Moed aleph exam 5770 − my answers to Matlab questions
Note there are many ways to do everything!

%%

Section A, Question 2
−−−−−−−−−−−−−−−−−−−−

M−file q2.m

```
==============================
function s=q1(v)

s=0;
for i=1:length(v)
  if floor(v(i)/2)==v(i)/2
    s=s+v(i);
  end
end

end
==============================
```

Example of use:

```
 q2([1 2 3 4 5 6 7 8])

ans =

    20
```

%%

Section A, Question 4
−−−−−−−−−−−−−−−−−−−−

M−file q4.m

```
==============================
function z=q4(x)

  z=1./(2+x.^2+sin(x).^4);

end
==============================
```

(note this works for a vector x so we can use quad on it)

Then type

```
fzero( @(x) q4(x)−quad(@q4,0,x), 1)

ans =

    0.7817
```

Or you might prefer to make another M−file qu44.m

```
==============================
function z=q44(x)

  z=q4(x)−quad(@q4,0,x)

end
==============================
```

```
(note this only works for scalar x, but that's fine)

and then do fzero(@q44,1)

See plot of f(x) and the integral on my webpage.

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Section A, Question 5
---------------------

M-file q55.m

==============================
function k=qu55(t)

X = fminsearch( @(x) q5(x,t), 0);
k = 1000*(q5(X+0.01,t)-2*q5(X,t)+q5(X-0.01,t));

end
==============================

where the M-file q5.m is

==============================
function z=q5(x,t)

z = sqrt(1+x.^2)+t*sin(x)./sqrt(1+x.^2);

end
==============================

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

Section B, Question 1
---------------------
a) M-file qb1a.m

============================
function z=qb1a()

N=20;   %size of matrix
b=5;    %diagonal cpts from -b to b
a=1;    %off diagonal from -a to a

A=a*(2*rand(N,N)-1);   % start with A all randoms from -a to a
for j=1:(N-1)          % make symmetric
   for k=(j+1):N
        A(j,k)=A(k,j);
   end
end
for j=1:N              % repace diagonal with randoms -b to b
   A(j,j)=(b/a)*A(j,j);
end
z=eig(A);              % find eigenvalues

end
============================

b) M-file qb1b.m

============================
s=0;                % the counter
for i=1:1000
   z=qb1a();        % make the eigenvalues
   m=max(abs(z));   % biggest absolute value
```

```
   if m>5
      s=s+1;
   end
end
s                    % print out s
============================

c) M-file qb1c.m

============================
s=zeros(200,1);      % counting how many in each range
for i=1:1000
   z=qb1a();         % make eigenvalues
   for j=1:length(z)
       box=floor(10*(z(j)+10.1));  % box number for eigenvalue j
       if box>0 & box<201          % careful! might have big eigenvalues!
          s(box)=s(box)+1;
       end
   end
end
plot(s)              % I did not really ask for this, but it says more than
                     % just printing out s. See example of output on webpage.
============================

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

Section B, Question 2
---------------------

a) M-file qb2a.m

============================
function z=qb2a(A)

a1 = dot(A(:,1),A(:,3))/dot(A(:,1),A(:,1)) + dot(A(:,2),A(:,3))/dot(A(:,2),A(:,2));
a2 = dot(A(:,2),A(:,1))/dot(A(:,2),A(:,2)) + dot(A(:,3),A(:,1))/dot(A(:,3),A(:,3));
a3 = dot(A(:,3),A(:,2))/dot(A(:,3),A(:,3)) + dot(A(:,1),A(:,2))/dot(A(:,1),A(:,1));

if all(a1<0,a2<0,a3<0)
   z=1;
else
   z=0;
end
============================

b) The trick here is to always move the point we want to check to the origin

M-file qb2b.m

============================
function z=qb2b(A)

A1 = [ A(:,2)-A(:,1) , A(:,3)-A(:,1) , A(:,4)-A(:,1) ]; % point 1 at origin
A2 = [ A(:,1)-A(:,2) , A(:,3)-A(:,2) , A(:,4)-A(:,2) ]; % point 2 at origin
A3 = [ A(:,1)-A(:,3) , A(:,2)-A(:,3) , A(:,4)-A(:,3) ]; % point 3 at origin
A4 = [ A(:,1)-A(:,4) , A(:,2)-A(:,4) , A(:,3)-A(:,4) ]; % point 4 at origin

if qb2a(A1)==1
   z=1;
elif qb2a(A2)==1
   z=2;
elif qb2a(A3)==1
   z=3;
elif qb2a(A4)==1
   z=4;
else
```

```
   z=0;
end

end
============================

c) M-file qb2c.m

============================
function z=qb2a(T,S)

z=0;
for i=1:size(S,2)
   A=[ T(:,1)-S(:,i) , T(:,2)-S(:,i) , T(:,3)-S(:,i) ];  % origin at (x_i,y_i)
   if qb2a(A)==1
      z=z+1;
   end
end

end
============================

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```