```
w1 = [1, 2, -1, 3]';
w2 = [4, 1, 1, 8]';
w3 = [1, 0, 2, 2]';
w4 = [-1, 1, 2, -1]';

%write as a matrix
S1 = [w1,w2,w3,w4]

%show that S1 is not equal to R4
dimension_of_S1 = rank(S1)
% because the rank is 3, it is 3 dimension so it is not in R4


%Find which vector is a multiple of each other and take out of the set
[B,RB] = rref(S1)
idx = 1 : size(S1,2) % the number of columns
idx(RB) = [] % the number of independent columns/pivot columns
S1_dependent = B(:,idx) % indicate that this column vector will be
eliminated from subspace S1

new_S1 = [w1, w2,w3] %original column vectors with just L.I. column vectors


%the span of S1 is a hyperplane with a basis {w1,w2,w3}

%ambient_space = size(S1, 1);
if dimension_of_S1 == 3 %ambient space - 1 determines if it is hyperplane
    disp('S1 is a hyperplane');
elseif dimension_of_S1 == 4
    disp('S1 is a plane');
end



% Q2.2

z2 = [1,0,2,2]'
z3 = [3,4,0,8]'

Z2_S1 = [new_S1, z2]
Z2_S1reduced = rref(Z2_S1)

Z3_S1 = [new_S1, z3]
Z3_S1reduced = rref(Z3_S1)


%z2 and z3 are multiples of vectors in S1 and therefore belong in
%S1 bc they are linearly dependent

%Q2.3
a = 6 ;
z1 = [2, 4, -2, a]';
```

```
S2 = [z1,z2,z3]
rref(S2);
dimension_of_S2 = rank(S2) % dimension is 2 bc rank = 2


%Q2.4
a = 5

q4_z1 = [2,4,-2,a]';
q4_S2 = [-q4_z1,-z2,-z3];

M1 = new_S1;
M2 = q4_S2;

M = [M1 M2]

% Dimension of subspace S1 ∩ S2 is equal to the rank of the null space basis
nullspace_basis = null(M)
rank(nullspace_basis)
dim_of_vectors = rref(nullspace_basis)
dimension_intersection = rank(nullspace_basis)


S1 =

     1     4     1    -1
     2     1     0     1
    -1     1     2     2
     3     8     2    -1


dimension_of_S1 =

     3


B =

     1     0     0     1
     0     1     0    -1
     0     0     1     2
     0     0     0     0


RB =

     1     2     3


idx =

     1     2     3     4
```

```
idx =

     4


S1_dependent =

     1
    -1
     2
     0


new_S1 =

     1     4     1
     2     1     0
    -1     1     2
     3     8     2

S1 is a hyperplane

z2 =

     1
     0
     2
     2


z3 =

     3
     4
     0
     8


Z2_S1 =

     1     4     1     1
     2     1     0     0
    -1     1     2     2
     3     8     2     2


Z2_S1reduced =

     1     0     0     0
     0     1     0     0
     0     0     1     1
     0     0     0     0
```

```
Z3_S1 =

     1     4     1     3
     2     1     0     4
    -1     1     2     0
     3     8     2     8


Z3_S1reduced =

     1     0     0     2
     0     1     0     0
     0     0     1     1
     0     0     0     0


S2 =

     2     1     3
     4     0     4
    -2     2     0
     6     2     8


dimension_of_S2 =

     2


a =

     5


M =

     1     4     1    -2    -1    -3
     2     1     0    -4     0    -4
    -1     1     2     2    -2     0
     3     8     2    -5    -2    -8


nullspace_basis =

   -0.1111    0.8455
   -0.0000    0.0000
    0.6733    0.3035
    0.0000   -0.0000
    0.7289   -0.1193
   -0.0555    0.4228


ans =
```

```
     2


dim_of_vectors =

     1     0
     0     1
     0     0
     0     0
     0     0
     0     0


dimension_intersection =

     2
```

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