Exercise : 7.8

One norm = sum of abselute terms = 15. Two norm = root of the sum of squares = $\sqrt{77}$. Infinity norm = largest abselute term = 6.

Exercise : 7.9

one norm = largest of the sum of abselute terms in a columb = 14. infinity norm = largest of the sum of abselute terms in a row = 15.
Using octave $A^{-1} = \begin{bmatrix} -4 & 3 \\ 3.5 & -2.5 \end{bmatrix}$. Wich has a one norm of 7.5 and a infinity norm of 7. So its one norm condition number is 105 and its infinity condition number is 105.

Exercise : 7.10

Let v be a n-vector. WLoG let v_1 be the maximum abselute entry in v, and thus $|v_1| = ||v||_\infty$.

(a) Note that for all i, $v_i^2 \leq v_1^2$. Thus $v_1^2 \leq v_1^2 + \sum_{i=2}^n v_i^2 \leq n * v_1^2$ or $\sqrt{v_1^2} \leq \sqrt{v_1^2 + \sum_{i=2}^n v_i^2} \leq \sqrt{n * v_1^2}$ or $||v||_\infty \leq ||v||_2 \leq \sqrt{n}||v||_\infty$.

(b) Note that $(|a| + |b|)^2 = a^2 + b^2 + 2|ab| \geq a^2 + b^2$ by trivial induction we can conclude $\sum |v_i| \geq \sqrt{\sum v_i^2}$ or $||v||_1 \geq ||v||_2$.

(c) Note that $v_i \leq v_1$. Thus $\sum v_i \leq nv_1$ or $||v||_1 \leq n||v||_\infty$.

(a) There will never be equality for any non zero vector v living in $n > 1$ space. We can see this by simply considering the proposed equality, $||v||_\infty = ||v||_2 = \sqrt{n}||v||_\infty$, or in other words $||v||_\infty = \sqrt{n}||v||_\infty$ so $||v||_\infty = 0$, witch only occurs for $v = \vec{0}$.

(b) The vector $v = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ has the property that $||v||_1 = ||v||_2 = 1$.

(c) The vector $v = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ has the property that $||v||_1 = 2||v||_\infty = 2$.

Exercise : 4

```
>> A=[9 3 2 0 7;7 6 9 6 4;2 7 7 8 2;0 9 7 2 2;7 3 6 4 3];
>> b=[35, 58, 53, 37, 39]';
>> x=PPsolve(A,b)
x =

  -5.6251e-15
   1.0000e+00
```

```
   2.0000e+00
   3.0000e+00
   4.0000e+00

>> A*x
ans =

   35
   58
   53
   37
   39

>> diary off
```

```
function x=PPsolve(A,x)
[P,L,U]=myplu(A);
x=usolve(U,lsolve(L,P*x));
end
```

```
function [P,L,U]=myplu(A)
    n=length(A);
    p=[1:n];
    L=eye(n);
    U=A;
    for i=1:(n-1)
        [x,xi]=max(abs(U(i:n,i)));
        xi=xi+i-1;

        temp=p(i);
        p(i)=p(xi);
        p(xi)=temp;

        temp=U(i,i:n);
        U(i,i:n)=U(xi,i:n);
        U(xi,i:n)=temp;
        if i~=1
            temp=L(i,1:(i-1));
            L(i,1:(i-1))=L(xi,1:(i-1));
            L(xi,1:(i-1))=temp;
        end
        #we have now pivoted
        for j=(i+1):n
            k=U(j,i)/U(i,i);
            L(j,i)=k;
            U(j,i)=0;
            U(j,i+1:n)-=k*U(i,i+1:n);
        end
    end
    I=eye(n);
    P=I(p,:);
```

```
endfunction
```

```
function x=lsolve(L,y)
U=L(length(L):-1:1,length(L):-1:1);
y=y(length(y):-1:1);

x=usolve(U,y);

x=x(length(x):-1:1);
endfunction
```

```
function x=usolve(U,y)
    n=length(y);
    x=zeros(n,1);
    for(i=n:-1:1)
        #calc x
        x(i)=y(i)/U(i,i);
        #eliminate entries
        #note that we will not acctualy change the values of U only
        #remember that all terms furthur out than i are zero's
        y(1:(i-1))=y(1:(i-1))-x(i)*U(1:(i-1),i);
    end
endfunction
```

Exercise : 5

TBA???