

**Spring 2022****Your Name:** Cole  
firstBardin  
last**Section: 62**

As a convenience, this **answer template** is provided if you wish to easily submit your work. Be sure to save it as a PDF before submitting online!

**Note: You must also submit a copy of your MATLAB Live Script to receive full grades.**

**Lab 4: Parameterized System of Equations: Zero, One Infinity Theorem**

Consider the following parameterized system of linear equations with two unknowns:

**Line 1:**  $m \cdot x - y = 2 \cdot (1 - m)$

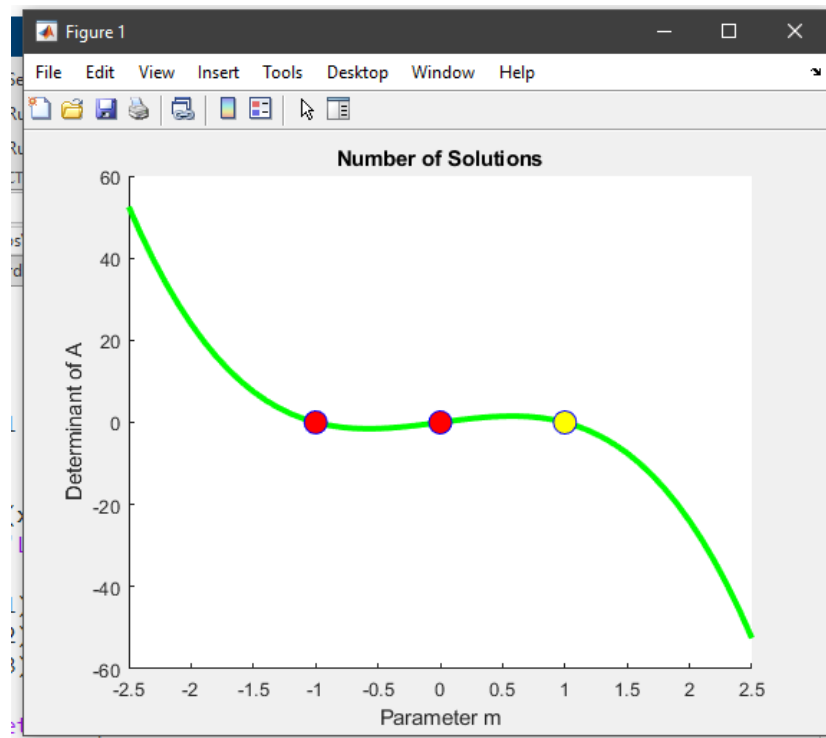
**Line 2:**  $(3m - m^3) \cdot x + (1 - 3m^2)y = 2(1 - m) \cdot (m^2 + 4m + 1)$

**Answer 1:** The determinant of  $A(m)$  is:  **$-4m^3 + 4m$**

**Answer 2:** The determinant of  $A(m)$  is zero for these values of  $m$ .

**$-1, 0$  and  $1$**

**Question 3:** Replace the sample plot with your completed plot for credit.



Grader will award one point for **4a** or **4b** at random.

**Answer 4a:** In the case where  $m = -1$ , the fully reduced augmented matrix is:

$$RAM = \left[ \begin{array}{cc|c} 1 & 1 & 0 \\ 0 & 0 & 1 \end{array} \right]$$

Is the system consistent?      **NO**

**Answer 4b:** In the case where  $m = +1$ , the fully reduced augmented matrix is:

$$RAM = \left[ \begin{array}{cc|c} 1 & -1 & 0 \\ 0 & 0 & 0 \end{array} \right]$$

How many solutions are there?      **Infinite**

**Answer 5:** In the case where  $m = 0$ , the fully reduced augmented matrix is:

$$RAM = \left[ \begin{array}{cc|c} 0 & 1 & 0 \\ 0 & 0 & 1 \end{array} \right]$$

Is the system consistent?      **NO**

Grader will award one point for **6a** or **6b** at random.

**Answer 6a:** After simplification the augmented matrix is:

$$RAM = \left[ \begin{array}{cc|c} -2 - \sqrt{3} & -1 & 6 + 2\sqrt{3} \\ 20 + 12\sqrt{3} & -20 - 12\sqrt{3} & 0 \end{array} \right]$$

Give the missing components in exact form using  $\sqrt{3}$  and integers. Do **not** use decimal approximations.

**A few components are given for free!**

**Answer 6b:** Now row reduce. The reduced augmented matrix is:

$$RAM = \left[ \begin{array}{cc|c} 1 & 0 & -2 \\ 0 & 1 & -2 \end{array} \right]$$

**Hint:** All entrees are integers now.

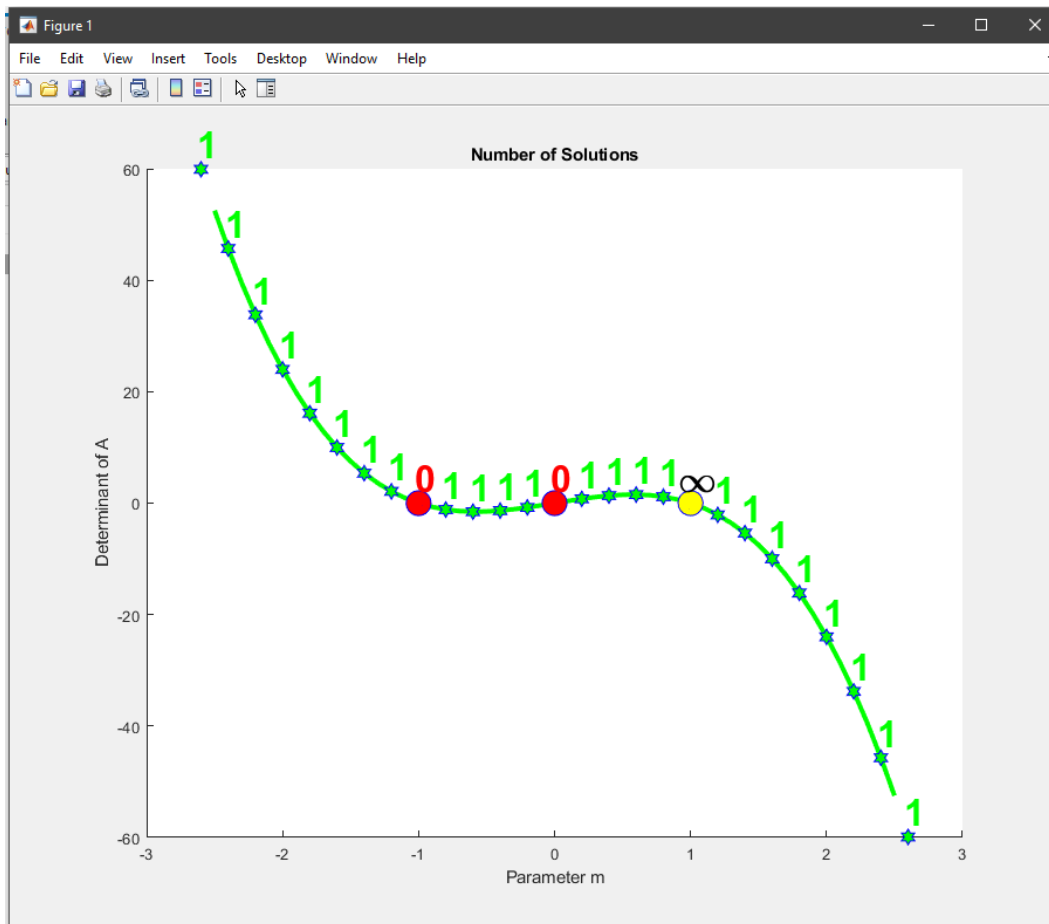
**Answer 7:** In the case where  $m \neq 0, \pm 1$ , but is otherwise symbolic, the fully reduced augmented matrix is:

$$RAM(m) = \left[ \begin{array}{cc|c} 1 & 0 & (-m^2 + 2m + 1)/(m^2 + m) \\ 0 & 1 & (m^2 + 2m - 1)/(m + 1) \end{array} \right]$$

The unique solution is:  $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} (-m^2 + 2m + 1)/(m^2 + m) \\ (m^2 + 2m - 1)/(m + 1) \end{bmatrix}$

A few components are given for free!

**Question 8:** Root Counting: Replace the sample graph with your completed plot.  
Your image must not have the angry kitten.



**Answer 9:** The angle (in degrees) the blue line makes with the horizontal axis is:

- a. 155                      b. 160                      **c. 165**                      d. 170

**Answer 10:** The unique solution (in terms of  $m$ ) using Cramer's rule is:

$$x_1 = \frac{(-m^2 + 2m + 1)}{(m(m + 1))}$$

$$x_2 = \frac{(m^2 + 2m - 1)}{(m + 1)}$$

Be sure to apply simplify first!

**Ready to Submit?**

Be sure all ten questions are answered. When your lab is complete, be sure to submit three files:

1. Your **completed Answer Template** as a PDF file
2. A copy of your **MATLAB Live Script**
3. A **PDF** copy of your **MATLAB Live Script** (Save-Export to PDF...)

The due date is the day after your lab section by **11:59pm** to receive full credit. You have one more day, to submit the lab (but with a small penalty), and then the window closes for good and your grade will be zero.