**Exercise 5.1**

1. >> v=[2;0;-1]

v =

2

0

-1

>> w=[1;3;3]

w =

1

3

3

>> x=[6;1;-3]

x =

6

1

-3

>> y=[1;0;2]

y =

1

0

2

>> z=[2;-15;-1]

z =

2

-15

-1

>> dot(v,w)

ans =

-1

>> dot(v,x)

ans =

15

>> dot(v,y)

ans =

0

>> dot(v,z)

ans =

5

>> dot(w,x)

ans =

0

>> dot(w,y)

ans =

7

>> dot(w,z)

ans =

-46

>> dot(x,y)

ans =

0

>> dot(x,z)

ans =

0

>> dot(y,z)

ans =

0

Maximal orthogonal subsets: {v,y}, {w,x}, {x,y,z}

The maximum number of non-zero orthogonal vectors that you can find in **R**3 is 3, and in **Rn** is n. This happens because there can only be a maximum number of vectors in a particular space that are perpendicular. After the maximum number, any other vectors will just be either parallel to the given vectors or non-orthogonal.

1. >> x=x/norm(x)

x =

0.8847

0.1474

-0.4423

>> y=y/norm(y)

y =

0.4472

0

0.8944

>> z=z/norm(z)

z =

0.1319

-0.9891

-0.0659

>> W=[x,y,z]

W =

0.8847 0.4472 0.1319

0.1474 0 -0.9891

-0.4423 0.8944 -0.0659

**Exercise 5.2**

a) >> W'\*W

ans =

1.0000 0 -0.0000

0 1.0000 0

-0.0000 0 1.0000

We get the identity matrix. We expect this result because when each column is multiplied by its transpose, it's equivalent to taking the dot product of the column with itself, which is the same as its norm.

b) >> norm(b)

ans =

3.6056

>> norm(W\*b)

ans =

3.6056

The norm of *b*and the norm of *Wb* are the same.

>> dot(a,b)

ans =

2

>> dot(W\*a,W\*b)

ans =

2

The dot products of vectors <a,b> and <Wa,Wb> are also the same.

c) >> inv(W)

ans =

0.8847 0.1474 -0.4423

0.4472 0 0.8944

0.1319 -0.9891 -0.0659

>> inv(W')

ans =

0.8847 0.4472 0.1319

0.1474 0 -0.9891

-0.4423 0.8944 -0.0659

**Exercise 5.3**

a) >> vbar=(dot(v,w)/dot(w,w))\*w

vbar =

-0.0526

-0.1579

-0.1579

>> z=v-vbar

z =

2.0526

0.1579

-0.8421

v=vbar+z

b) >> dot(z,vbar)

ans =

-2.7756e-17

**Exercise 5.4**

>> [x,y]\*[x,y]'\*[3;3;3]

ans =

3.3652

0.2609

2.8174

**Exercise 5.5**

a) >> [Q R]=qr([1 2 1; 2 1 2; 1 1 2])

Q =

-0.4082 0.8616 -0.3015

-0.8165 -0.4924 -0.3015

-0.4082 0.1231 0.9045

R =

-2.4495 -2.0412 -2.8577

0 1.3540 0.1231

0 0 0.9045

b) >> norm(v(2))

ans =

1.0000

>> norm(v(3))

ans =

1

The absolute value of all the eigenvalues are equal to 1.

**Exercise 5.6**

a) >> B=[1 75;1 100; 1 128;1 159;1 195]

B =

1 75

1 100

1 128

1 159

1 195

>> d=[15;23;26;34;38]

d =

15

23

26

34

38

>> [Q,R]=qr(B,0)

Q =

-0.4472 -0.5950

-0.4472 -0.3313

-0.4472 -0.0359

-0.4472 0.2912

-0.4472 0.6710

R =

-2.2361 -293.8193

0 94.7903

>> x=Q(:,1)

x =

-0.4472

-0.4472

-0.4472

-0.4472

-0.4472

>> y=Q(:,2)

y =

-0.5950

-0.3313

-0.0359

0.2912

0.6710

>> v = dot(x,d)\*x + dot(y,d)\*y

v =

16.5379

21.2640

26.5572

32.4176

39.2232

b) >> c = B\v

c =

2.3596

0.1890

>> B\*c-v

ans =

1.0e-13 \*

0.1066

0

0.0355

0

0.0711

c)>> c1=lscov(B,d,eye(5))

c1 =

2.3596

0.1890

This answer is the same as the one in part (b).

**Exercise 5.7**

a) y = 0.1890x + 2.3596

y represents pressure in lb/sq in. and x represents temperature in degrees Fahrenheit

b) >> 0.1890\*35 + 2.3596

ans =

8.9746

>> 0.1890\*170 + 2.3596

ans =

34.4896

>> 0.1890\*290 + 2.3596

ans =

57.1696

c)

****