Throughout this handout we consider the linear system $A\vec{x} = \vec{b}$ where

```
>> A = [ 1 2 1; -1 6 -2; 0 2 8];
>> b = [ 1; 0; 4];
>> M = [A b]; % form the augmented matrix
```

We can use MATLAB to perform row operations on matrices.

```
>> M(2,:) = M(1,:) + M(2,:)    % add R_1 and R_2 and put in R_1
>> M(3,:) = M(2,:) - 4*M(3)    % add R_2 and -4 times R_3 and put in R_3
>> M(3,:) = (1/4)*M(3,:)       % scales R_3 by 1/4
>> M([2 3],:) = M([3 2],:)     % exchanges R_2 and R_3
```

Column operations have a similar syntax, just change where the colon appears.

```
>> B = magic(3)
>> B(:,2) = B(:,2) + 4*B(:,1)  % add C_1 and 4 times C_2 and put in C_2
```

There is no command for "the" row-echelon form of a matrix in MATLAB since a matrix can be row equivalent to many matrices in row echelon form. There is, however, a command to find the row-reduced echelon form with `rref`.

```
>> M = [A b]  % reset M above
>> rref(M)    % returns the row reduced echelon form of M
```

As we've discussed in lecture we can interpret `rref(M)` to determine the solution set of the linear system $A\vec{x} = \vec{b}$. There is another method for solving linear systems of any size in MATLAB using the backslash operator `\`.

```
>> A\b             % "left division" by A
```

The backslash operator is the preferred method in professional settings for its speed and accuracy. Use whatever method suits your needs. Be careful, in the following example the system does not have a solution. Observe the different outputs we get when we try both methods.

```
>> C = [1 2 3; 0 0 1; 0 0 1];
>> d = [1; 2; 3];
>> C\d
>> rref([C d])
```

Find a system that has infinite solutions and apply both methods. What are the outputs for each method?