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## 3. Solving inhomogeneous systems

### Determinants and inverses (External resource)

(1.0 points possible)

# Determinants and inverses

The formula for finding the determinant of a square matrix becomes very complicated for  $n \times n$  matrices when  $n > 3$ , and finding an expression for its inverse is even harder. Thankfully there are very simple commands in MATLAB that can do both of these operations for us.

- We can calculate the determinant  $\det(\mathbf{A})$  of any square matrix  $\mathbf{A}$  using the following command:

```
d = det(A)
```

- Recall that if  $\det(\mathbf{A}) \neq 0$  then we can calculate the inverse  $\mathbf{B} = \mathbf{A}^{-1}$ . The MATLAB command for this is:

```
B = inv(A)
```

- Given a linear system  $\mathbf{Ax} = \mathbf{b}$ , where  $\det(\mathbf{A}) \neq 0$ , we can find the solution  $\mathbf{x} = \mathbf{A}^{-1}\mathbf{b}$  using either of the following commands:

```
x = inv(A)*b
%This is doing two things. Firstly it calculates the inverse of A, and then per
%
x = A\b
%This is the recommended way to solve a linear system. It is faster than the pre
%
```

In this problem we will consider solving a large system of equations written in matrix form  $\mathbf{Ax} = \mathbf{b}$ . Specifically, generate a random  $10 \times 10$  matrix  $\mathbf{A}$  and a random  $10 \times 1$  column vector  $\mathbf{b}$ . Use MATLAB to check that  $\mathbf{A}$  is non-singular and then solve the linear system.

## Your Script

 Save  Reset  MATLAB Documentation (<https://www.mathworks.com/help/>)

```
1 % Firstly we will generate a random 10x10 matrix A and a random RHS column vector
2 % You should use the command X=rand(M,N), where M is the number of rows and M is 1
3 %
4 A = rand(10,10);
5 b = rand(10,1)
6 %
7 % Now calculate the determinant of A and assign its value to a variable d
8 %
9 d = det(A)
```

```
9  u = uel(A)
10 %
11 % Now solve the linear system using the function inv() or \ to find the solution
12 %
13 x=A\b
14 %
15 % You can check for yourself that this does indeed solve the system by calculating
```

[▶ Run Script](#)[? \(\)](#)**Assessment: Correct**[Submit](#)[? \(\)](#)

✓ Are A and b defined correctly?

✓ Is the solution vector correct?

✓ d is correct

## Output

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