comp math fundam

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Problem 1. Calculate the dot product u.v where u = [0.5; 0.5] and v = [3; −4].

octave:1> u = [0.5;0.5] u =

0.50000 0.50000

octave:2> v = [3;-4] v =

3 -4

octave:3> dot(u,v)

ans = -0.50000

Problem 2. What are the lengths of u and v?

% Length of U using norm()

octave:4> norm(u) ans = 0.70711

% Length of V using norm()

octave:5> norm(v) ans = 5

% Length of V without using norm()

octave:6> 3^2 + (-4)^2

ans = 25

octave:7> sqrt(25)

ans = 5

% Length of U without using norm()

octave:8> $.5^2$ + .5^2

ans = 0.50000

octave:9> sqrt(.5)

ans = 0.70711

Problem 3. What is the linear combination: 3u − 2v?

octave:15> (3u)-(2v)

ans =

-4.5000 9.5000

Problem 4. What is the angle between u and v?

octave:28> acos(dot(u,v)/(norm(u)*norm(v))) ans = 1.7127 radians

1.7127 radians x 180/pi ~ 98.13 degrees.

Problem 5. Set up a system of equations with 3 variables and 3 constraints and solve for x. Please write a function in Octave that will take two variables (matrix A & constraint vector b) and solve using elimination. Your function should produce the right answer for the system of equations for any 3-variable, 3-equation system. You don't have to worry about degenerate cases and can safely assume that the function will only be tested with a system of equations that has a solution. Please note that you do have to worry about zero pivots, though.

Please test it with the system below and it should produce a solution x = [−1.55, −0.33, 0.95]

% define function solveelim that takes in a matrix and a vector A and b.

octave:44> function [x] = solveelim(A,b)

% number of equations in the system to solve

num = length(b)

% eliminate using gaussian method

for col = 1:(num-1)

for row = (col+1):num

reduc = A(row,col)/A(col,col);

A(row,:) = A(row,:)-reduc*A(col,:)

b(row) = b(row)-reduc*b(col)

end

end

for row = num:-1:1

x(row) = b(row);

for iter = (row+1):num

x(row) = x(row)-A(row,iter)*x(iter);

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end
x(row) = x(row)/A(row,row);
end
x = x';
return
endfunction
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%%%Solution%%%

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octave:47> solveelim(A,b)
num =  3
A =

   1  1  3
   0 -3 -1
  -1 -2  4


b =

   1
   0
   6

A =

   1  1  3
   0 -3 -1
   0 -1  7
```

b =

  1
  0
  7

A =

  1.00000 1.00000 3.00000
  0.00000 -3.00000 -1.00000
  0.00000 0.00000 7.33333

b =

  1
  0
  7

ans =

 -1.54545
 -0.31818
  0.95455