University of Toronto Scarborough
MATA35: Calculus II for Biological Sciences
Assignment 4
Due at the beginning of tutorial on June 21

Instructions for hand-in assignments:

1. Print this cover page, fill it out entirely, sign at the bottom, and STAPLE it to the front of your assignment answer sheets. **Doing this correctly is worth 1 mark.**
2. Submit your assignments ONLY in the tutorial in which you are enrolled.
3. Please double-check your tutorial code on blackboard, and your TA's name on the course syllabus. If there is a discrepancy between Blackboard and ROSI/ACORN, then your correct tutorial is the one on Blackboard, not on ROSI/ACORN.

Last name: .....

First name: .....

Student number: .....

Tutorial code: .....

TA name: .....

IMPORTANT NOTES ON COLLABORATION

Solving a mathematical assignment has two parts:

1.The discovery phase. This is the time you spent trying to figure out how to solve the problems, and it often takes most of the time. You are welcome and encouraged to collaborate with other students in this phase. Collaboration is a healthy practice, and this is how mathematics is done in real life.

2. The write-up phase. This consists of writing your solutions once you have an idea of how the problem can be solved. You should do this entirely by yourself. Be alone when you write your solutions. If you collaborate on this part, or you copy part of your solutions from somebody else, or you have notes written by somebody else in front of you when you write your solutions, or you use a draft or sketch that you wrote in collaboration with somebody else, you are engaging in academic misconduct.

The University of Toronto takes academic integrity very seriously. We are obligated to report all suspected instances of misconduct to OSAI. Please do not force us to do so. Please SIGN below to verify that you have read and understood the instructions on collaboration.

Signature: _____ Date: _____

1.[5 pts] Find all critical points of $f(x, y) = x^2 + y^2 + 2x + y - 1$, and determine whether they are local min/max or saddle points.

Given that Leslie matrix of a population equals to

$$\mathbf{A} = \begin{bmatrix} 2 & 3 \\ 2 & 1 \end{bmatrix}, \text{ the population today is } \mathbf{v_0} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$$

2.[3 pts] Compute $\mathbf{Av_0}$, $\mathbf{A^2v_0}$, $\mathbf{A^3v_0}$.

3.[2 pts] Use the formula to compute $\mathbf{A^{10}v_0}$.