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# Dr. Leon VanDommelen (11/07/19) 1

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### IMPORTANT:

Do not change **anything** in this header (besides your name and exam date above as needed)!

Put your solution to the question completely at the end of this file.

## EXAM 2, Question 1

```
if ~exist('__code__', 'var') ; clear ; end
format compact
more off
```

## SOLUTION:

```
% size of the matrix
n=4
% form it
A=zeros(n);
for i=1:n
    for j=1:n
        A(i,j)=i*j;
    end
end
% display it and its transpose
A
AT=A'

% find the eigenvalues and vectors
[E Lambda]=eig(A)
% take the last two eigenvectors out of E
eVec3=E(:,3)
eVec4=E(:,4)
% take the first eigenvalue out of Lambda
lam4=Lambda(4,4)

% check that A eVec4 equals lam4 eVec4
Products=[A*eVec4 lam4*eVec4]

% check the lengths of eVec1 and eVec2
eVec3Length=norm(eVec3)
eVec4Length=norm(eVec4)
% alternatively
eVec3LengthAlt=sqrt(eVec3'*eVec3)
```

```

eVec4LengthAlt=sqrt(eVec4'*eVec4)

% check that eVec3 and eVec3 are orthogonal
cosAngle=dot(eVec3,eVec4)
% alternatively
cosAngleAlt=eVec3'*eVec4

n =
    4
A =
    1    2    3    4
    2    4    6    8
    3    6    9   12
    4    8   12   16
AT =
    1    2    3    4
    2    4    6    8
    3    6    9   12
    4    8   12   16
E =
   -0.2880    0.8944   -0.2894    0.1826
   -0.5760   -0.4472   -0.5787    0.3651
    0.7398         0   -0.3907    0.5477
   -0.1949         0    0.6547    0.7303
Lambda =
   -0.0000         0         0         0
         0         0         0         0
         0         0    0.0000         0
         0         0         0   30.0000
eVec3 =
   -0.2894
   -0.5787
   -0.3907
    0.6547
eVec4 =
    0.1826
    0.3651
    0.5477
    0.7303
lam4 =
    30
Products =
    5.4772    5.4772
   10.9545   10.9545
   16.4317   16.4317
   21.9089   21.9089
eVec3Length =
    1
eVec4Length =
    1.0000
eVec3LengthAlt =
    1.0000
eVec4LengthAlt =
    1.0000

```

```
cosAngle =  
  -5.5511e-17  
cosAngleAlt =  
  -5.5511e-17
```

*Published with MATLAB® R2015b*