

HW 26 - Alan Ho

OK to post

P14) i)  $x'(t) = 2x(t)(1-x(t))(2-x(t))(3-x(t))$

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

$x = 0, 1, 2, 3$  ( $\Leftarrow$  equilibrium solutions)

ii) TimeSeries [ $2x(1-x)(2-x)(3-x)$ ], [x], [0, 0.01, 1, 10, 1]

$\Rightarrow$  horizontal asymptote  $y=1 \therefore x=0$  is stable

Time Series [ " " ], [x], [1.1, 10, 1]

[ " " ], [x], [0.9, 10, 1]

$\Rightarrow$  horizontal asymptote  $y=1 \therefore x=1$  is stable

Time Series [ " " ], [x], [2.1, 10, 1]

[ " " ], [x], [4.9, 10, 1]

$\Rightarrow$  asymptote not  $y=2 \therefore x=2$  is not stable

Time Series [ " " ], [x], [2.9, 10, 1]

[ " " ], [x], [3.1, 10, 1]

$\Rightarrow$  asymptote  $y=3 \therefore x=3$  is stable

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

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

$f'(0) = 12 > 0 \therefore$  not stable,  $f'(1) = -4 < 0 \therefore$  stable

$f'(2) = 4 > 0 \therefore$  not stable,  $f'(3) = -12 < 0 \therefore$  stable

P15)  $(x(n-1)^2 + 2y(n-1), x(n-1)^2 + 5y(n-1)^2)$ ;  $x(0) = 1, y(0) = 3$

$x(1) = (1)^2 + 6, 1 + 45 = (7, 46)$

$x(2) = (7^2 + 2(46), 49 + 5(46)^2) = (435, 10629)$

$x(3) = (435^2 + 2(10629), 435^2 + 5(10629)^2) = (82334133, 565067430)$

$x(0) = [1, 3], x(1) = [7, 46], x(2) = [435, 10629]$

$x(3) = [82334133, 565067430]$

$\uparrow$  Orb ( $[x^2 + 2y, x^2 + 5y^2]$ , [x, y], [1, 3], 0, 3)

