

hw 8

SMTWTFSS
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1. Using the following code:

```
read 'M.B.B.txt';
f := taRF(x, 3);
r := SSS(f, 2);
evalf(r);
```

Orb(f, x, x0, 7000, 2010);

and comparing the outputs of the final lines.

$$① \quad f = \frac{7x^3 + 10x^2 + 5x + 8}{3x^3 + 8x^2 + 4047}$$

$$r = 1.3075$$

$$\text{Orb for } -100.1 = 1.3075$$

$$-10.1 = 1.3075$$

$$10.1 = 1.3075$$

$$100.1 = 1.3075$$

Convergence verified

$$② \quad f = \frac{9x^3 + 6x^2 + 8x + 9}{7x^3 + 7x^2 + 6x + 1}$$

$$r = 1.36 \quad \text{Orb for } -100.1 = 1.36$$

$$-10.1 = 1.36$$

$$10.1 = 1.36$$

$$\text{Convergence verified } 100.1 = 1.36$$

$$③ \quad f = \frac{3x^3 + 5x^2 + 3x + 3}{x^3 + 3x^2 + 10x + 8}$$

$$r = 0.419 \quad \text{Orb for } -100.1 = 0.419$$

$$-10.1 = 0.419$$

$$10.1 = 0.419$$

$$\text{Convergence verified } 100.1 = 0.419$$

$$④ \quad f = \frac{5x^3 + 5x^2 + 3x + 1}{2x^3 + 10x^2 + 10x + 10}$$

$$r = 0.129 \quad \text{Orb for } -100.1 = 0.129$$

$$-10.1 = 0.129$$

$$10.1 = 0.129$$

$$\text{Convergence verified } 100.1 = 0.129$$

$$⑤ \quad f = \frac{9x^3 + 2x^2 + 4x + 8}{4x^3 + 7x^2 + 9x + 5}$$

$$r = 0.913 \quad \text{Orb for } -100.1 = 0.913$$

$$-10.1 = 0.913$$

$$10.1 = 0.913$$

$$\text{Convergence verified } 100.1 = 0.913$$

$$⑥ \quad f = \frac{10x^3 + 6x^2 + 10x + 3}{8x^3 + 7x^2 + 9x + 4}$$

$$r = 1.165 \quad \text{Orb for } -100.1 = 1.165$$

$$-10.1 = 1.165$$

$$10.1 = 1.165$$

$$\text{Convergence verified } 100.1 = 1.165$$

$$⑦ \quad f = \frac{2x^3 + 10x^2 + 7x + 9}{x^3 + 8x^2 + 7x + 4}$$

$$r = 1.095 \quad \text{Orb for } -100.1 = 1.095$$

$$-10.1 = 1.095$$

$$10.1 = 1.095$$

$$\text{Convergence verified } 100.1 = 1.095$$

$$\textcircled{8} \quad f = \frac{7x^3 + 7x^2 + 7x + 8}{7x^3 + 5x^2 + 3x + 5}$$

$$r = 0.967 \quad \text{orb at } \begin{array}{l} -100.1 = 0.967 \\ -10.1 = 0.967 \\ 10.1 = 0.967 \\ 100.1 = 0.967 \end{array}$$

Convergence verified

$$\textcircled{9} \quad f = \frac{8x^3 + 6x^2 + 12x + 5}{8x^3 + 6x^2 + 7x + 10}$$

$$r = 0.839 \quad \text{orb at } \begin{array}{l} -100.1 = 0.839 \\ -10.1 = 0.839 \\ 10.1 = 0.839 \\ 100.1 = 0.839 \end{array}$$

Convergence verified

$$\textcircled{10} \quad f = \frac{9x^3 + 7x^2 + 8x + 4}{7x^3 + 3x^2 + 10x + 4}$$

$$r = 2.81 \quad \text{orb at } \begin{array}{l} -100.1 = 2.81 \\ -10.1 = 2.81 \\ 10.1 = 2.81 \\ 100.1 = 2.81 \end{array}$$

Convergence verified

2. Code.

```
read 'DUB6.txt'
K:=1 (for example)
S:=(K)*x*(1-x)
orb(f,x,0.5,2000,2030)
```

For $K=1$, the orbit sequence seems to converge to around 0.00049.

For $K=2$ it has converged to 0.5

$K=2.5$ it has converged to 0.6

$K=3.1$ seems to alternate between y, z where $y \approx 0.558, z \approx 0.765$

$K=3.2$ again alternating, but different numbers to 3.1.

$K=3.3$ Once again alternating

$K=3.5$ It seems to cycle between the same 4 values.

3. seems to be $K=361$ with $SSS = \{3, 5\}$

I struggled to rigorously show this.

$\text{orb}(f, x, 2.9, 2000, 2010)$ shows convergence to 3

$\text{orb}(f, x, 5.9, 2000, 2010)$
displays convergence to 3.

Seems to be $K=2571$ with $SSS = \{1, 3, 5, 7\}$

$\text{orb}(f, x, 0.9, 2000, 2010)$

$\text{orb}(f, x, 7.9, 2000, 2010)$

$\text{orb}(f, x, 4.9, 2000, 2010)$

$\text{orb}(f, x, 7.1, 2000, 2010)$

These each display convergence.