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>> % MATLAB Recitation Demo for Tuesday, September 23.
>> % File: rdemo3
>> %
>> % *** Computing the nullspace of A via nullbasis(A).
>> % *** Display formats: format short and format rat.
>> %
>> %
>> % *** From the Athena Dash menu, start MATLAB using
>> % ***    Courseware / 18 Mathematics / 18.06 / 18.06 MATLAB
>> % *** Otherwise, MATLAB will not be able to find the new
>> % *** command "nullbasis" - which is demonstrated below.
>> %
>> % Remarks: By default, MATLAB results are displayed in a
>> %   scaled fixed point format with 5 digits.
>> %   We can display results as fractions by using the command
>> %   format rat.
>> %   'help format' gives additional details and formats.
>> %
>> %   The MATLAB command nullbasis(A) computes a matrix whose columns
>> %   are "special" solutions to Ax = 0.
>> %   These solutions express the zero vector as 1 * free column +
>> %   some linear combination of the previous pivot columns.
>> %
>> diary rdemo3
>>
>> % Let's compute the nullspace of the following 3 by 5 matrix A.
>> % For comparison, we also compute its reduced row echelon form.
>> % Can you see how the nonzero entries in the free columns are
>> % related to the entries in the "special" solutions?!
>>
>> A = [-1  3  8  -2   1;
        -1  3  9  -1   3;
         1 -3 -9   1  -3]

A =

    -1     3     8    -2     1
    -1     3     9    -1     3
     1    -3    -9     1    -3

>> Z = nullbasis(A)

Z =
```

```
     3   -10   -15
     1     0     0
     0    -1    -2
     0     1     0
     0     0     1

>> R = ref(A)

R =

     1    -3     0    10    15
     0     0     1     1     2
     0     0     0     0     0
>> %
>> %%%%%%%%%%%%%%%%%%%%%%%%
>> %%% Another Example %%%
>> %%%%%%%%%%%%%%%%%%%%%%%%
>> %
>> A = [24   8   -3   3   0   13;
        24   8   -3   4   4   16]

A =

    24     8    -3     3     0    13
    24     8    -3     4     4    16

>> Z = nullbasis(A)

Z =

   -0.3333    0.1250    0.5000   -0.1667
    1.0000         0         0         0
         0    1.0000         0         0
         0         0   -4.0000   -3.0000
         0         0    1.0000         0
         0         0         0    1.0000
>> %
>> %%% Use format rat to display entries as fractions.
>> %
>> format rat
>> Z

Z =

    -1/3          1/8          1/2         -1/6
```

```
      1            0            0            0
      0            1            0            0
      0            0           -4           -3
      0            0            1            0
      0            0            0            1

>> %
>> %%% With practice, you should be able to inspect the reduced
>> %%% row echelon form and determine the "special" solutions.
>> %
>> R = ref(A)

R =

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

>> diary off
```