```
> #Hrudai Battini Hw 20
  read "/Users/hb334/Documents/DMB.txt":
> #1(i) 3 variations
  N := 1000;
  v:=2;
  g:=5;
  b1 := 0.3*v/N;
  b2 := 0.9*v/N;
  b3 := 3.9*v/N;
  F := SIRS(s,i,b1,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);

  F := SIRS(s,i,b2,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);

  F := SIRS(s,i,b3,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);
```

$$N := 1000$$

$$v := 2$$

$$g := 5$$

$$b1 := 0.0006000000000$$

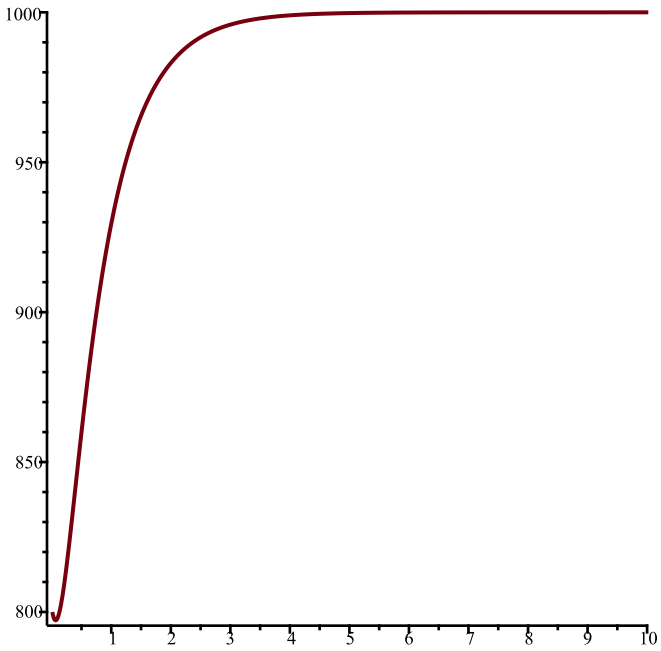
$$b2 := 0.001800000000$$

$$b3 := 0.007800000000$$

$$F := [-0.0006000000000\, s\, i + 5000 - 5\, s - 5\, i,\ 0.0006000000000\, s\, i - 2\, i]$$

$$\{[1000.,\ 0.],\ [3333.333333,\ -1666.666667]\}$$

$$\{[1000.,\ 0.]\}$$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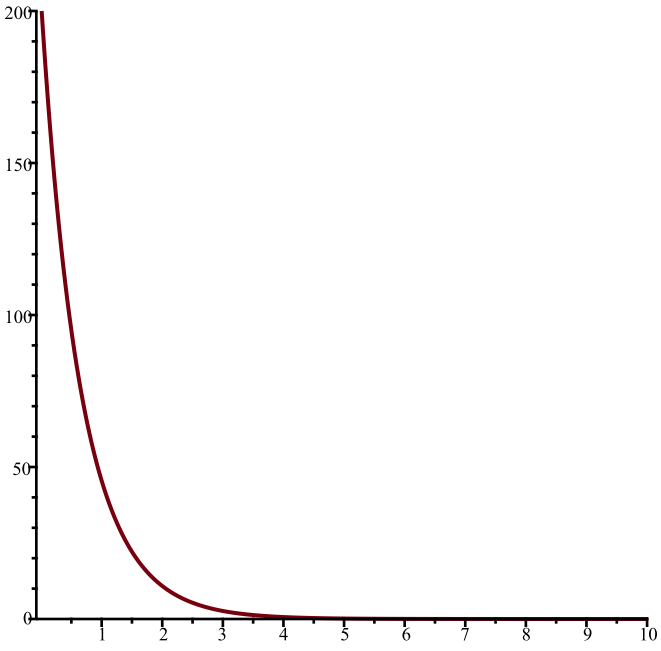
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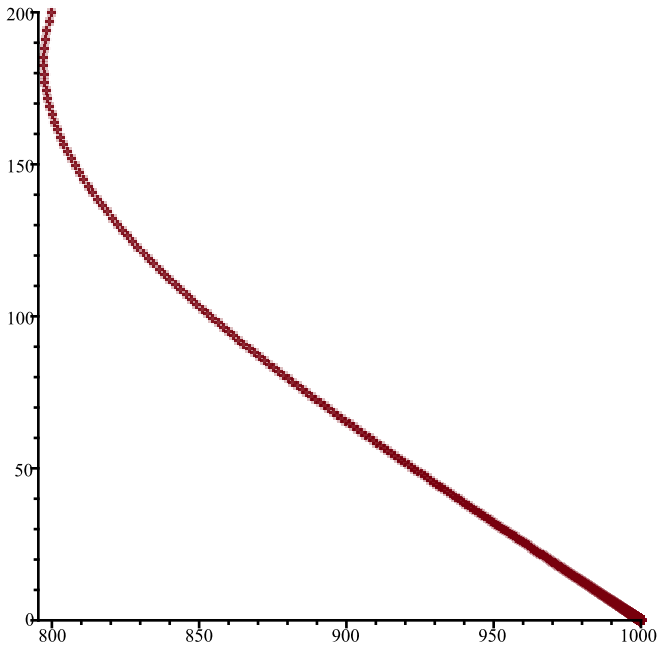
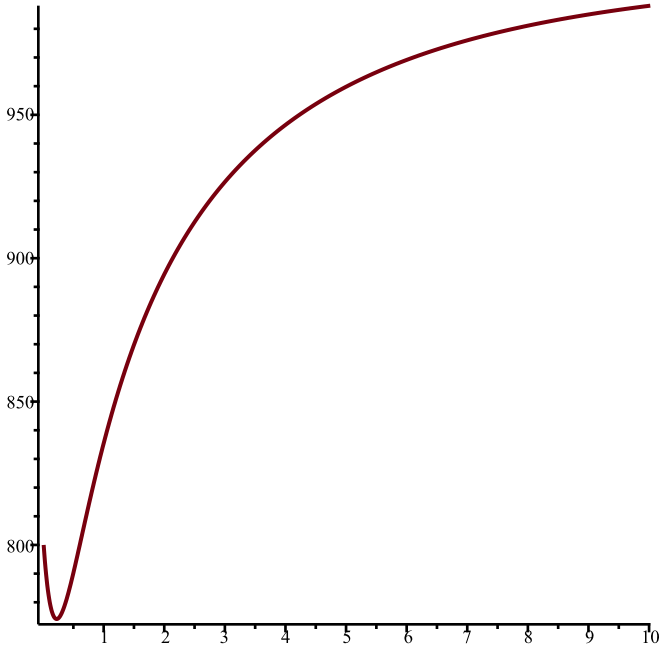
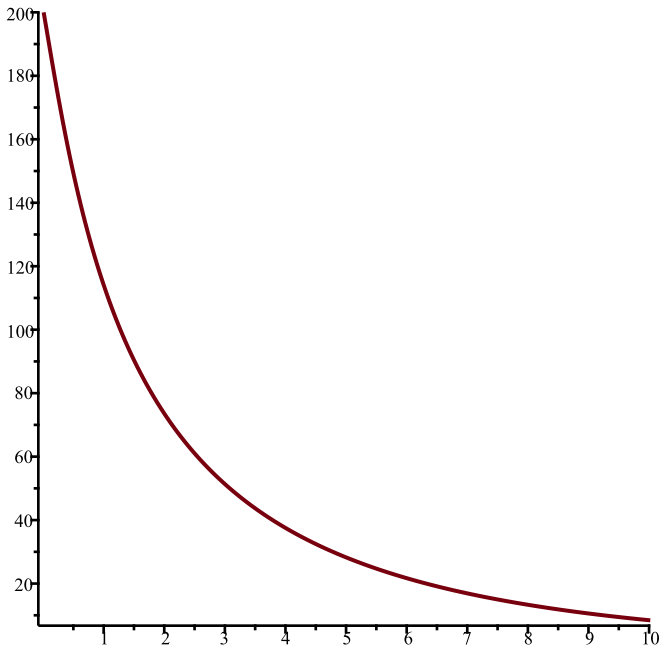


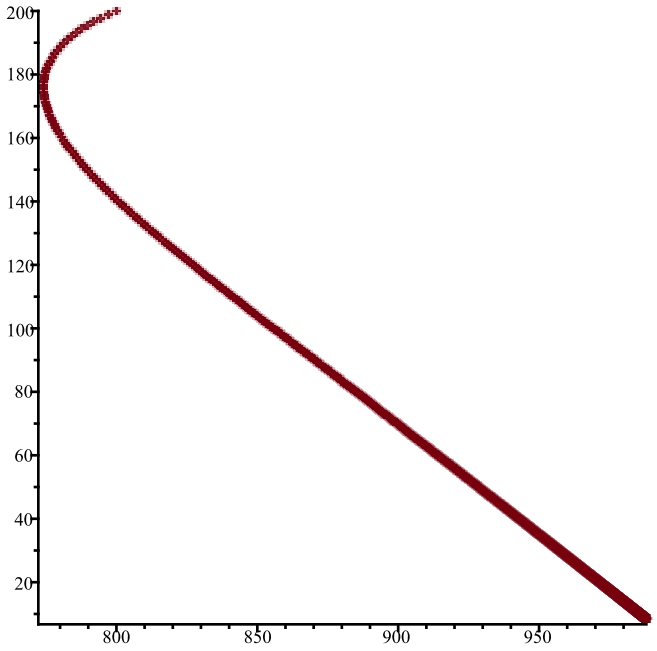
$$F := [-0.001800000000\, s\, i + 5000 - 5\, s - 5\, i,\ 0.001800000000\, s\, i - 2\, i]$$

$$\{[1000.,\ 0.],\ [1111.111111,\ -79.36507937]\}$$

$$\{[1000.,\ 0.]\}$$



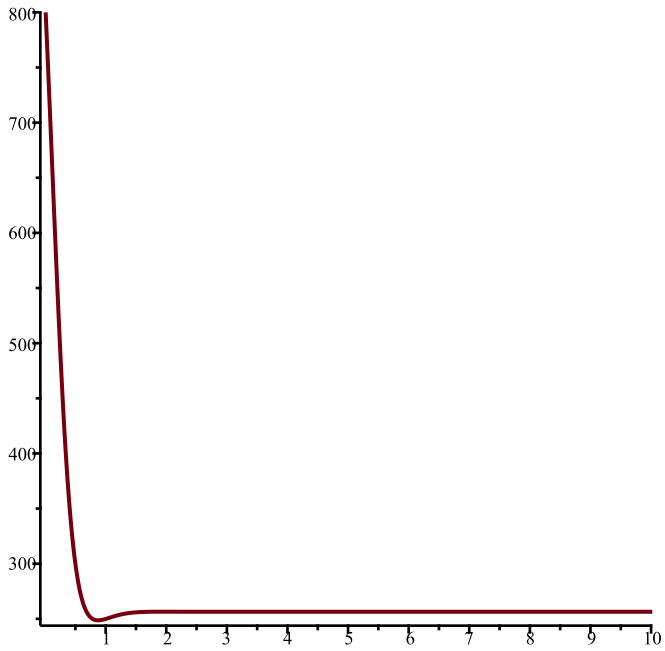




$$F := [-0.007800000000\, s\, i + 5000 - 5\, s - 5\, i,\ 0.007800000000\, s\, i - 2\, i]$$

$$\{[256.4102564,\ 531.1355311],\ [1000.,\ 0.]\}$$

$$\{[256.4102564,\ 531.1355311]\}$$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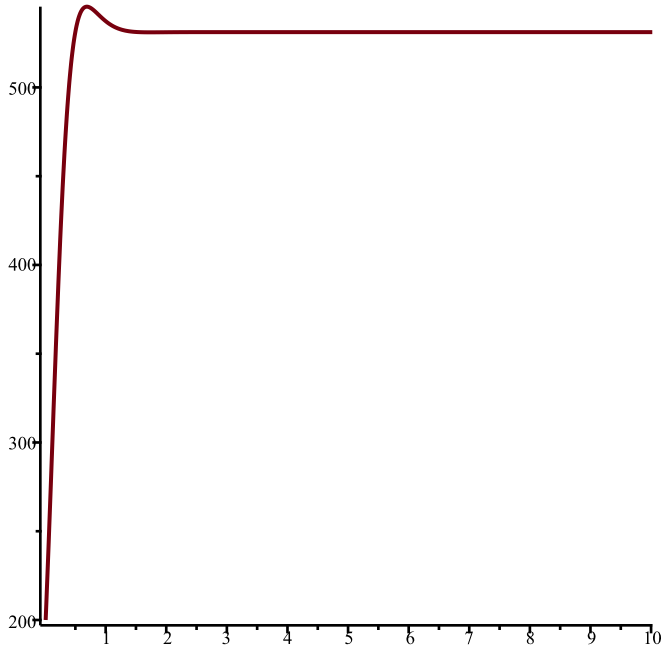
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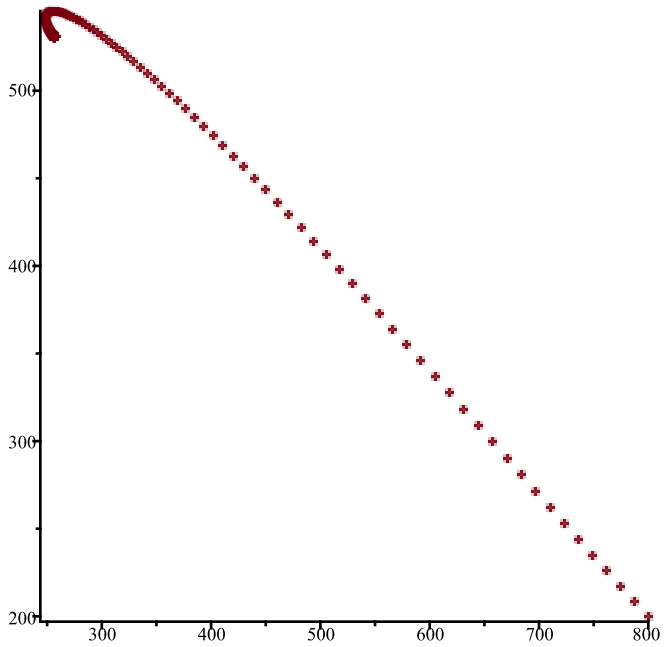



```
> #1(ii) 3 variations
  N := 1000;
  v:=3;
  g:=6;
  b1 := 0.3*v/N;
  b2 := 0.9*v/N;
  b3 := 3.9*v/N;
  F := SIRS(s,i,b1,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);

  F := SIRS(s,i,b2,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);

  F := SIRS(s,i,b3,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);
```

$$N := 1000$$

$$v := 3$$

$$g := 6$$

$$b1 := 0.0009000000000$$

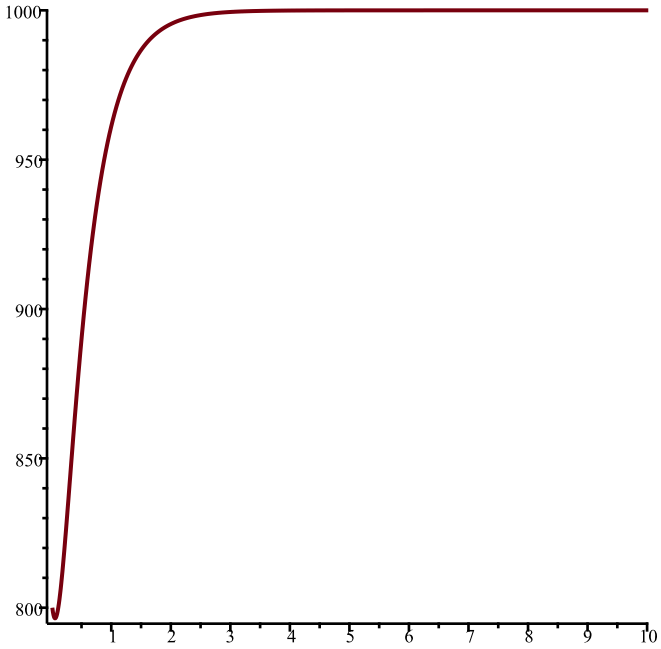
$$b2 := 0.002700000000$$

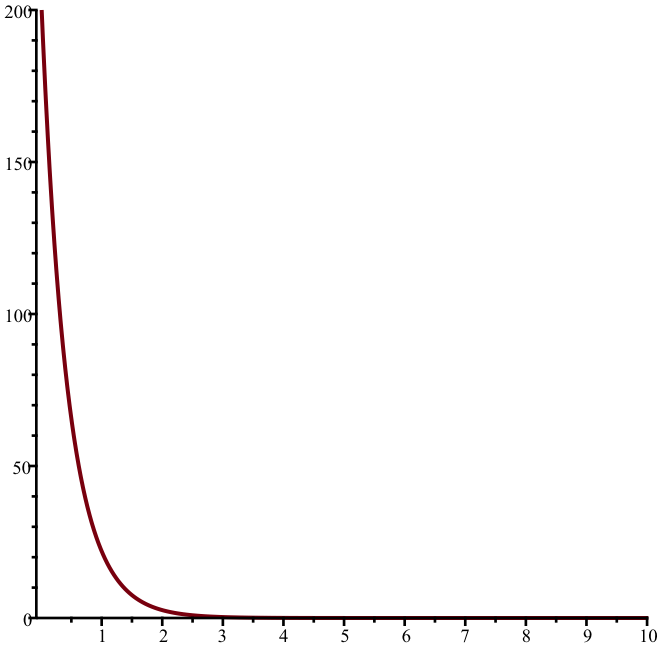
$$b3 := 0.01170000000$$

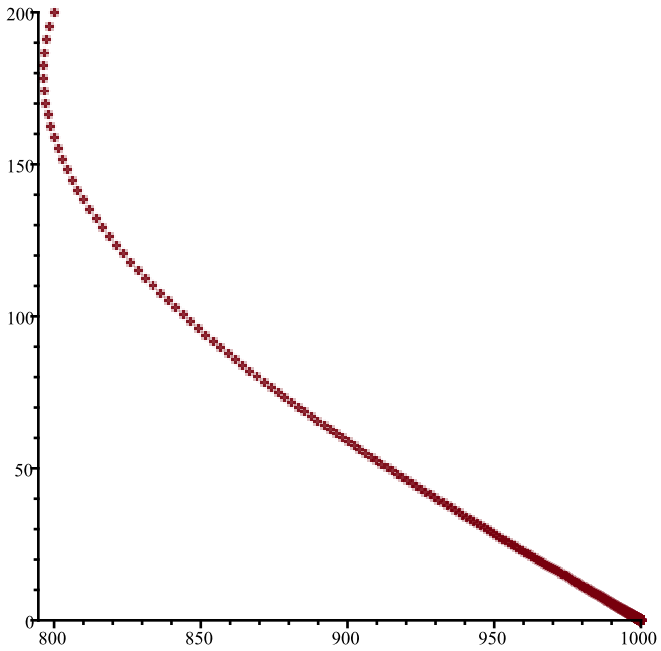
$$F := [-0.0009000000000\,s\,i + 6000 - 6\,s - 6\,i,\ 0.0009000000000\,s\,i - 3\,i]$$

$$\{[1000.,\ 0.],\ [3333.333333,\ -1555.555556]\}$$

$$\{[1000.,\ 0.]\}$$



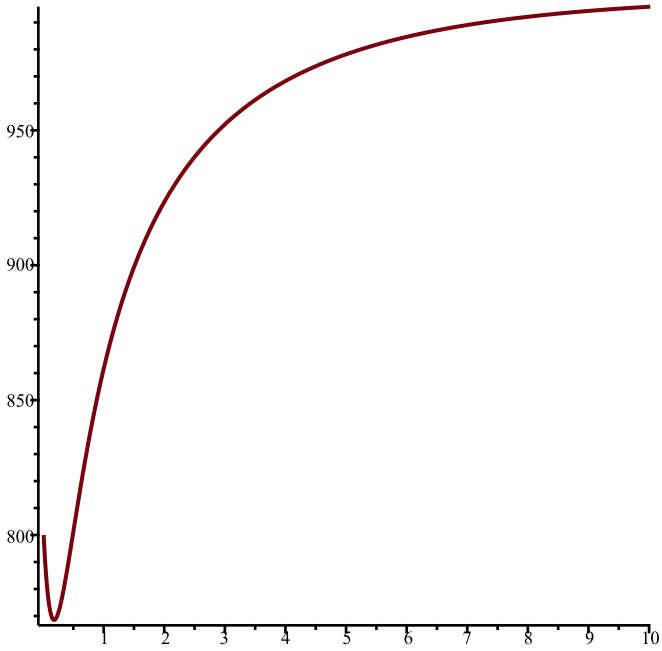


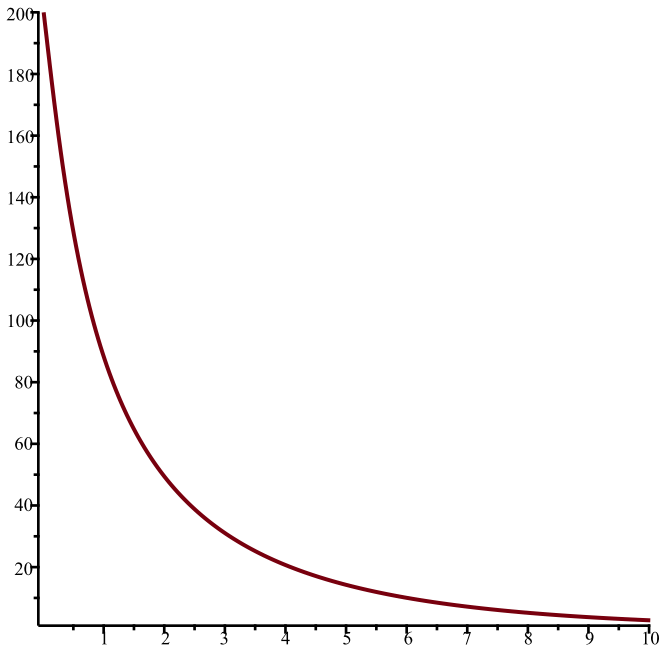


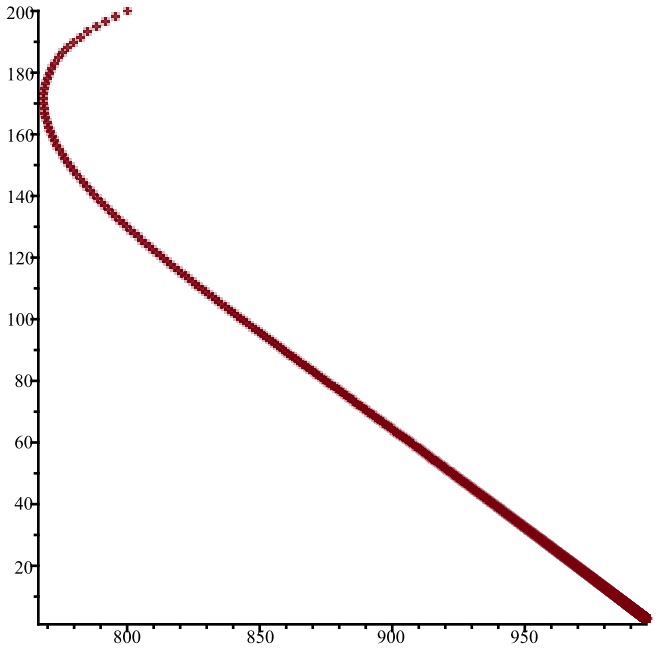
$$F := [-0.002700000000\, s\, i + 6000 - 6\, s - 6\, i,\ 0.002700000000\, s\, i - 3\, i]$$

$$\{[1000., 0.], [1111.111111, -74.07407407]\}$$

$$\{[1000., 0.]\}$$



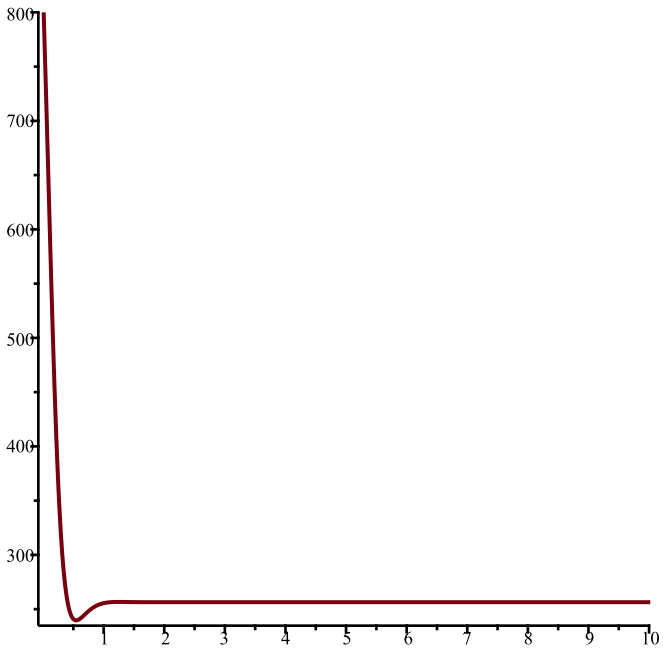




$$F := [-0.01170000000\, s\, i + 6000 - 6\, s - 6\, i,\ 0.01170000000\, s\, i - 3\, i]$$

$$\{[256.4102564,\ 495.7264957],\ [1000.,\ 0.]\}$$

$$\{[256.4102564,\ 495.7264957]\}$$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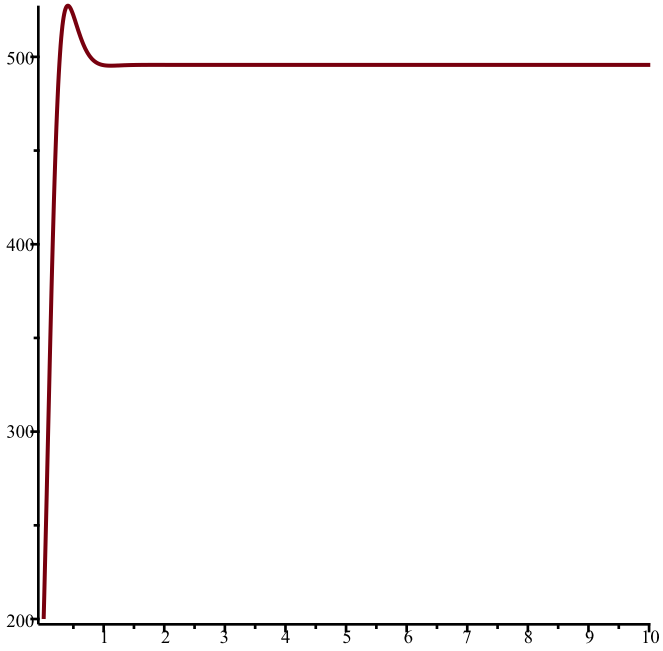
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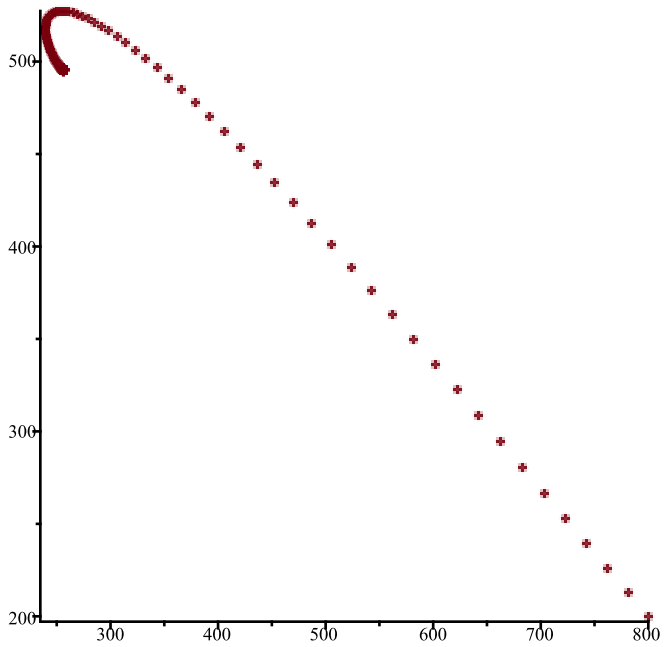



```
> #1(iii) 3 variations
  N := 1000;
  v:=4;
  g:=1;
  b1 := 0.3*v/N;
  b2 := 0.9*v/N;
  b3 := 3.9*v/N;
  F := SIRS(s,i,b1,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);

  F := SIRS(s,i,b2,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);

  F := SIRS(s,i,b3,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);
```

$$N := 1000$$

$$v := 4$$

$$g := 1$$

$$b1 := 0.001200000000$$

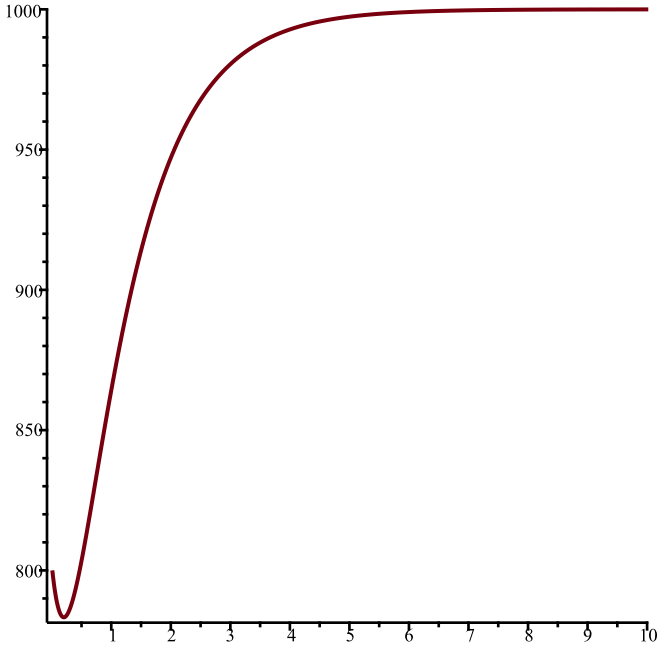
$$b2 := 0.003600000000$$

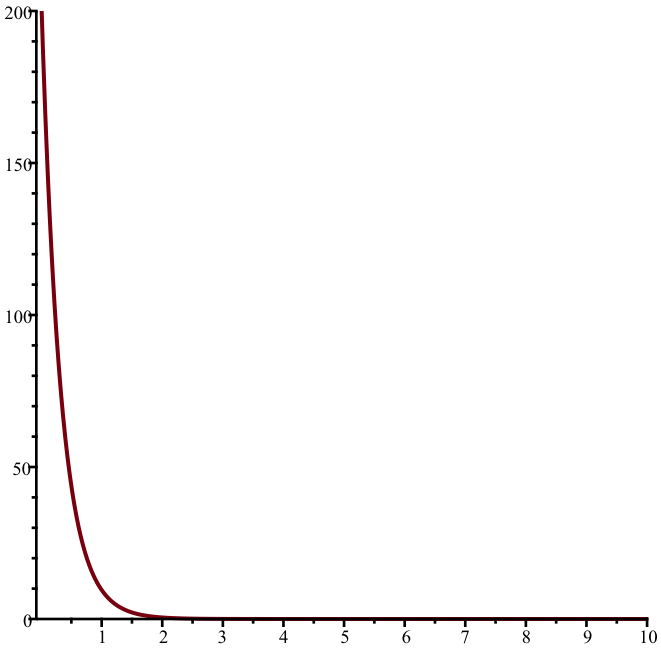
$$b3 := 0.01560000000$$

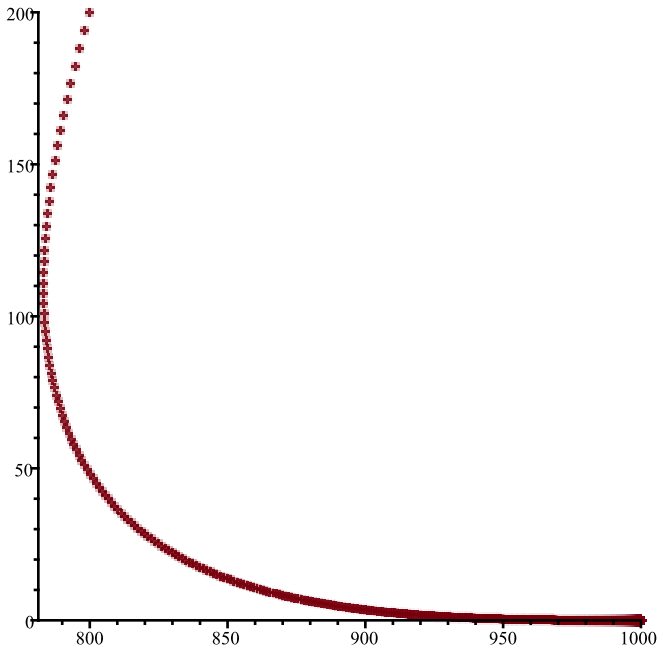
$$F := [\,-0.001200000000\,s\,i + 1000 - s - i,\ 0.001200000000\,s\,i - 4\,i\,]$$

$$\{[1000.,\ 0.],\ [3333.333333,\ -466.6666667]\}$$

$$\{[1000.,\ 0.]\}$$



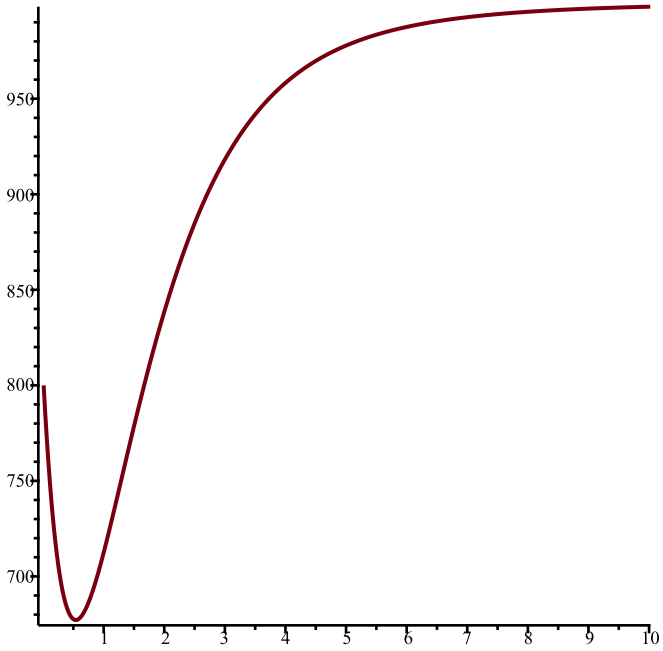


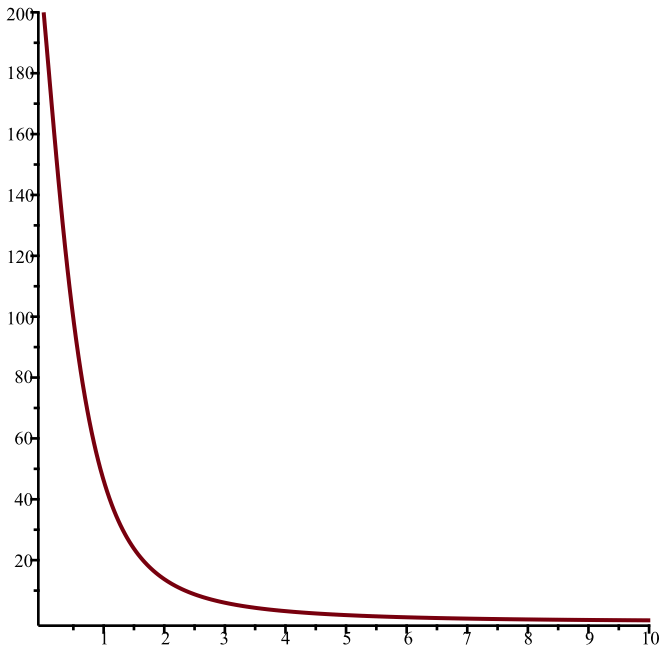


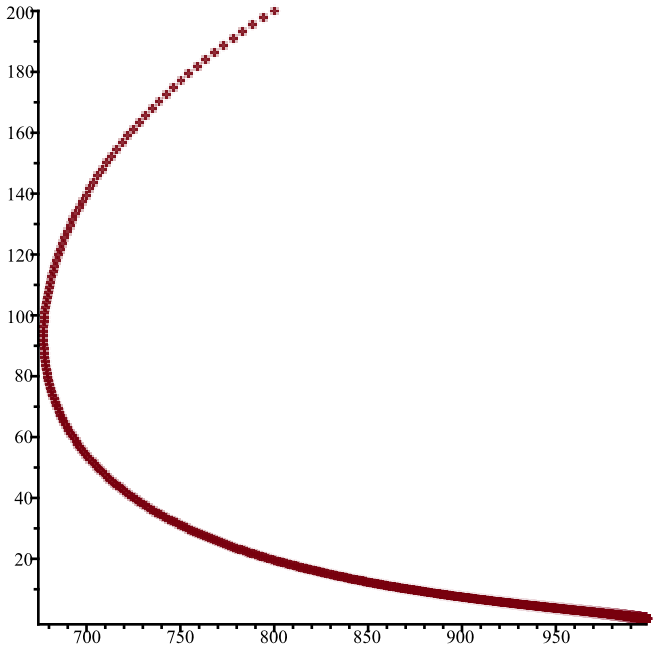
$$F := [-0.003600000000\, s\, i + 1000 - s - i,\ 0.003600000000\, s\, i - 4\, i]$$

$$\{[1000., 0.], [1111.111111, -22.22222222]\}$$

$$\{[1000., 0.]\}$$



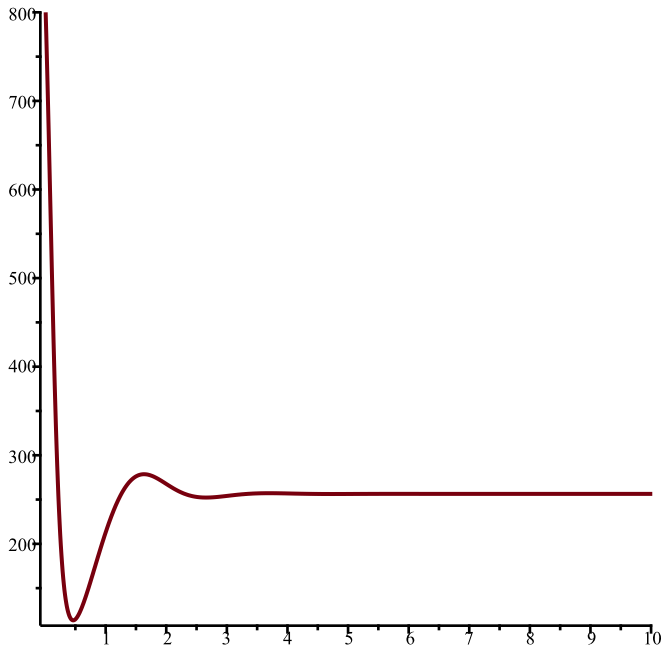




$$F := [-0.01560000000\, s\, i + 1000 - s - i,\ 0.01560000000\, s\, i - 4\, i]$$

$$\{[256.4102564,\ 148.7179487],\ [1000.,\ 0.]\}$$

$$\{[256.4102564,\ 148.7179487]\}$$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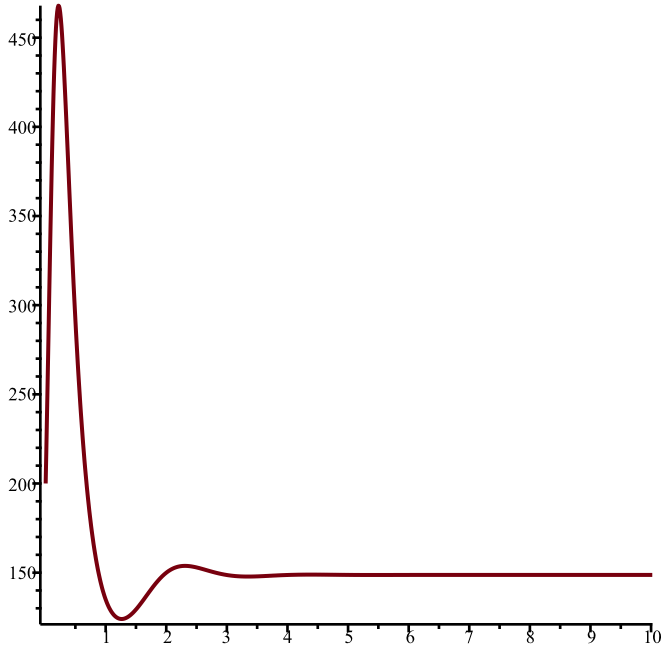
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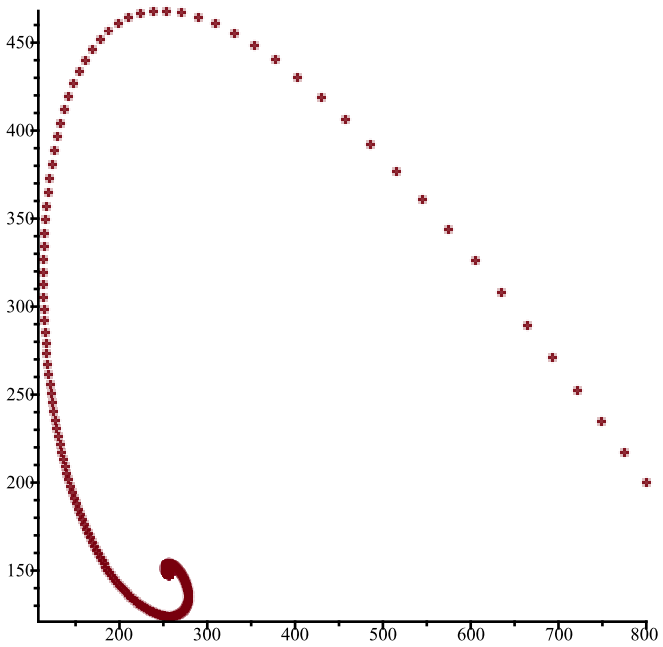



```
> #1(iv) 3 variations
  N := 1000;
  v:=7;
  g:=10;
  b1 := 0.3*v/N;
  b2 := 0.9*v/N;
  b3 := 3.9*v/N;
  F := SIRS(s,i,b1,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);

  F := SIRS(s,i,b2,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);

  F := SIRS(s,i,b3,g,v,N);
  EquP(F,[s,i]);
  SEquP(F,[s,i]);
  TimeSeries(F,[s,i],[800,200],0.01,10,1);
  TimeSeries(F,[s,i],[800,200],0.01,10,2);
  PhaseDiag(F,[s,i],[800,200],0.01,10);
```

$$N := 1000$$

$$v := 7$$

$$g := 10$$

$$b1 := 0.002100000000$$

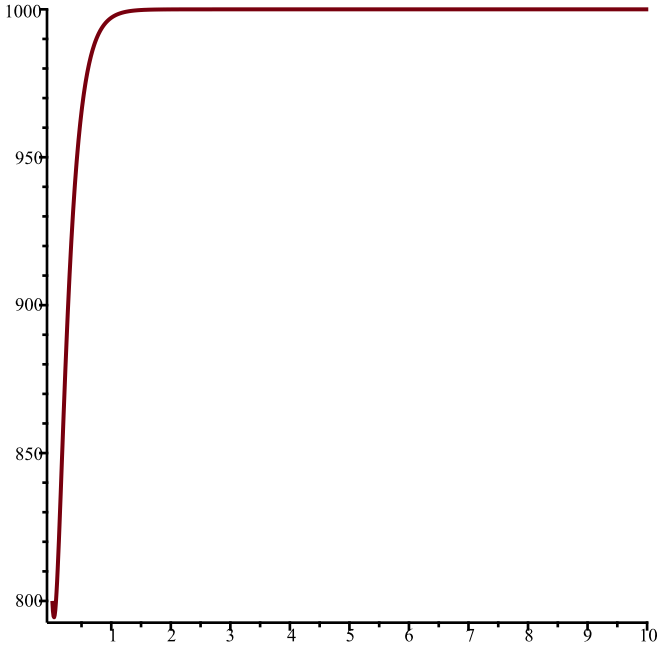
$$b2 := 0.006300000000$$

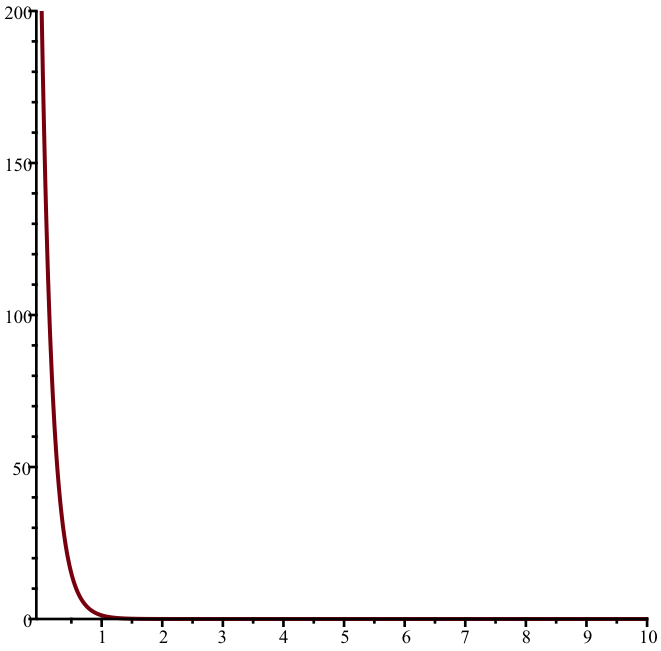
$$b3 := 0.02730000000$$

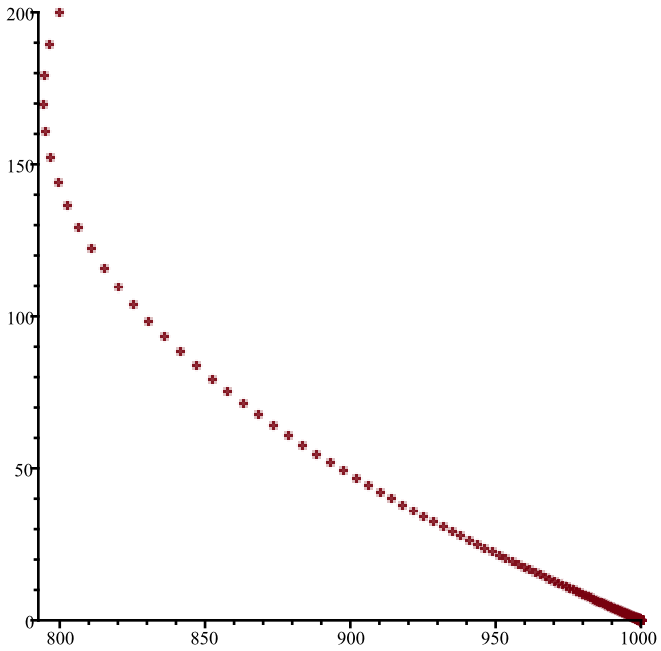
$$F := [-0.002100000000\, s\, i + 10000 - 10\, s - 10\, i,\ 0.002100000000\, s\, i - 7\, i]$$

$$\{[1000., 0.], [3333.333333, -1372.549020]\}$$

$$\{[1000., 0.]\}$$



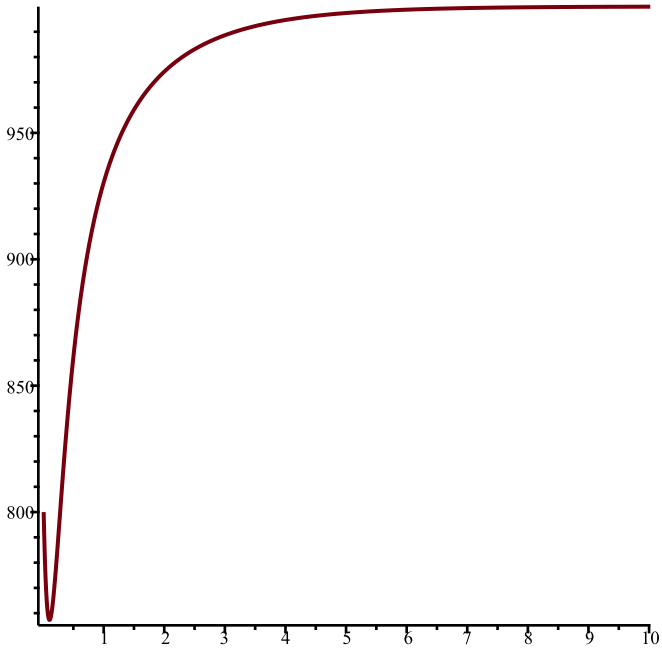


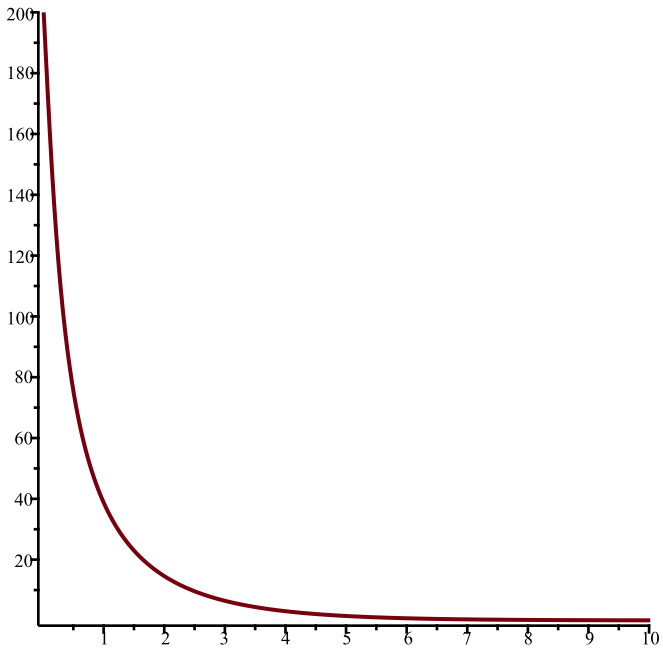


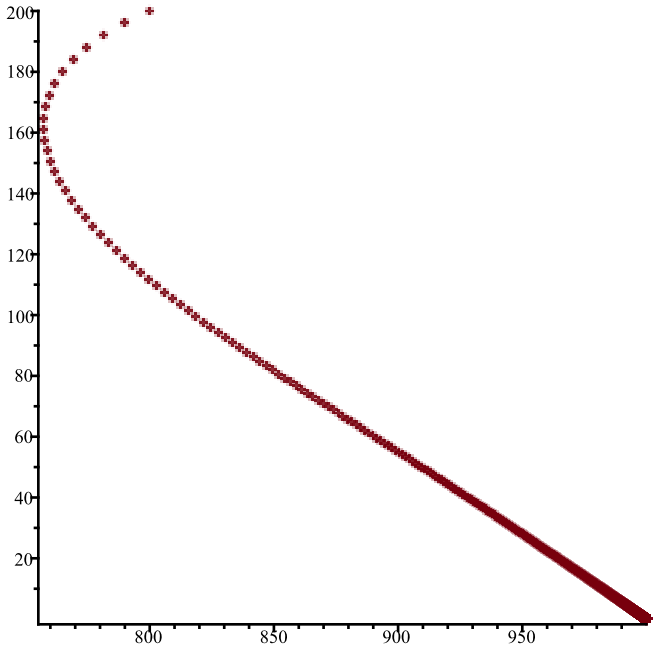
$$F := [-0.006300000000\, s\, i + 10000 - 10\, s - 10\, i,\ 0.006300000000\, s\, i - 7\, i]$$

$$\{[1000., 0.], [1111.111111, -65.35947712]\}$$

$$\{[1000., 0.]\}$$



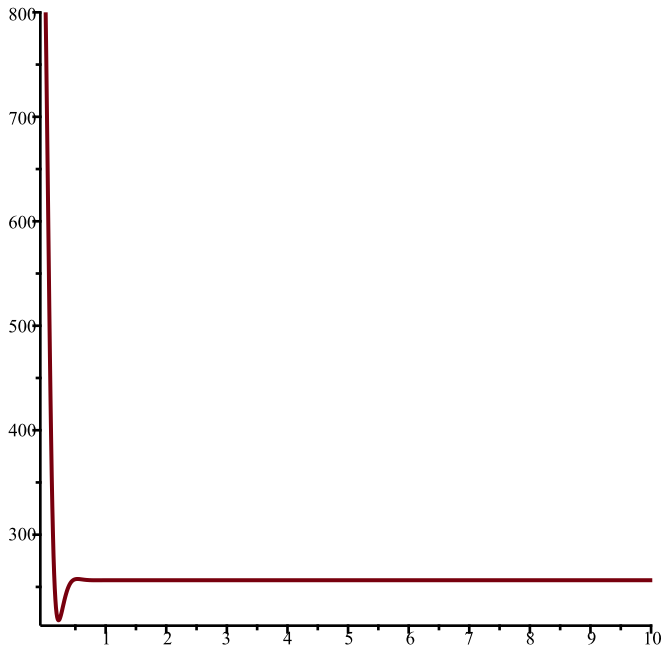




$$F := [-0.02730000000\, s\, i + 10000 - 10\, s - 10\, i,\ 0.02730000000\, s\, i - 7\, i]$$

$$\{[256.4102564,\ 437.4057315],\ [1000.,\ 0.]\}$$

$$\{[256.4102564,\ 437.4057315]\}$$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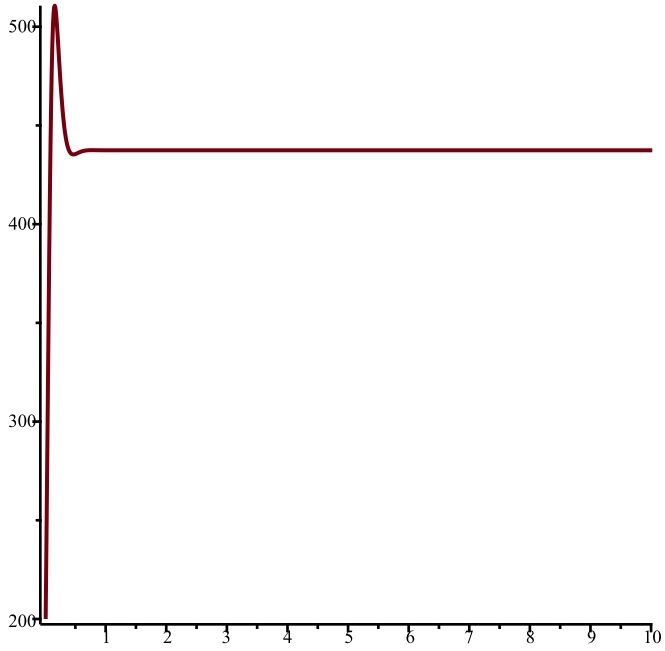
500
400
300
200
1
2
3
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5
6
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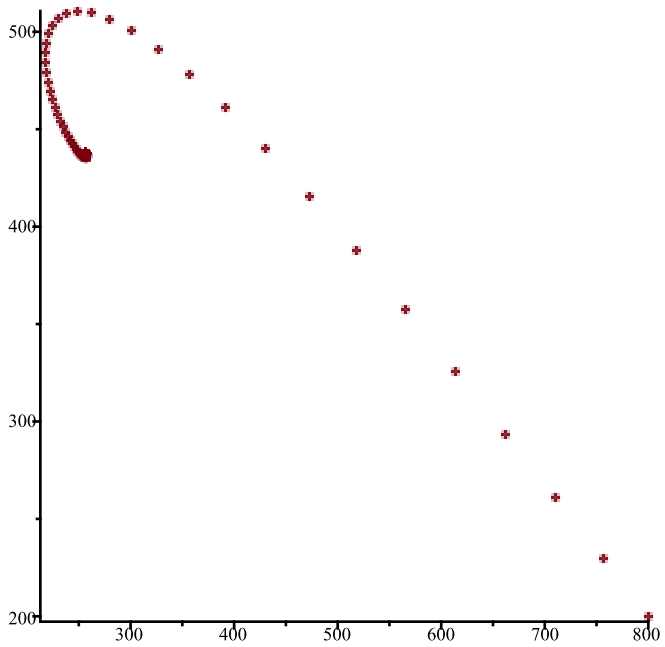
8
9
10




```
> F1 := RandNice([x,y],3);
  EquP(F1,[x,y]);
  SEquP(F1,[x,y]);
  F2 := RandNice([x,y],3);
  EquP(F2,[x,y]);
  SEquP(F2,[x,y]);
  F3 := RandNice([x,y],3);
  EquP(F3,[x,y]);
  SEquP(F3,[x,y]);
```

$$F1 := [(2-2x-3y)\ (2-3x-2y),\ (1-x-y)\ (3-x-3y)]$$

$$\left\{\left[-1,\ \frac{4}{3}\right],\ [0,\ 1],\ [1,\ 0]\right\}$$

$$\{[-1.,\ 1.333333333],\ [1.,\ 0.]\}$$

$$F2 := [(2-3x-y)\ (2-x-3y),\ (1-3x-y)\ (1-2x-2y)]$$

$$\left\{\left[-\frac{1}{4},\ \frac{3}{4}\right],\ \left[\frac{1}{8},\ \frac{5}{8}\right],\ \left[\frac{3}{4},\ -\frac{1}{4}\right]\right\}$$

$$\{[0.1250000000,\ 0.6250000000]\}$$

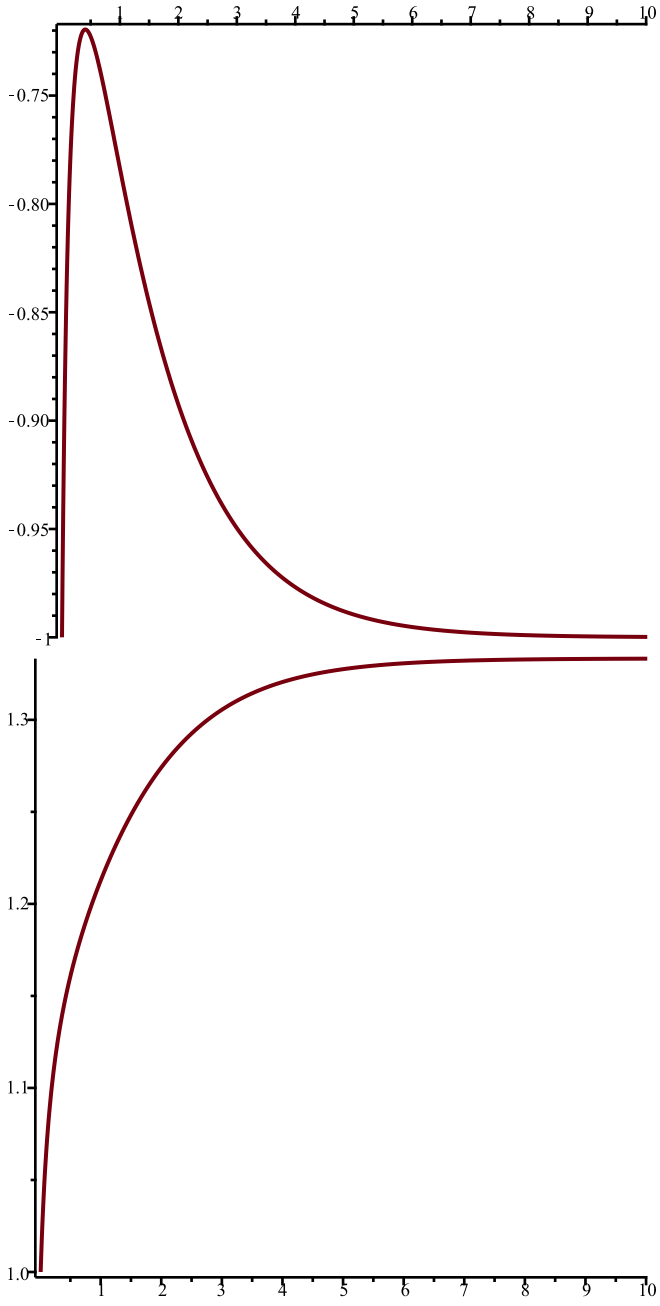
$$F3 := [(3-3x-y)\ (1-2x-y),\ (3-2x-y)\ (1-x-y)]$$

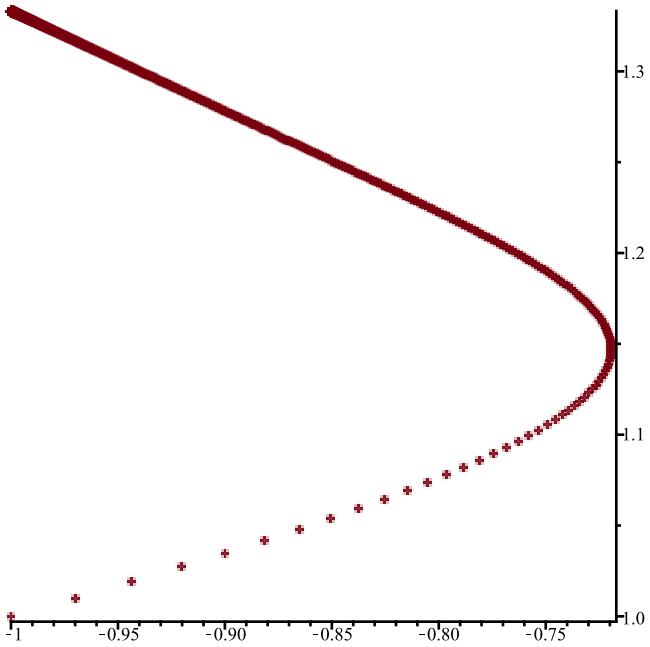
$$\{[0,\ 1],\ [0,\ 3],\ [1,\ 0]\}$$

$$\{[0.,\ 1.]\}$$

(1)

```
> TimeSeries(F1,[x,y],[-1,1],0.01,10,1);
  TimeSeries(F1,[x,y],[-1,1],0.01,10,2);
  PhaseDiag(F1,[x,y],[-1,1],0.01,10);
  TimeSeries(F2,[x,y],[0.12,0.6],0.01,10,1);
  TimeSeries(F2,[x,y],[0.12,0.6],0.01,10,2);
  PhaseDiag(F2,[x,y],[0.12,0.6],0.01,10);
  TimeSeries(F3,[x,y],[0.1,0.9],0.01,10,1);
  TimeSeries(F3,[x,y],[0.1,0.9],0.01,10,2);
  PhaseDiag(F3,[x,y],[0.1,0.9],0.01,10);
```


1
2
3
4
5
6
7
8
9
10
-0.75
-0.80
-0.85
-0.90
-0.95
-1
1.3
1.2
1.1
1.0
1
2
3
4
5
6
7
8
9
10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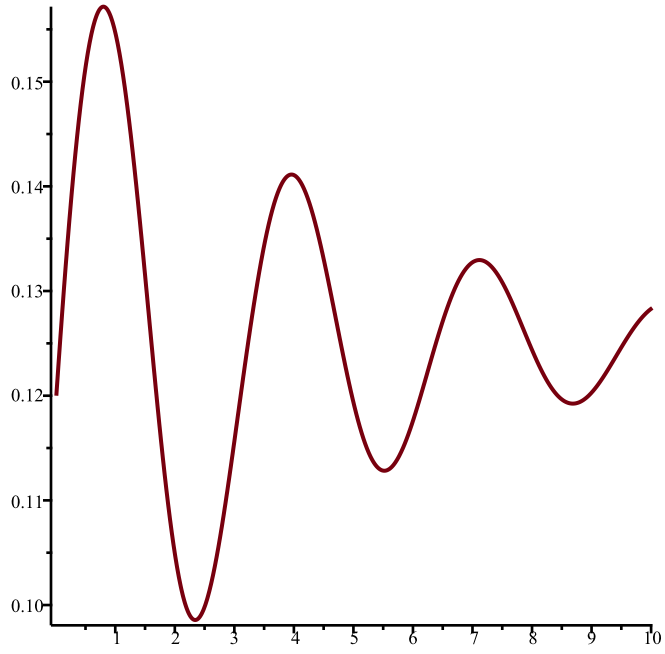
1.2
1.1
1.0
-1
-0.95
-0.90
-0.85
-0.80
-0.75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0.13
0.12
0.11
0.10
1
2
3
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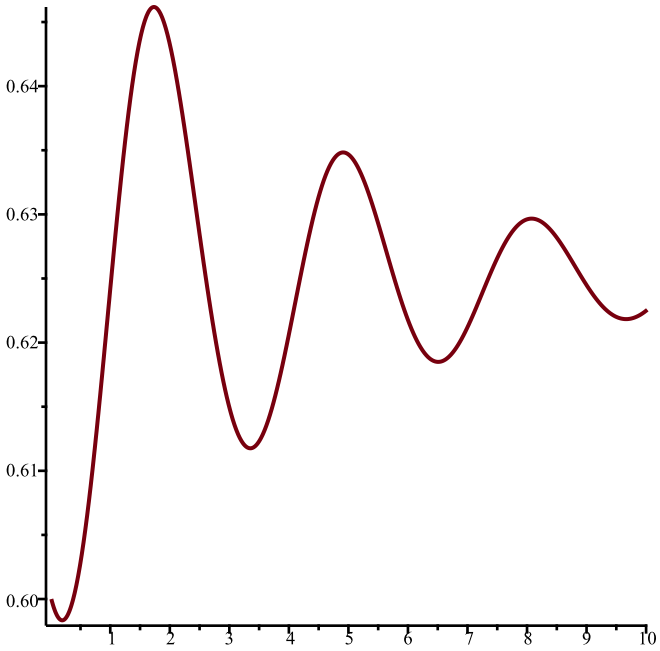
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0.62
0.61
0.60
1
2
3
4
5
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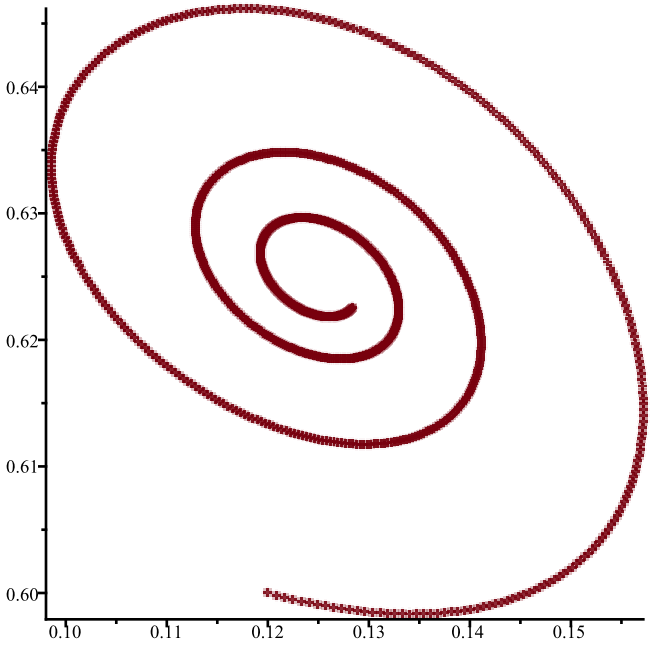
9
10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0.62
0.61
0.60
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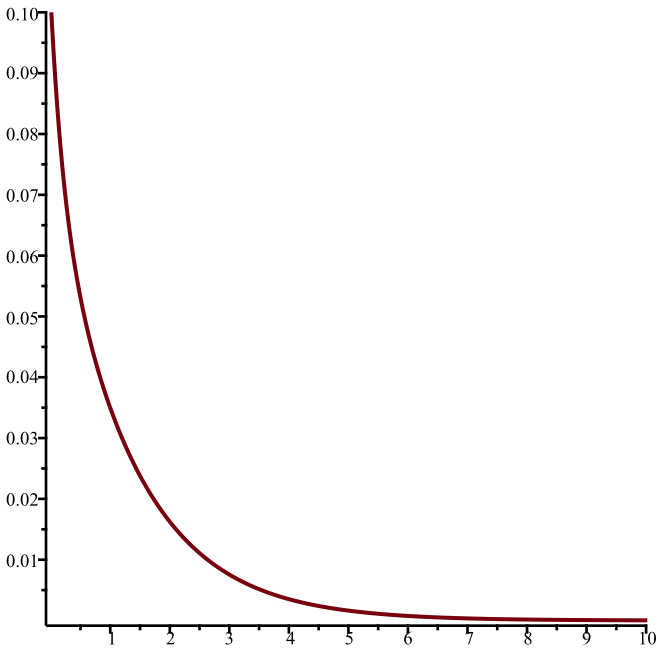
0.11
0.12
0.13
0.14
0.15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0.03
0.02
0.01
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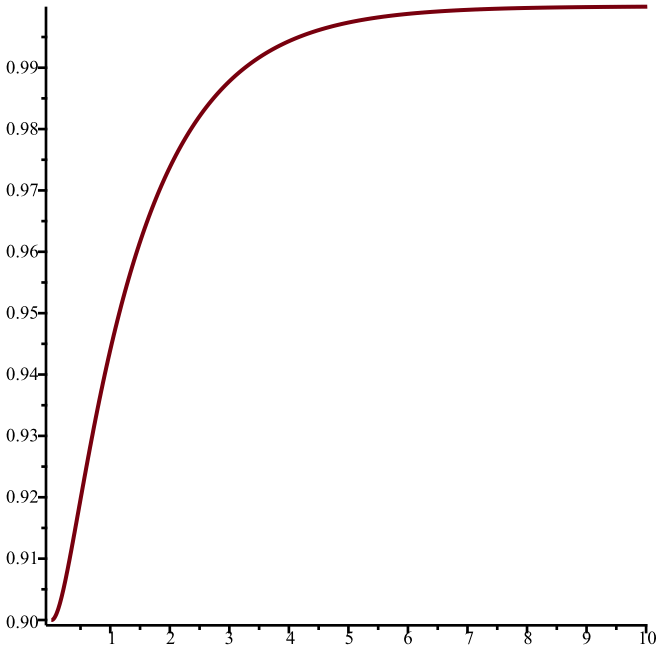
9
10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0.92
0.91
0.90
1
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4
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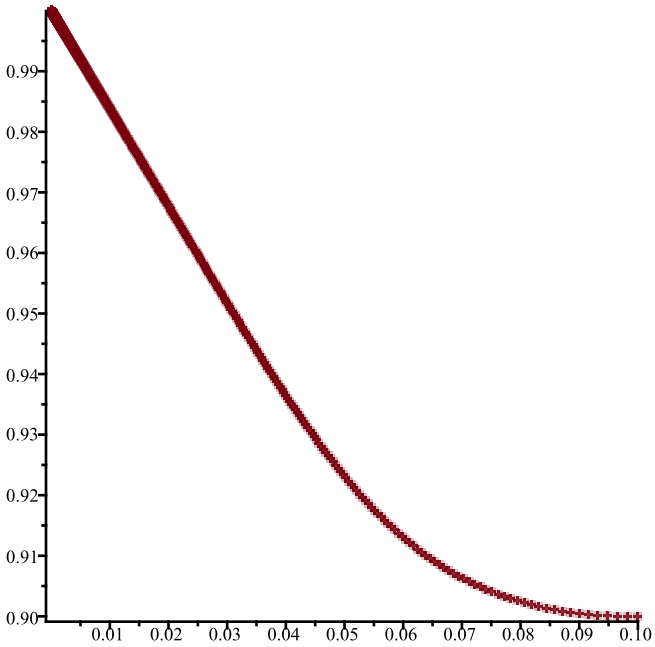


```
> #3
  #x(n) = (3 + x(n-2)+x(n-3)+x(n-4))/(1+x(n-1)+x(n-3));
  Orbk(4,z,(3+z[2]+z[3]+z[4])/(1+z[1]+z[3]),[1.,4.,7.,9.],2000,
  2005);
  Orbk(4,z,(3+z[2]+z[3]+z[4])/(1+z[1]+z[3]),[0.,0.,1.,2.],2000,
  2005);
  Orbk(4,z,(3+z[2]+z[3]+z[4])/(1+z[1]+z[3]),[0.,2.,0.,0.],2000,
  2005);#Closest Iteration however The value at the orbit
  oscillates.
  g := (3+z[2]+z[3]+z[4])/(1+z[1]+z[3]);
  G:=ToSys(4,z,g);
  SFP(G);
```

$$[3.361949597, 1.111471286, 3.361949597, 1.111471286, 3.361949597, 1.111471286]$$

$$[2.102371582, 1.592131201, 2.102371582, 1.592131201, 2.102371582, 1.592131201]$$

$$[1.766389404, 1.881881430, 1.766389404, 1.881881430, 1.766389404, 1.881881430]$$

$$g := \frac{3 + z_2 + z_3 + z_4}{1 + z_1 + z_3}$$

$$G := \left[\frac{3 + z_2 + z_3 + z_4}{1 + z_1 + z_3}, z_1, z_2, z_3 \right], [z_1, z_2, z_3, z_4]$$

$$\{[1.822875656, 1.822875656, 1.822875656, 1.822875656]\} \quad \textbf{(2)}$$

```
>
>
```