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> #OK to post
> #Anusha Nagar, Homework 13, 10.16.2021
>
> read "C://Users/an646/Downloads/M13.txt"
> Help13( )
      RT2(x,y,d,K), Orb2(F,x,y,pt0,K1,K2), FP2(F,x,y), SFP2(F,x,y) (1)
> SFP2( [ [ (z^2 + 8·z + 5) / z^2, (7·z^2 + 8·z + 5) / (5·z^2 + 3) ], z, y ] #Problem2
      [[3.604383935, 1.836079746]] (2)
> #Here, we see there is a stable fixed point!
> Orb2( [ [ (z^2 + 8·z + 5) / z^2, (7·z^2 + 8·z + 5) / (5·z^2 + 3) ], z, y, [8 + 0.5, 0.5], 1000, 1020 ]
      [[3.604383934, 1.836079745], [3.604383935, 1.836079746], [3.604383936, 1.836079745],
      [3.604383934, 1.836079745], [3.604383935, 1.836079746], [3.604383936, 1.836079745],
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      [3.604383934, 1.836079745], [3.604383935, 1.836079746], [3.604383936, 1.836079745],
      [3.604383934, 1.836079745], [3.604383935, 1.836079746]] (3)
>
> #Problem 3
> F1 := RT2(x, y, 1, 100)
      F1 := [ (35 + 29y + 34x) / (66 + 44y + 60x), (83 + 32y + 85x) / (100 + 68y + 59x) ] (4)
> F2 := RT2(x, y, 1, 100)
      F2 := [ (40 + 76y + 92x) / (39 + 17y + 50x), (78 + 20y + 18x) / (18 + 51y + 34x) ] (5)
> F3 := RT2(x, y, 1, 100)
      F3 := [ (78 + 10y + 52x) / (100 + 13y + 87x), (13 + 37y + 92x) / (97 + 69y + 62x) ] (6)
> F4 := RT2(x, y, 1, 100)
      F4 := [ (92 + 71y + 67x) / (78 + 51y + 53x), (12 + 19y + 63x) / (40 + 90y + 3x) ] (7)
> F5 := RT2(x, y, 1, 100)
      F5 := [ (49 + 49y + 67x) / (74 + 90y + 74x), (27 + 98y + 72x) / (2 + 73y + 85x) ] (8)
> F6 := RT2(x, y, 1, 100)
      F6 := [ (41 + 4y + 44x) / (13 + 19y + 10x), (15 + 64y + 9x) / (12 + 52y + 25x) ] (9)

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$$\begin{aligned} &> F7 := RT2(x, y, 1, 100) \\ & \quad F7 := \left[\frac{72 + 90y + 18x}{43 + 55y + 40x}, \frac{17 + 70y + 52x}{81 + 87y + 34x} \right] \end{aligned} \quad (10)$$

$$\begin{aligned} &> F8 := RT2(x, y, 1, 100) \\ & \quad F8 := \left[\frac{85 + 9y + 68x}{83 + 63y + 100x}, \frac{70 + 36y + 36x}{10 + 40y + 66x} \right] \end{aligned} \quad (11)$$

$$\begin{aligned} &> F9 := RT2(x, y, 1, 100) \\ & \quad F9 := \left[\frac{87 + 16y + 98x}{43 + 53y + 61x}, \frac{47 + 28y + 75x}{3 + 5y + 11x} \right] \end{aligned} \quad (12)$$

$$\begin{aligned} &> F10 := RT2(x, y, 1, 100) \\ & \quad F10 := \left[\frac{37 + 75y + 4x}{91 + 22y + 40x}, \frac{58 + 93y + 98x}{11 + 30y + 6x} \right] \end{aligned} \quad (13)$$

$$\begin{aligned} &> F11 := RT2(x, y, 1, 100) \\ & \quad F11 := \left[\frac{32 + 40y + 24x}{80 + 96y + 11x}, \frac{23 + 41y + 52x}{58 + 67y + 81x} \right] \end{aligned} \quad (14)$$

$$\begin{aligned} &> F12 := RT2(x, y, 1, 100) \\ & \quad F12 := \left[\frac{65 + 69y + 2x}{36 + 61y + 84x}, \frac{96 + 94y + 31x}{81 + 31y + 54x} \right] \end{aligned} \quad (15)$$

$$\begin{aligned} &> F13 := RT2(x, y, 1, 100) \\ & \quad F13 := \left[\frac{72 + 95y + 100x}{55 + 81y + 38x}, \frac{88 + 20y + 16x}{17 + 68y + 79x} \right] \end{aligned} \quad (16)$$

$$\begin{aligned} &> F14 := RT2(x, y, 1, 100) \\ & \quad F14 := \left[\frac{48 + 67y + 98x}{86 + 92y + 74x}, \frac{33 + 55y + 17x}{82 + 25y + 94x} \right] \end{aligned} \quad (17)$$

$$\begin{aligned} &> F15 := RT2(x, y, 1, 100) \\ & \quad F15 := \left[\frac{3 + 73y + 88x}{37 + 60y + 94x}, \frac{52 + 16y + 29x}{51 + 3y + 45x} \right] \end{aligned} \quad (18)$$

$$\begin{aligned} &> F16 := RT2(x, y, 1, 100) \\ & \quad F16 := \left[\frac{24 + 60y + 74x}{17 + 14y + 12x}, \frac{87 + 79y + 64x}{7 + 69y + 90x} \right] \end{aligned} \quad (19)$$

$$\begin{aligned} &> F17 := RT2(x, y, 1, 100) \\ & \quad F17 := \left[\frac{64 + 43y + 57x}{52 + 62y + 46x}, \frac{76 + 9y + 53x}{37 + 88y + 50x} \right] \end{aligned} \quad (20)$$

$$\begin{aligned} &> F18 := RT2(x, y, 1, 100) \\ & \quad F18 := \left[\frac{83 + 3y + 48x}{16 + 84y + 63x}, \frac{41 + 53y + 30x}{44 + 55y + 85x} \right] \end{aligned} \quad (21)$$

$$\begin{aligned} &> F19 := RT2(x, y, 1, 100) \\ & \quad F19 := \left[\frac{33 + 38y + 42x}{89 + 65y + 46x}, \frac{67 + 37y + 90x}{44 + 99y + 21x} \right] \end{aligned} \quad (22)$$

$$\begin{aligned} &> F20 := RT2(x, y, 1, 100) \end{aligned} \quad (23)$$

$$F20 := \left[\frac{21 + 5y + 58x}{3 + 86y + 55x}, \frac{97 + 4y + 92x}{46 + 88y + 34x} \right] \quad (23)$$

> *SFP2*(*F1*, *x*, *y*)
 [[0.5738382141, 0.8318160241]] (24)

> *Orb2*(*F1*, *x*, *y*, [0.9, 1.5], 1000, 1020)
 [[0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247], [0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247], [0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247], [0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247], [0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247], [0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247], [0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247], [0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247], [0.5738382137, 0.8318160242], [0.5738382136, 0.8318160247]] (25)

> *SFP2*(*F2*, *x*, *y*)
 [[1.922169930, 0.9893531309]] (26)

> *Orb2*(*F2*, *x*, *y*, [0.9, 1.5], 1000, 1020)
 [[1.922169931, 0.9893531312], [1.922169930, 0.9893531312], [1.922169931, 0.9893531312], [1.922169930, 0.9893531312], [1.922169931, 0.9893531312], [1.922169930, 0.9893531312], [1.922169931, 0.9893531312], [1.922169930, 0.9893531312], [1.922169931, 0.9893531312], [1.922169930, 0.9893531312], [1.922169931, 0.9893531312], [1.922169930, 0.9893531312], [1.922169931, 0.9893531312], [1.922169930, 0.9893531312], [1.922169931, 0.9893531312], [1.922169930, 0.9893531312], [1.922169931, 0.9893531312], [1.922169930, 0.9893531312]] (27)

> *SFP2*(*F3*, *x*, *y*)
 [[0.7127296415, 0.5521890015]] (28)

> *Orb2*(*F3*, *x*, *y*, [0.9, 1.5], 1000, 1020)
 [[0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016], [0.7127296417, 0.5521890016]] (29)

> *SFP2*(*F4*, *x*, *y*)
 [[1.259593358, 0.8791974895]] (30)

> *Orb2*(*F4*, *x*, *y*, [0.9, 1.5], 1000, 1020)
 [[1.259593358, 0.8791974894], [1.259593358, 0.8791974894], [1.259593358, 0.8791974894]] (31)

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> $SFP2(F5, x, y)$ (32)
[[0.6528216031, 1.321846941]]

> $Orb2(F5, x, y, [0.9, 1.5], 1000, 1020)$ (33)
[[0.6528216034, 1.321846940], [0.6528216034, 1.321846940], [0.6528216034,
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> $SFP2(F6, x, y)$ (34)
[[3.169979666, 0.6897016763]]

> $Orb2(F6, x, y, [0.9, 1.5], 1000, 1020)$ (35)
[[3.169979666, 0.6897016765], [3.169979666, 0.6897016765], [3.169979666,
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> $SFP2(F7, x, y)$ (36)
[[1.208133500, 0.7042432306]]

> $Orb2(F7, x, y, [0.9, 1.5], 1000, 1020)$ (37)
[[1.208133500, 0.7042432303], [1.208133499, 0.7042432307], [1.208133501,
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> $SFP2(F8, x, y)$
[[0.6049974286, 1.350612004]] (38)

> $Orb2(F8, x, y, [0.9, 1.5], 1000, 1020)$
[[0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004], [0.6049974288, 1.350612003], [0.6049974288, 1.350612004]] (39)

> $SFP2(F9, x, y)$
[[0.586850559, 6.506538819]] (40)

> $Orb2(F9, x, y, [0.9, 1.5], 1000, 1020)$
[[0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820], [0.5868505549, 6.506538820]] (41)

> $SFP2(F10, x, y)$
[[1.459248295, 4.082633122]] (42)

> $Orb2(F10, x, y, [0.9, 1.5], 1000, 1020)$
[[1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120], [1.459248294, 4.082633122], [1.459248294, 4.082633120]] (43)

> $SFP2(F11, x, y)$
[[0.47477235, 0.5258468959]] (44)

> $Orb2(F11, x, y, [0.9, 1.5], 1000, 1020)$
[[0.4747723604, 0.5258468959], [0.4747723604, 0.5258468959], [0.4747723604, 0.5258468959]] (45)

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> $SFP2(F12, x, y)$ (46)
[[0.8556835833, 1.523365570]]

> $Orb2(F12, x, y, [0.9, 1.5], 1000, 1020)$ (47)
[[0.8556835829, 1.523365570], [0.8556835824, 1.523365569], [0.8556835833,
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> $SFP2(F13, x, y)$ (48)
[[1.780780757, 0.6423275397]]

> $Orb2(F13, x, y, [0.9, 1.5], 1000, 1020)$ (49)
[[1.780780757, 0.6423275398], [1.780780757, 0.6423275398], [1.780780757,
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> $SFP2(F14, x, y)$ (50)
[[0.8513003524, 0.4052158791]]

> $Orb2(F14, x, y, [0.9, 1.5], 1000, 1020)$ (51)
[[0.8513003518, 0.4052158791], [0.8513003523, 0.4052158792], [0.8513003518,
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> $SFP2(F15, x, y)$ **(52)**
[[0.853140670, 1.004404651]]

> $Orb2(F15, x, y, [0.9, 1.5], 1000, 1020)$ **(53)**
[[0.8531406699, 1.004404651], [0.8531406704, 1.004404651], [0.8531406699,
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> $SFP2(F16, x, y)$ **(54)**
[[4.997130943, 0.9217676234]]

> $Orb2(F16, x, y, [0.9, 1.5], 1000, 1020)$ **(55)**
[[4.997130943, 0.9217676234], [4.997130943, 0.9217676234], [4.997130943,
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[4.997130943, 0.9217676234], [4.997130943, 0.9217676234], [4.997130943,
0.9217676234], [4.997130943, 0.9217676234], [4.997130943, 0.9217676234],
[4.997130943, 0.9217676234], [4.997130943, 0.9217676234], [4.997130943,
0.9217676234], [4.997130943, 0.9217676234], [4.997130943, 0.9217676234]]

> $SFP2(F17, x, y)$ **(56)**
[[1.048512675, 0.8483878075]]

> $Orb2(F17, x, y, [0.9, 1.5], 1000, 1020)$ **(57)**
[[1.048512675, 0.8483878077], [1.048512675, 0.8483878071], [1.048512676,
0.8483878071], [1.048512675, 0.8483878077], [1.048512675, 0.8483878071],
[1.048512676, 0.8483878071], [1.048512675, 0.8483878077], [1.048512675,
0.8483878071], [1.048512676, 0.8483878071], [1.048512675, 0.8483878077],
[1.048512675, 0.8483878071], [1.048512676, 0.8483878071], [1.048512675,
0.8483878077], [1.048512675, 0.8483878071], [1.048512676, 0.8483878071],
[1.048512675, 0.8483878077], [1.048512675, 0.8483878071], [1.048512676,
0.8483878071], [1.048512675, 0.8483878077], [1.048512675, 0.8483878071]]

> $SFP2(F18, x, y)$ **(58)**
[[1.001883613, 0.6385393185]]

> $Orb2(F18, x, y, [0.9, 1.5], 1000, 1020)$ **(59)**
[[1.001883613, 0.6385393188], [1.001883614, 0.6385393196], [1.001883613,

```

0.6385393194], [1.001883614, 0.6385393192], [1.001883613, 0.6385393188],
[1.001883614, 0.6385393196], [1.001883613, 0.6385393194], [1.001883614,
0.6385393192], [1.001883613, 0.6385393188], [1.001883614, 0.6385393196],
[1.001883613, 0.6385393194], [1.001883614, 0.6385393192], [1.001883613,
0.6385393188], [1.001883614, 0.6385393196], [1.001883613, 0.6385393194],
[1.001883614, 0.6385393192], [1.001883613, 0.6385393188], [1.001883614,
0.6385393196], [1.001883613, 0.6385393194], [1.001883614, 0.6385393192]]

```

```

> SFP2(F19, x, y)
                                [[0.5216525243, 0.9859905528]]
                                                                (60)

```

```

> Orb2(F19, x, y, [0.9, 1.5], 1000, 1020)
[[0.5216525246, 0.9859905527], [0.5216525246, 0.9859905527], [0.5216525246,
0.9859905527], [0.5216525246, 0.9859905527], [0.5216525246, 0.9859905527],
[0.5216525246, 0.9859905527], [0.5216525246, 0.9859905527], [0.5216525246,
0.9859905527], [0.5216525246, 0.9859905527], [0.5216525246, 0.9859905527],
[0.5216525246, 0.9859905527], [0.5216525246, 0.9859905527], [0.5216525246,
0.9859905527], [0.5216525246, 0.9859905527], [0.5216525246, 0.9859905527],
[0.5216525246, 0.9859905527], [0.5216525246, 0.9859905527], [0.5216525246,
0.9859905527], [0.5216525246, 0.9859905527], [0.5216525246, 0.9859905527]]
                                                                (61)

```

```

> SFP2(F20, x, y)
                                [[0.4717553510, 0.975686992]]
                                                                (62)

```

```

> Orb2(F20, x, y, [0.9, 1.5], 1000, 1020)
[[0.4717553511, 0.9756869935], [0.4717553507, 0.9756869935], [0.4717553510,
0.9756869935], [0.4717553511, 0.9756869935], [0.4717553507, 0.9756869935],
[0.4717553510, 0.9756869935], [0.4717553511, 0.9756869935], [0.4717553507,
0.9756869935], [0.4717553510, 0.9756869935], [0.4717553511, 0.9756869935],
[0.4717553507, 0.9756869935], [0.4717553510, 0.9756869935], [0.4717553511,
0.9756869935], [0.4717553507, 0.9756869935], [0.4717553510, 0.9756869935],
[0.4717553511, 0.9756869935], [0.4717553507, 0.9756869935], [0.4717553510,
0.9756869935], [0.4717553511, 0.9756869935], [0.4717553507, 0.9756869935]]
                                                                (63)

```

```

> #The two methods (SFP2 and Orb2 with random initial conditions give the same answers

```

```

> #Problem 4

```

```

> #i

```

```

> RT3 := proc(x, y, z, d, K) local ra, i, j, k, f, g, h :
ra := rand(1 ..K) : #random integer from -K to K
f := add(add(add(ra( ) * x^i * y^j * z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d) / add(add(add(ra( )
* x^i * y^j * z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d) :
g := add(add(add(ra( ) * x^i * y^j * z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d) / add(add(add(ra( )
* x^i * y^j * z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d) :
h := add(add(add(ra( ) * x^i * y^j * z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d) / add(add(add(ra( )

```



```

    *x^i*y^j*z^k, k=0..d-j), j=0..d-i), i=0..d) :
[f, g, h] :
end:

```

```

> #ii
> Orb3 := proc(F, x, y, z, pt0, K1, K2) local pt, L, i :
pt := pt0 :

```

```

for i from 1 to K1 do
pt := subs( {x=pt[1], y=pt[2], z=pt[3]}, F) :
od:

```

```

L := [ ] :
for i from K1 + 1 to K2 do
pt := subs( {x=pt[1], y=pt[2], z=pt[3]}, F) :
L := [op(L), pt] :
od:
L :
end:

```

```

>
> #iii is same as ii (above)

```

```

> #iv
> FP3 := proc(F, x, y, z) local L, i :
L := [solve( {F[1]=x, F[2]=y, F[3]=z}, {x, y, z} )] :

```

```

[seq(subs(L[i], [x, y, z]), i=1..nops(L))] :
end:

```

```

> #V
> SFP3 := proc(F, x, y, z) local L, J, S, J0, i, pt, EV :

```

```

L := evalf(FP3(F, x, y, z)) :
#F is the list of ALL fixed points of the transformation [x,y]->F using the previous procedure
FP2(F,x,y), but since we are interested in numbers we take the floating point version using
evalf

```

```

J := Matrix(normal([ [diff(F[1], x), diff(F[2], x), diff(F[3], x)], [diff(F[1], y), diff(F[2],
y), diff(F[3], y)], [diff(F[1], z), diff(F[2], z), diff(F[3], z) ]])) :
#J is the Jacobian matrix in general (in terms of the variables x and y). Note that J is a
SYMBOLIC matrix featuring variables x and y

```

```

S := [ ] : #S is the list of stable fixed points that starts out empty

```

```

for i from 1 to nops(L) do #we examine it case by case
pt := L[i] : #pt is the current fixed point to be examined

```

```

J0 := subs( {x=pt[1], y=pt[2], z=pt[3]}, J) :
#J0 is the NUMERICAL matrix obtained by plugging-in the examined fixed pt

```

$EV := \text{Eigenvalues}(J0) :$

We used Maple's command Eigenvalues to find the eigenvalues of this 2 by 2 matrix

if $\text{abs}(EV[1]) < 1$ **and** $\text{abs}(EV[2]) < 1$ **and** $\text{abs}(EV[3]) < 1$ **then**

$S := [\text{op}(S), pt] :$

#If both eigenvalues have absolute value less than 1 it means that they are stable, so we append the examined fixed point, pt, to the list of fixed points

fi:

od:

$S : \text{\#the output is } S$

end:

> *#Problem 5*

> $F21 := RT3(x, y, z, 1, 100)$

$$F21 := \left[\frac{2xz + 50x + 73y + z + 65}{15xz + 33x + 4y + 60z + 35}, \frac{62xz + 25x + 36y + 45z + 22}{14xz + 8x + 63y + 79z + 20}, \frac{88xz + 20x + 60y + 100z + 69}{16xz + 29x + 25y + 43z + 12} \right] \quad (64)$$

> $F22 := RT3(x, y, z, 1, 100)$

$$F22 := \left[\frac{12xz + 76x + 34y + 35z + 53}{25xz + 61x + 68y + 83z + 83}, \frac{37xz + 81x + 86y + 7z + 54}{75xz + 76x + 34y + 94z + 4}, \frac{48xz + 21x + 28y + 34z + 42}{81xz + 62x + 77y + 20z + 2} \right] \quad (65)$$

> $F23 := RT3(x, y, z, 1, 100)$

$$F23 := \left[\frac{6xz + 30x + 75y + 43z + 3}{12xz + 46x + 94y + 16z + 28}, \frac{67xz + 72x + 39y + 69z + 66}{96xz + 3x + 18y + 42z + 14}, \frac{27xz + 36x + 29y + 6z + 76}{47xz + 67x + 77y + 20z + 96} \right] \quad (66)$$

> $F24 := RT3(x, y, z, 1, 100)$

$$F24 := \left[\frac{55xz + 40x + 52y + 84z + 93}{18xz + 52x + 30y + 16z + 95}, \frac{80xz + 84x + 84y + 84z + 53}{51xz + 41x + 56y + 88z + 33}, \frac{84xz + 14x + 95y + 29z + 13}{4xz + 82x + 57y + 92z + 65} \right] \quad (67)$$

> $F25 := RT3(x, y, z, 1, 100)$

$$F25 := \left[\frac{64xz + 31x + 83y + 52z + 85}{50xz + 35x + 57y + 68z + 57}, \frac{54xz + 41x + 23y + 26z + 50}{2xz + 95x + 6y + 35z + 87}, \frac{79xz + 46x + 84y + 32z + 35}{86xz + 15x + 10y + 33z + 16} \right] \quad (68)$$

> $F26 := RT3(x, y, z, 1, 100)$

$$F26 := \left[\frac{9xz + 34x + 92y + 81z + 42}{68xz + 62x + 75y + 25z + 49}, \frac{48xz + 70x + 8y + 98z + 76}{xz + 97x + 74y + 37z + 45}, \frac{85xz + 14x + 94y + 39z + 7}{54xz + 65x + 8y + 100z + 28} \right] \quad (69)$$

$$\begin{aligned} &> F27 := RT3(x, y, z, 1, 100) \\ F27 &:= \left[\frac{91xz + 66x + 45y + 18z + 72}{14xz + 75x + 77y + 19z + 99}, \frac{77xz + 16x + 34y + 15z + 50}{8xz + 55x + 98y + 13z + 10}, \right. \\ &\quad \left. \frac{19xz + 22x + 53y + z + 98}{82xz + 93x + 66y + 50z + 81} \right] \end{aligned} \tag{70}$$

$$\begin{aligned} &> F28 := RT3(x, y, z, 1, 100) \\ F28 &:= \left[\frac{73xz + 31x + 97y + 17z + 85}{19xz + 72x + 80y + 72z + 21}, \frac{59xz + 54x + 67y + 91z + 92}{73xz + 97x + 65y + 45z + 66}, \right. \\ &\quad \left. \frac{80xz + 63x + 44y + 42z + 28}{2xz + 66x + 97y + 22z + 51} \right] \end{aligned} \tag{71}$$

$$\begin{aligned} &> F29 := RT3(x, y, z, 1, 100) \\ F29 &:= \left[\frac{42xz + 97x + 8y + 21z + 19}{13xz + 77x + 94y + 3z + 100}, \frac{90xz + 99x + 60y + 94z + 98}{61xz + 39x + 51y + 42z + 12}, \right. \\ &\quad \left. \frac{82xz + 89x + 46y + 42z + 69}{81xz + 14x + 31y + 33z + 52} \right] \end{aligned} \tag{72}$$

$$\begin{aligned} &> F30 := RT3(x, y, z, 1, 100) \\ F30 &:= \left[\frac{57xz + 6x + 37y + 18z + 39}{93xz + 47x + 15y + 82z + 81}, \frac{13xz + 78x + 48y + 49z + 97}{3xz + 42x + 3y + 75z + 39}, \right. \\ &\quad \left. \frac{80xz + 75x + 79y + 81z + 53}{87xz + 27x + 86y + 33z + 4} \right] \end{aligned} \tag{73}$$

$$\begin{aligned} &> F31 := RT3(x, y, z, 1, 100) \\ F31 &:= \left[\frac{6xz + 18x + 71y + 50z + 76}{32xz + 12x + 20y + 35z + 80}, \frac{58xz + 13x + 4y + 4z + 56}{10xz + 16x + 15y + 88z + 78}, \right. \\ &\quad \left. \frac{39xz + 2x + 38y + 45z + 51}{27xz + 61x + 66y + 8z + 2} \right] \end{aligned} \tag{74}$$

$$\begin{aligned} &> SFP3(F21, x, y, z) \\ &\quad \quad \quad [[0.6703060493, 0.94829042, 2.84440519]] \end{aligned} \tag{75}$$

$$\begin{aligned} &> Orb3(F21, x, y, z, [0.9, 1.5, 0.8], 1000, 1020) \\ &\quad [[0.6703060495, 0.9482904133, 2.844405190], [0.6703060495, 0.9482904133, \\ &\quad 2.844405190], [0.6703060495, 0.9482904133, 2.844405190], [0.6703060495, \\ &\quad 0.9482904133, 2.844405190], [0.6703060495, 0.9482904133, 2.844405190], \\ &\quad [0.6703060495, 0.9482904133, 2.844405190], [0.6703060495, 0.9482904133, \\ &\quad 2.844405190], [0.6703060495, 0.9482904133, 2.844405190], [0.6703060495, \\ &\quad 0.9482904133, 2.844405190], [0.6703060495, 0.9482904133, 2.844405190], \\ &\quad [0.6703060495, 0.9482904133, 2.844405190], [0.6703060495, 0.9482904133, \\ &\quad 2.844405190], [0.6703060495, 0.9482904133, 2.844405190], [0.6703060495, \\ &\quad 0.9482904133, 2.844405190], [0.6703060495, 0.9482904133, 2.844405190], \\ &\quad [0.6703060495, 0.9482904133, 2.844405190], [0.6703060495, 0.9482904133, \\ &\quad 2.844405190], [0.6703060495, 0.9482904133, 2.844405190], [0.6703060495, \\ &\quad 0.9482904133, 2.844405190]] \end{aligned} \tag{76}$$

$$\begin{aligned} &> SFP3(F22, x, y, z) \\ &\quad \quad \quad [[0.6282492197, 1.161357405, 0.7393574289]] \end{aligned} \tag{77}$$

$$\begin{aligned} &> Orb3(F22, x, y, z, [0.9, 1.5, 0.8], 1000, 1020) \\ &\quad [[0.6282492199, 1.161357405, 0.7393574278], [0.6282492196, 1.161357405, \\ &\quad 0.7393574282], [0.6282492199, 1.161357405, 0.7393574282], [0.6282492199, \\ &\quad 1.161357405, 0.7393574278], [0.6282492196, 1.161357405, 0.7393574282], \\ &\quad [0.6282492199, 1.161357405, 0.7393574282], [0.6282492199, 1.161357405, \\ &\quad 0.7393574278], [0.6282492196, 1.161357405, 0.7393574282], [0.6282492199, \\ &\quad 1.161357405, 0.7393574282], [0.6282492199, 1.161357405, 0.7393574278], \\ &\quad [0.6282492196, 1.161357405, 0.7393574282], [0.6282492199, 1.161357405, \\ &\quad 0.7393574282], [0.6282492199, 1.161357405, 0.7393574278], [0.6282492196, \\ &\quad 1.161357405, 0.7393574282], [0.6282492199, 1.161357405, 0.7393574282], \\ &\quad [0.6282492199, 1.161357405, 0.7393574278], [0.6282492196, 1.161357405, \\ &\quad 0.7393574282], [0.6282492199, 1.161357405, 0.7393574282], [0.6282492199, \\ &\quad 1.161357405, 0.7393574278], [0.6282492196, 1.161357405, 0.7393574282]] \end{aligned} \tag{78}$$

$$\begin{aligned} &> SFP3(F23, x, y, z) \\ &\quad \quad \quad [[0.76339849, 2.32112113, 0.5201919526]] \end{aligned} \tag{79}$$

$$\begin{aligned} &> Orb3(F23, x, y, z, [0.9, 1.5, 0.8], 1000, 1020) \\ &\quad [[0.7633984150, 2.321121068, 0.5201919528], [0.7633984153, 2.321121067, \\ &\quad 0.5201919527], [0.7633984150, 2.321121068, 0.5201919528], [0.7633984153, \\ &\quad 2.321121067, 0.5201919527], [0.7633984150, 2.321121068, 0.5201919528], \\ &\quad [0.7633984153, 2.321121067, 0.5201919527], [0.7633984150, 2.321121068, \\ &\quad 0.5201919528], [0.7633984153, 2.321121067, 0.5201919527], [0.7633984150, \\ &\quad 2.321121068, 0.5201919528], [0.7633984153, 2.321121067, 0.5201919527], \\ &\quad [0.7633984150, 2.321121068, 0.5201919528], [0.7633984153, 2.321121067, \\ &\quad 0.5201919527], [0.7633984150, 2.321121068, 0.5201919528], [0.7633984153, \\ &\quad 2.321121067, 0.5201919527], [0.7633984150, 2.321121068, 0.5201919528], \\ &\quad [0.7633984153, 2.321121067, 0.5201919527], [0.7633984150, 2.321121068, \\ &\quad 0.5201919528], [0.7633984153, 2.321121067, 0.5201919527], [0.7633984150, \\ &\quad 2.321121068, 0.5201919528], [0.7633984153, 2.321121067, 0.5201919527]] \end{aligned} \tag{80}$$

$$\begin{aligned} &> SFP3(F24, x, y, z) \\ &\quad \quad \quad [[1.47116531, 1.498431339, 0.8658076063]] \end{aligned} \tag{81}$$

$$\begin{aligned} &> Orb3(F24, x, y, z, [0.9, 1.5, 0.8], 1000, 1020) \\ &\quad [[1.471165331, 1.498431339, 0.8658076064], [1.471165332, 1.498431338, 0.8658076064], \\ &\quad [1.471165332, 1.498431338, 0.8658076061], [1.471165332, 1.498431339, \\ &\quad 0.8658076058], [1.471165331, 1.498431339, 0.8658076064], [1.471165332, \\ &\quad 1.498431338, 0.8658076064], [1.471165332, 1.498431338, 0.8658076061], \\ &\quad [1.471165332, 1.498431339, 0.8658076058], [1.471165331, 1.498431339, \\ &\quad 0.8658076064], [1.471165332, 1.498431338, 0.8658076064], [1.471165332, \end{aligned} \tag{82}$$

1.498431338, 0.8658076061], [1.471165332, 1.498431339, 0.8658076058],
[1.471165331, 1.498431339, 0.8658076064], [1.471165332, 1.498431338,
0.8658076064], [1.471165332, 1.498431338, 0.8658076061], [1.471165332,
1.498431339, 0.8658076058], [1.471165331, 1.498431339, 0.8658076064],
[1.471165332, 1.498431338, 0.8658076064], [1.471165332, 1.498431338,
0.8658076061], [1.471165332, 1.498431339, 0.8658076058]]

> *SFP3(F25, x, y, z)*

[[1.144318317, 0.96989627, 1.47670483]]

(83)

> *Orb3(F25, x, y, z, [0.9, 1.5, 0.8], 1000, 1020)*

[[1.144318317, 0.9698954225, 1.476704803], [1.144318317, 0.9698954225, 1.476704803],
[1.144318317, 0.9698954225, 1.476704803], [1.144318317, 0.9698954225,
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[1.144318317, 0.9698954225, 1.476704803], [1.144318317, 0.9698954225,
1.476704803], [1.144318317, 0.9698954225, 1.476704803], [1.144318317,
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[1.144318317, 0.9698954225, 1.476704803], [1.144318317, 0.9698954225,
1.476704803], [1.144318317, 0.9698954225, 1.476704803], [1.144318317,
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[1.144318317, 0.9698954225, 1.476704803], [1.144318317, 0.9698954225,
1.476704803], [1.144318317, 0.9698954225, 1.476704803]]

(84)

> *SFP3(F26, x, y, z)*

[[0.949211614, 1.134655895, 0.9878333816]]

(85)

> *Orb3(F26, x, y, z, [0.9, 1.5, 0.8], 1000, 1020)*

[[0.9492116161, 1.134655895, 0.9878333812], [0.9492116168, 1.134655895,
0.9878333812], [0.9492116172, 1.134655896, 0.9878333816], [0.9492116165,
1.134655895, 0.9878333816], [0.9492116161, 1.134655895, 0.9878333812],
[0.9492116168, 1.134655895, 0.9878333812], [0.9492116172, 1.134655896,
0.9878333816], [0.9492116165, 1.134655895, 0.9878333816], [0.9492116161,
1.134655895, 0.9878333812], [0.9492116168, 1.134655895, 0.9878333812],
[0.9492116172, 1.134655896, 0.9878333816], [0.9492116165, 1.134655895,
0.9878333816], [0.9492116161, 1.134655895, 0.9878333812], [0.9492116168,
1.134655895, 0.9878333812], [0.9492116172, 1.134655896, 0.9878333816],
[0.9492116165, 1.134655895, 0.9878333816], [0.9492116161, 1.134655895,
0.9878333812], [0.9492116168, 1.134655895, 0.9878333812], [0.9492116172,
1.134655896, 0.9878333816], [0.9492116165, 1.134655895, 0.9878333816]]

(86)

> *SFP3(F27, x, y, z)*

[[0.9085635984, 0.90578765, 0.59145918]]

(87)

1.980546739, 1.422832310], [0.3806560498, 1.980546738, 1.422832310],
[0.3806560499, 1.980546739, 1.422832310], [0.3806560498, 1.980546739,
1.422832310], [0.3806560498, 1.980546738, 1.422832310]]

> *SFP3(F30, x, y, z)* (93)
[[0.5427277347, 1.695193718, 1.453429309]]

> *Orb3(F30, x, y, z, [0.9, 1.5, 0.8], 1000, 1020)* (94)
[[0.5427277347, 1.695193718, 1.453429312], [0.5427277347, 1.695193719, 1.453429313],
[0.5427277344, 1.695193717, 1.453429313], [0.5427277346, 1.695193717,
1.453429313], [0.5427277344, 1.695193717, 1.453429312], [0.5427277347,
1.695193718, 1.453429312], [0.5427277347, 1.695193719, 1.453429313],
[0.5427277344, 1.695193717, 1.453429313], [0.5427277346, 1.695193717,
1.453429313], [0.5427277344, 1.695193717, 1.453429312], [0.5427277347,
1.695193718, 1.453429312], [0.5427277347, 1.695193719, 1.453429313],
[0.5427277344, 1.695193717, 1.453429313], [0.5427277346, 1.695193717,
1.453429313], [0.5427277344, 1.695193717, 1.453429312], [0.5427277347,
1.695193718, 1.453429312], [0.5427277347, 1.695193719, 1.453429313],
[0.5427277344, 1.695193717, 1.453429313], [0.5427277346, 1.695193717,
1.453429313], [0.5427277344, 1.695193717, 1.453429312]]

> *SFP3(F31, x, y, z)* (95)
[[1.118097442, 0.6920409133, 1.129580597]]

> *Orb3(F31, x, y, z, [0.9, 1.5, 0.8], 1000, 1020)* (96)
[[1.118097442, 0.6920409138, 1.129580612], [1.118097442, 0.6920409138, 1.129580612],
[1.118097442, 0.6920409138, 1.129580612], [1.118097442, 0.6920409138,
1.129580612], [1.118097442, 0.6920409138, 1.129580612], [1.118097442,
0.6920409138, 1.129580612], [1.118097442, 0.6920409138, 1.129580612],
[1.118097442, 0.6920409138, 1.129580612], [1.118097442, 0.6920409138,
1.129580612], [1.118097442, 0.6920409138, 1.129580612], [1.118097442,
0.6920409138, 1.129580612], [1.118097442, 0.6920409138, 1.129580612],
[1.118097442, 0.6920409138, 1.129580612], [1.118097442, 0.6920409138,
1.129580612], [1.118097442, 0.6920409138, 1.129580612], [1.118097442,
0.6920409138, 1.129580612], [1.118097442, 0.6920409138, 1.129580612],
[1.118097442, 0.6920409138, 1.129580612], [1.118097442, 0.6920409138,
1.129580612], [1.118097442, 0.6920409138, 1.129580612]]

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