

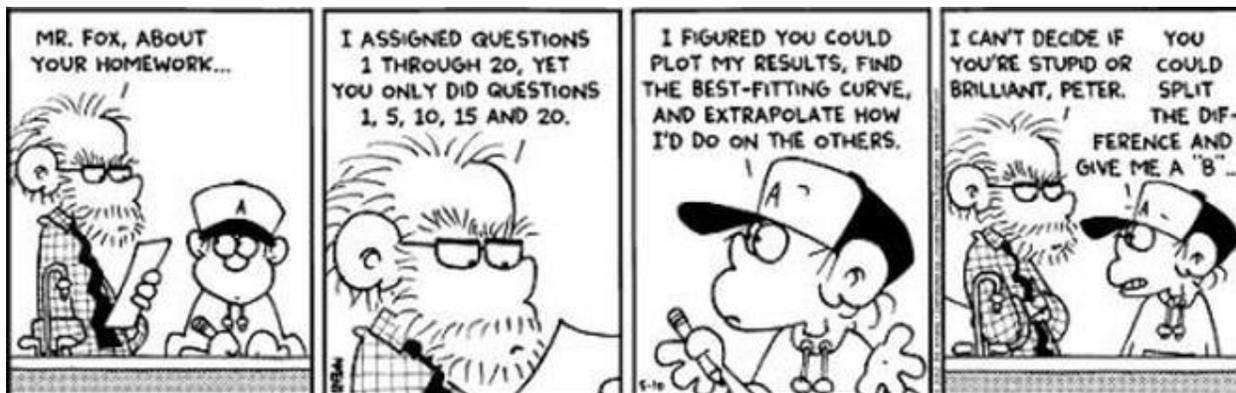
Midterm Exam #2 – DO NOT OPEN UNTIL INSTRUCTED

NAME: _____

By writing my name, I certify that I have abided by all academic honesty policies.

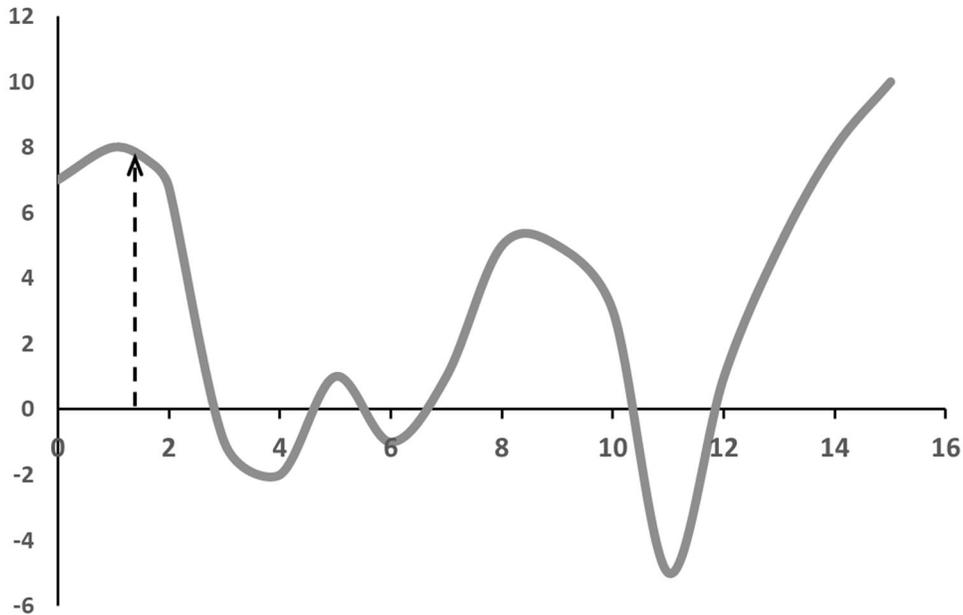
- This portion of the exam is closed book, closed course notes. No additional resources may be consulted to complete this portion of the exam.
- This portion of the exam is worth **20 points** (point value written by each problem).
- Write your answers to be graded in the space provided.
- You must turn in this portion of the exam before you will receive the free response portion, which is worth an additional **60 points**.

Enjoy this comic while you wait:



Source: Foxtrot

1. For the given function shown below complete the following tasks:
 - a. **(2 pts)** Using the initial guess point (denoted by the black arrow) draw the path of a Newton Raphson method of root finding. Place a star on the root to which it will converge.
 - b. **(2 pts)** If you used the bisection method on interval $x = 6$ to 14 , what root would be found? Place a square on the root to which it will converge.



2. **(2 pts)** Match the following features and names for open vs. bracket methods for root finding. Write an 'O' next to the ones that correspond with open and 'B' to the ones that correspond to bracketed.

Feature	O or B?
Need to supply one initial guess.	
Need to supply two values for initial guess.	
Has the potential to diverge.	
Bisection is one example.	
Modified secant method is one example.	

3. **(2 pts)** Consider three reactors that are perturbed by independent stimuli. You perform a mass balance on species B, determine a system of linear equations, find a coefficient matrix A and take the inverse which is shown below. How much would the level of species B drop in reactor 2 if the stimulus in reactor 3 is dropped by 5 units?

$$A^{-1} = \begin{matrix} 2.3 & 5.1 & 1.7 \\ 3.9 & 1.4 & 9.2 \\ 5.2 & 2.8 & 3.1 \end{matrix}$$

4. **(4 pts)** Write the Jacobian for the following set of two equations:

$$x = x^2y + 12x$$

$$12 = y^2x^2 - yx + 5x$$

5. **(3 pts)** In Unit 2 we introduced the following three useful functions built into Matlab. For each explain (briefly) what it is used for and what differentiates it from the other two.

- **fzero**

- **fminsearch**

- **fmincon**

6. **(1 pt)** Define residual

7. **(2 pts)** What does it mean to have a singular system of equations? What would the determinant be for such a system?

8. **(2 pts)** What is the meaning of the coefficient of determination?