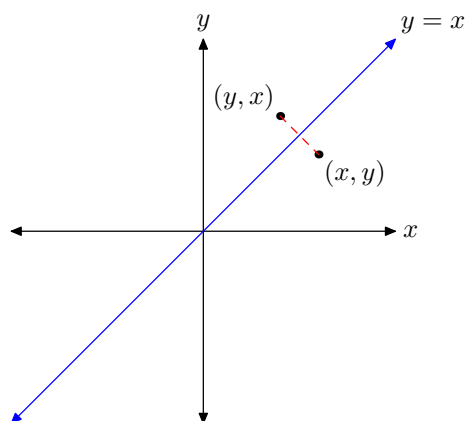
□

**Exercise 3(b)**

$$\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} (4 \ 5 \ 6) = \begin{pmatrix} 4 \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} 5 \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} 6 \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \end{pmatrix} = \begin{pmatrix} 4 & 5 & 6 \\ 8 & 10 & 12 \\ 12 & 15 & 18 \end{pmatrix}$$

□

**Exercise 4.** The vector  $(x, y)$  is reflected across the line  $y = x$  onto the vector  $(y, x)$ .



Note that

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} y \\ x \end{pmatrix}.$$

## Exercise 4

**Exercise 5.**

```
>> X=(1:2:5)'
```

```
X =
```

```
1
```

```
3
```

```
5
```

```
>> A=[X, X.^2, X.^3]
```

```
A =
```

```
1    1    1
```

```
3    9   27
```

```
5   25  125
```

## Exercise 5