

```
> #HW 13 Hrudai Battini RUID: 185007576 0=3
read "/Users/hb334/Documents/M13.txt";
Help13();
RT2(x,y,d,K), Orb2(F,x,y,pt0,K1,K2), FP2(F,x,y), SFP2(F,x,y), PlotOrb2(L), FP2drz(F,x,y),
SFP2drz(F,x,y) (1)
```

```
> #2
f := [(x^2 + 8*x + 5)/(x^2 + 3*x + 3), (7*x^2 + 8*x + 5)/(5*x^2 + 3*x + 5)];
evalf(FP2(f, x, y));
SFP2(f, x, y);
Orb2(f, x, y, [8.5, 3.5], 100, 105);
f := [ [x^2 + 8x + 5, 7x^2 + 8x + 5]
       [x^2 + 3x + 3, 5x^2 + 3x + 5] ]
[[1.930801600, 1.581332474]]
[[1.930801600, 1.581332474]]
[[1.930801601, 1.581332474], [1.930801601, 1.581332474], [1.930801601, 1.581332474],
[1.930801601, 1.581332474], [1.930801601, 1.581332474]] (2)
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```
> #3
i := 0;
fp := { };

while i < 20 do
d := RT2(x, y, 1, 100) :
i := i + 1 :
fp := {op(fp), FP2drz(d, x, y)};

sfp := SFP2drz(d, x, y);
print(sfp);
orb := evalf(Orb2(d, x, y, [2, 1.5], 300, 303));
print(orb);
od:

i := 0
fp := ∅
[[0.6084620505, 2.394266375]]
[[0.6084620500, 2.394266375], [0.6084620500, 2.394266375], [0.6084620500,
2.394266375]]
[[1.189232712, 2.198284816]]
[[1.189232710, 2.198284816], [1.189232711, 2.198284816], [1.189232710, 2.198284816]]
[[1.403951638, 1.455764197]]
[[1.403951639, 1.455764198], [1.403951639, 1.455764198], [1.403951639, 1.455764198]]
[[0.8480993767, 1.004083363]]
[[0.8480993818, 1.004083363], [0.8480993818, 1.004083363], [0.8480993818,
1.004083363]]
```

[[0.9982589949, 0.4636531573]]
[[0.9982589955, 0.4636531576], [0.9982589955, 0.4636531572], [0.9982589955, 0.4636531576]]
[[0.5700972493, 0.5124075583]]
[[0.5700972502, 0.5124075585], [0.5700972499, 0.5124075581], [0.5700972502, 0.5124075585]]
[[1.215491207, 0.6476655818]]
[[1.215491208, 0.6476655829], [1.215491208, 0.6476655829], [1.215491208, 0.6476655829]]
[[0.8122457454, 1.150135445]]
[[0.8122457655, 1.150135445], [0.8122457655, 1.150135445], [0.8122457655, 1.150135445]]
[[0.9813659356, 1.047894864]]
[[0.9813659342, 1.047894864], [0.9813659333, 1.047894864], [0.9813659342, 1.047894864]]
[[0.8196147234, 0.8036231102]]
[[0.8196147233, 0.8036231102], [0.8196147233, 0.8036231102], [0.8196147233, 0.8036231102]]
[[1.062609222, 1.937746222]]
[[1.062609230, 1.937746221], [1.062609230, 1.937746221], [1.062609230, 1.937746221]]
[[1.170453721, 1.161091742]]
[[1.170453722, 1.161091740], [1.170453718, 1.161091743], [1.170453722, 1.161091740]]
[[1.507441113, 0.7903834021]]
[[1.507441114, 0.7903834024], [1.507441113, 0.7903834020], [1.507441114, 0.7903834024]]
[[0.4762127706, 0.9513543140]]
[[0.4762127708, 0.9513543141], [0.4762127708, 0.9513543141], [0.4762127708, 0.9513543141]]
[[0.8073421061, 0.7262335035]]
[[0.8073421061, 0.7262335038], [0.8073421061, 0.7262335038], [0.8073421061, 0.7262335038]]
[[1.335685785, 0.8063402645]]
[[1.335685785, 0.8063402643], [1.335685786, 0.8063402649], [1.335685785, 0.8063402639]]
[[1.368399242, 1.627411702]]
[[1.368399243, 1.627411703], [1.368399242, 1.627411702], [1.368399243, 1.627411703]]
[[1.345612138, 1.737717141]]
[[1.345612161, 1.737717141], [1.345612161, 1.737717142], [1.345612161, 1.737717141]]

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[[1.068810736, 1.164365424]]
[[1.068810734, 1.164365423], [1.068810734, 1.164365423], [1.068810734, 1.164365423]]
[[0.5638276491, 0.8099458725]]
[[0.5638276470, 0.8099458726], [0.5638276470, 0.8099458726], [0.5638276470,
0.8099458726]]

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(3)

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> #4
#i
RT3 := proc(x, y, z, d, K)
  local ra, i, j, k, f, g, h;
  ra := rand(1 ..K);
  f :=  $\frac{\text{add}(\text{add}(\text{add}(ra( ) \cdot x^i \cdot y^j \cdot z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d)}{\text{add}(\text{add}(\text{add}(ra( ) \cdot x^i \cdot y^j \cdot z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d)}$ ;
  g :=  $\frac{\text{add}(\text{add}(\text{add}(ra( ) \cdot x^i \cdot y^j \cdot z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d)}{\text{add}(\text{add}(\text{add}(ra( ) \cdot x^i \cdot y^j \cdot z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d)}$ ;
  h :=  $\frac{\text{add}(\text{add}(\text{add}(ra( ) \cdot x^i \cdot y^j \cdot z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d)}{\text{add}(\text{add}(\text{add}(ra( ) \cdot x^i \cdot y^j \cdot z^k, k=0 ..d-j), j=0 ..d-i), i=0 ..d)}$ ;
  [f, g, h] ;
end proc;
#ii
Orb3 :=proc(F, x, y, z, pt0, K1, K2)
  local pt, L, i;
  pt := pt0;
  for i to K1 do
    pt := subs( {x=pt[1], y=pt[2], z=pt[3]}, F)
  end do;
  L := [ ];
  for i from K1 + 1 to K2 do
    L := [op(L), pt];
    pt := subs( {x=pt[1], y=pt[2], z=pt[3]}, F)
  end do;
  L
end proc;
#iii
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 proc;
#iv
SFP3 := proc(F, x, y, z)
  local L, J, S, J0, i, pt, EV;
  L := evalf(FP3(F, x, y, z));
  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)]]));
  S := [ ];

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for  $i$  to  $nops(L)$  do
   $pt := L[i]$ ;
   $J0 := subs(\{x=pt[1], y=pt[2], z=pt[3]\}, J)$ ;
   $EV := LinearAlgebra:-Eigenvalues(J0)$ ;
  if  $abs(EV[1]) < 1$  and  $abs(EV[2]) < 1$  and  $abs(EV[3]) < 1$  then
     $S := [op(S), pt]$ 
  end if
end do;
 $S$ 
end proc:

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> #5

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 $e := 0$ ;

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while  $e < 10$  do

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

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 $fp3 := \{op(fp3), evalf(FP3(k, x, y, z))\}$ ;

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 $sfp3 := SFP3(k, x, y, z)$ ;

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 $print(sfp3)$ ;

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 $orb3 := evalf(Orb3(k, x, y, z, [3.5, 4, 5], 100, 103), 10)$ ;

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 $print(orb3)$ ;

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 $e := e + 1$  :

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od:

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 $e := 0$ 

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[ ]

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[[1.625995768, 1.262916835, 1.173190138], [1.625995767, 1.262916835, 1.173190138],
 [1.625995768, 1.262916835, 1.173190138]]

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[ ]

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[[1.449385467, 1.993785456, 2.237094366], [1.449385466, 1.993785456, 2.237094365],
 [1.449385467, 1.993785456, 2.237094365]]

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[ ]

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[[5.748704447, 0.8368835408, 0.8929326538], [5.748704447, 0.8368835408,
 0.8929326538], [5.748704447, 0.8368835408, 0.8929326538]]

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[[0.9232959349, 0.827344236, 0.7234351]]

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[[0.9232959351, 0.8273443550, 0.7234348895], [0.9232959347, 0.8273443550,
 0.7234348898], [0.9232959351, 0.8273443550, 0.7234348892]]

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[[0.7278667181, 0.945293663, 0.736848417]]

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[[0.7278667178, 0.9452936635, 0.7368484044], [0.7278667181, 0.9452936644,
 0.7368484047], [0.7278667179, 0.9452936640, 0.7368484048]]

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[ ]

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[[1.453470823, 1.371904333, 0.8524475246], [1.453470823, 1.371904333, 0.8524475246],

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[1.453470823, 1.371904333, 0.8524475246]]

[[0.4838514198, 1.665699759, 0.6195134185]]

[[0.4838514202, 1.665699758, 0.6195134183], [0.4838514200, 1.665699759,
0.6195134185], [0.4838514202, 1.665699758, 0.6195134183]]

[[0.8521931445, 0.7323830730, 1.542555092]]

[[0.8521931445, 0.7323830726, 1.542555102], [0.8521931445, 0.7323830726,
1.542555102], [0.8521931445, 0.7323830726, 1.542555102]]

[]

[[7.354913120, 1.062110229, 1.604943829], [7.354913120, 1.062110229, 1.604943829],
[7.354913120, 1.062110229, 1.604943829]]

[]

[[1.103043289, 1.141414462, 0.9160672410], [1.103043289, 1.141414462, 0.9160672410],
[1.103043289, 1.141414462, 0.9160672410]]

(4)

