

P1, $z^3 + 3z^2 - 11z + 2 = 0$ $z = 2$ $z = 3$

$z^3 + 3z^2 - 11z + 2 = 0$ $z = 2$ is a solution
 $8 + 12 - 22 + 2 = 0$

~~$z^3 + 3z^2 - 11z + 2 = 0$~~ ~~$z = 3$ is a solution~~
 $27 + 27 - 33 + 2 \neq 0$ $z = 3$ is not a solution

P2, $\sin(z) = 0$

~~$\sin(\pi) = 0$~~ $\sin(\pi) = 0$
 $\sin(\frac{\pi}{2}) \neq 0$

P3, $\sin(\frac{\pi}{3})^2 + \cos(\frac{\pi}{3})^2 = 1$ ✓

$\sin(\frac{\pi}{5})^2 + \cos(\frac{\pi}{5})^2 = 1$ ✓

P4, $\sin^2(z) + \cos^2(z) = 1$

$z =$ all real numbers

P5, $x(t) = t^4$

$x'(t) = 4t^3$

$x'(2) = 32$

$x''(t) = 12t^2$

$x''(2) = 48$

P6, $f(x) = x^2 + 2x$ semistable

~~$f(x) = x^2 + 2x$~~

$1 = 1$, stable fixed

$2 = 2$, stable fixed

$3 = 3$, fixed

$-1 = -1$, not fixed

P7,
 $x = x + y + 1$
 $0 \neq 2$

$y = x - y - 2$
 $1 \neq -3$

P8, $x(0) = 0.5$

$x(1) = 1/(1.5) = \frac{2}{3}$

$x(2) = 1/(\frac{2}{3} + 1) = 1/(\frac{5}{3}) = \frac{2}{5}$

ii Orb $([1/(x-1)], [x], [0.5], 0, z)$;

iii Orb $([1/(x-1)], [x], [0.5], 1000, 1000) [1]$
 $= 0.618034887$

P9,

i. $(1.0, 1.0, 1.0), P(1.0, 1.0, 1.0) = (\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$

$P(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}) = (\frac{2}{5}, \frac{2}{5}, \frac{2}{5})$

ii. Orb $([x/(1+y+z)], [y/(1+x+z)], [z/(1+x+y)], [x, y, z], [1.0, 1.0, 1.0], 0, z)$;

iii. Orb $([x/(1+y+z)], [y/(1+x+z)], [z/(1+x+y)], [x, y, z], [1.0, 1.0, 1.0], 1000, 1000) [1]$;
 $= (\frac{1}{2001}, \frac{1}{2001}, \frac{1}{2001})$

P11, $x(n) = x(n-1)^2 - 2x(n-1) + 2$
 $x = x^2 - 2x + 2$
 $0 = x^2 - 3x + 2$
 $0 = (x-2)(x-1)$
 $x = 1, 2 = x(n)$

P12, $x = \frac{5}{2}x(1-x)$
 $x = \frac{5}{2}x - \frac{5}{2}x^2$
 $0 = \frac{3}{2}x - \frac{5}{2}x^2$
 $0 = 3x - 5x^2$
 $0 = x(3-5x)$
 $x = 0, \frac{3}{5}$

P13, $x = kx(1-x)$
 $x = kx - kx^2$
 $0 = (k-1)x - kx^2$
 $0 = kx - x - kx^2$
 $0 = x(k-1-kx)$
 $x = 0, \frac{1-k}{-k}$

P11', $f(x) = x^2 - 2x + 2$
 $f'(x) = 2x - 2$
 $f(0) = -2$, ~~stable~~ unstable

P12', $f(x) = \frac{5}{2}x(1-x) = \frac{5}{2}x - \frac{5}{2}x^2$
 $f'(x) = \frac{5}{2} - 5x$
~~stable~~ $f(0) = \frac{5}{2}$, unstable


```
> read "/Users/jjj104/Documents/DMB.txt";  
      First Written: Nov. 2021
```

This is DMB.txt, A Maple package to explore Dynamical models in Biology (both discrete and continuous)

accompanying the class Dynamical Models in Biology, Rutgers University. Taught by Dr. Z. (Doron Zeilbeger)

*The most current version is available on WWW at:
<http://sites.math.rutgers.edu/~zeilberg/tokhniot/DMB.txt> .
Please report all bugs to: DoronZeil at gmail dot com .*

*For general help, and a list of the MAIN functions,
type "Help():". For specific help type "Help(procedure_name);"*

*For a list of the supporting functions type: Help1();
For help with any of them type: Help(ProcedureName);*

*For a list of the functions that give examples of Discrete-time dynamical systems (some famous),
type: HelpDDM();*

For help with any of them type: Help(ProcedureName);

*For a list of the functions continuous-time dynamical systems (some famous) type: HelpCDM();
For help with any of them type: Help(ProcedureName);*

(1)

```
> Orb([ x2 - 2·x + 2 ], [x], [0.99], 1000, 1010);  
[[1.000000000], [1.000000000], [1.000000000], [1.000000000], [1.000000000],  
 [1.000000000], [1.000000000], [1.000000000], [1.000000000], [1.000000000],  
 [1.000000000]]
```

(2)

```
> Orb([ x2 - 2·x + 2 ], [x], [1.99], 1000, 1010);  
[[1.000000000], [1.000000000], [1.000000000], [1.000000000], [1.000000000],
```

(3)

[[1.000000000], [1.000000000], [1.000000000], [1.000000000], [1.000000000],
[1.000000000]]

[> $Orb\left(\left[\frac{5}{2} \cdot x - \frac{5}{2} \cdot x^2\right], [x], [0.59], 1000, 1010\right);$
[[0.5999999995], [0.6000000005], [0.5999999995], [0.6000000005], [0.5999999995],
[0.6000000005], [0.5999999995], [0.6000000005], [0.5999999995], [0.6000000005],
[0.5999999995]] (4)

[> $Orb\left(\left[\frac{5}{2} \cdot x - \frac{5}{2} \cdot x^2\right], [x], [0.1], 1000, 1010\right)$
[[0.5999999995], [0.6000000005], [0.5999999995], [0.6000000005], [0.5999999995],
[0.6000000005], [0.5999999995], [0.6000000005], [0.5999999995], [0.6000000005],
[0.5999999995]] (5)