> *#OK to post Homework*
  #Shreya Ghosh, 12-6-2021, Assignment 26

> **read** "/Users/shreyaghosh/Documents/DMB.txt"

(1)

> *#14ii)*

> $TimeSeries\left(\left[2 \cdot x \cdot (1-x) \cdot (2-x) \cdot (3-x)\right], [x], [0.1], 0.01, 10, 1\right)$
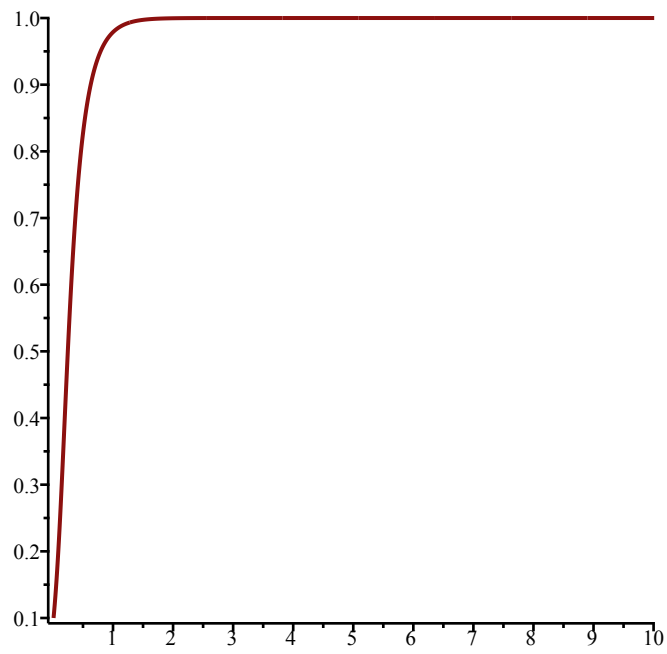
> *TimeSeries* $([2 \cdot x \cdot (1-x) \cdot (2-x) \cdot (3-x)], [x], [1.1], 0.01, 10, 1)$
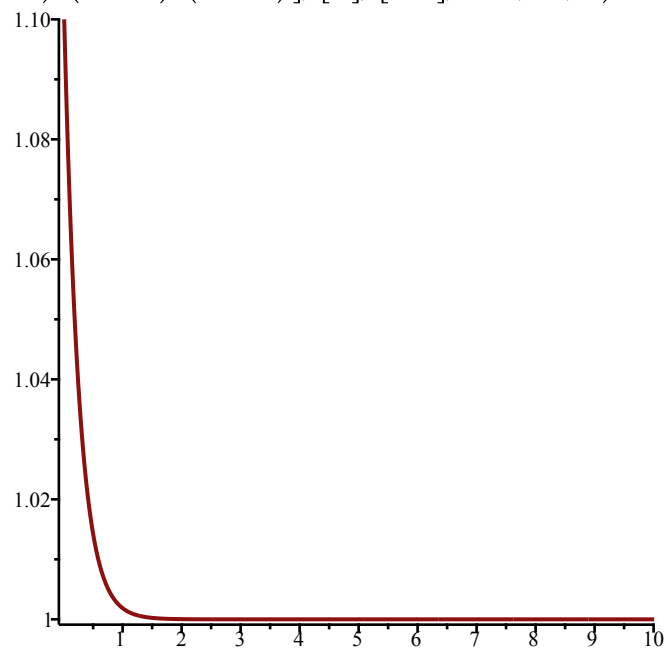
> *TimeSeries* $([2 \cdot x \cdot (1-x) \cdot (2-x) \cdot (3-x)], [x], [2.1], 0.01, 10, 1)$

> $TimeSeries\left(\left[2 \cdot x \cdot (1-x) \cdot (2-x) \cdot (3-x)\right], [x], [3.1], 0.01, 10, 1\right)$
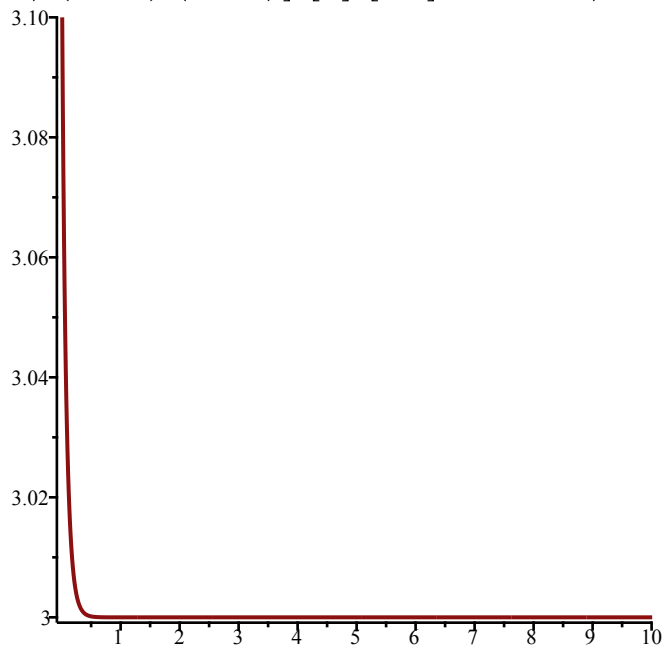
> #There seems to be stability at x=1 and x=3

>

> #15)

> $Orb\left(\left[x^3 + 2 \cdot y, x^2 + 5 \cdot y\right], [x, y], [1, 3], 0, 3\right)$
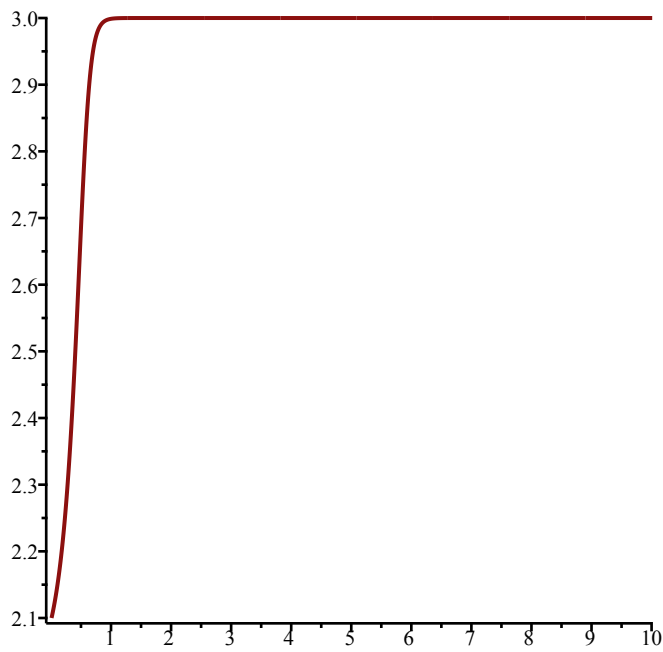
$$[[1, 3], [7, 16], [375, 129], [52734633, 141270]]$$ **(2)**

>

> #16)

> $F := \left[\dfrac{2+x+y}{2+2 \cdot x + 2 \cdot y}, \dfrac{2+x+y}{1+2 \cdot x + 2 \cdot y}\right]$

(3)

$$F := \left[\frac{2+x+y}{2+2x+2y}, \frac{2+x+y}{1+2x+2y}\right]$$ **(3)**

> $SFP(F, [x, y])$

$$\{[0.6953496364, 0.8641637014]\}$$ **(4)**

> $Orb(F, [x, y], [0.5, 0.4], 1000, 1000)[1]$

$$[0.6953496364, 0.8641637013]$$ **(5)**

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> #17)

> $TimeSeries([[(1 - 2 \cdot x - 3 \cdot y) \cdot (2 - 2 \cdot x - 3 \cdot y), (3 - x - 2 \cdot y) \cdot (1 - x - 2 \cdot y)], [x, y], [-5, 4], 0.01, 10, 1)$

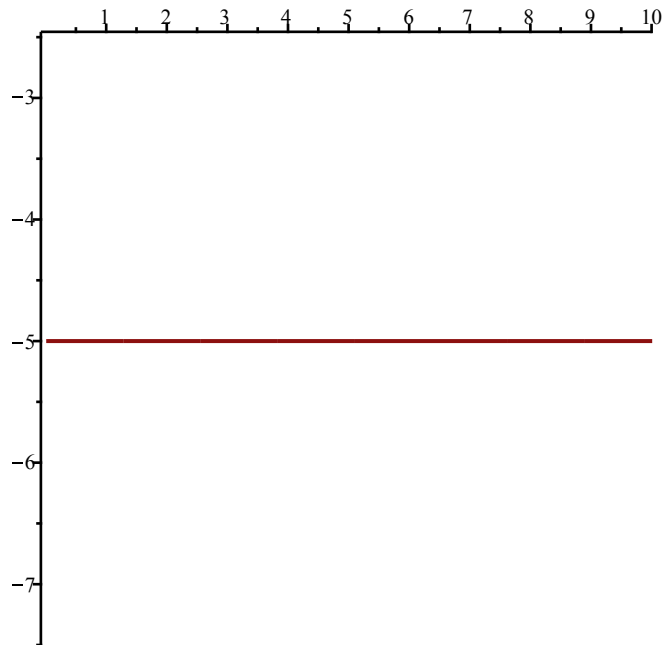> $TimeSeries([[(1 - 2 \cdot x - 3 \cdot y) \cdot (2 - 2 \cdot x - 3 \cdot y), (3 - x - 2 \cdot y) \cdot (1 - x - 2 \cdot y)], [x, y], [-5, 4], 0.01, 10, 2)$
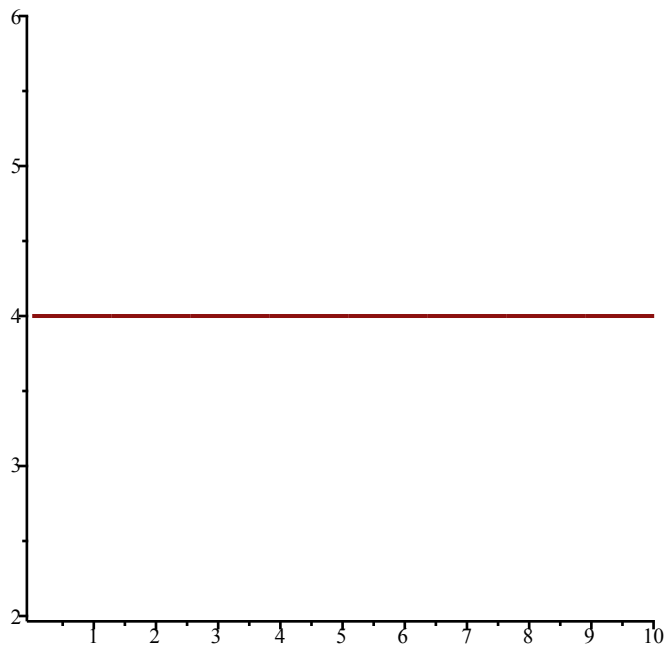
> *TimeSeries* $([[(1 - 2 \cdot x - 3 \cdot y) \cdot (2 - 2 \cdot x - 3 \cdot y), (3 - x - 2 \cdot y) \cdot (1 - x - 2 \cdot y)], [x, y], [$
$-4.9, 4.1], 0.01, 10, 1)$
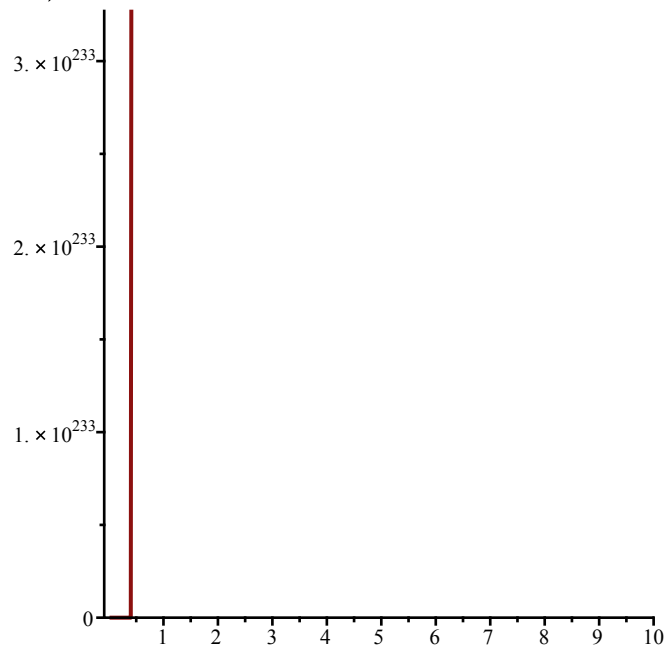
> *#[-5,4] is unstable*

> *TimeSeries* $([[(1 - 2 \cdot x - 3 \cdot y) \cdot (2 - 2 \cdot x - 3 \cdot y), (3 - x - 2 \cdot y) \cdot (1 - x - 2 \cdot y)], [x, y], [1,$
$0], 0.01, 10, 1)$
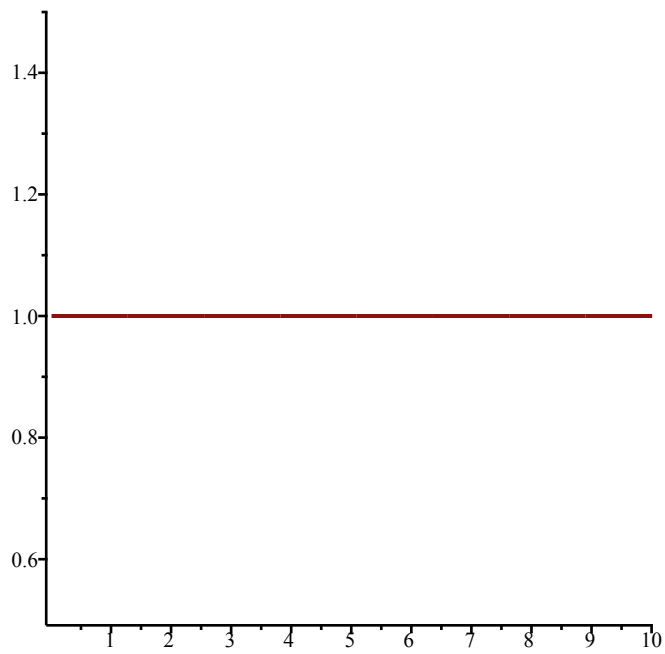
> $TimeSeries\left(\left[\,(1-2\cdot x-3\cdot y)\cdot(2-2\cdot x-3\cdot y),\,(3-x-2\cdot y)\cdot(1-x-2\cdot y)\,\right],\,[x,y],\,[1, 0],\,0.01,\,10,\,2\right)$
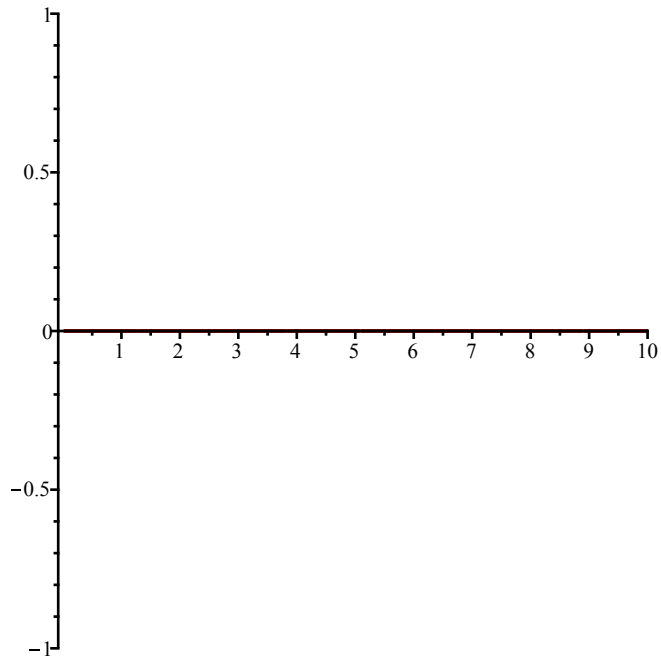
> $TimeSeries\left(\left[\,(1-2\cdot x-3\cdot y)\cdot(2-2\cdot x-3\cdot y),\,(3-x-2\cdot y)\cdot(1-x-2\cdot y)\,\right],\,[x,y], [1.1,0.1],\,0.01,\,10,\,1\right)$
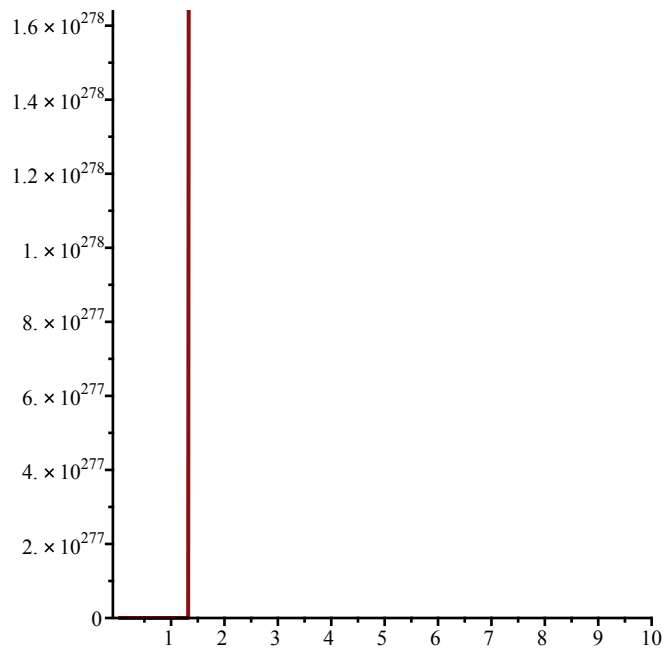
> #[1,0] is unstable

14. i) $x'(t) = 2x(t)(1-x(t))(2-x(t))(3-x(t))$

$f(x) = 2x(1-x)(2-x)(3-x)$

$0 = 2x(1-x)(2-x)(3-x)$

$x = 0, \; x = 1, \; x = 2, \; x = 3$

ii) In Maple

iii) $f(x) = (2x - 2x^2)(2-x)(3-x)$

$= (4x - 2x^2 - 4x^2 + 2x^3)(3-x)$

$= 12x - 4x^2 - 18x^2 + 6x^3 + 6x^3 - 2x^4$

$f(x) = 12x - 22x^2 + 12x^3 - 2x^4$

$f'(x) = 12 - 44x + 36x^2 - 8x^3$

$f'(0) = 12 \Rightarrow$ unstable $\quad (12 > 0)$

$f'(1) = -4 \Rightarrow$ stable $\quad (-4 < 0)$

$f'(2) = 4 \Rightarrow$ unstable $\quad (4 > 0)$

$f'(3) = -12 \Rightarrow$ stable $\quad (-12 < 0)$

15. $x(n) = x(n-1)^3 + 2y(n-1), \quad y(n) = x(n-1)^2 + 5y(n-1)^2, \quad x(0) = 1, \quad y(0) = 3$

$x(1) = x(0)^3 + 2y(0) = 1^3 + 2(3) = 7 \quad y(1) = x(0)^2 + 5y(0) = 1^2 + 5(3) = 16$

$x(2) = x(1)^3 + 2y(1) = 7^3 + 2(16) = 375 \quad y(2) = x(1)^2 + 5y(1) = 7^2 + 5(16) = 129$

$x(3) = x(2)^3 + 2y(2) = 375^3 + 2(129) = 52734633 \quad y(3) = x(2)^2 + 5y(2) = 141270$

$[[1,3], [7,16], [375, 129], [52734633, 141270]]$

16. In Maple

17. In Maple