```
> restart: with(plots):
Warning, the name changecoords has been redefined

> fplot:=proc() global f; local r,x,g; r:=args[1]; if nargs=1 then
  g:=f; else g:=args[2] end if; plot({g(r,x),x},x=0..1); end proc:
> suite:=proc() local u,L,i,r,s,t; r:=args[1]; if nargs<2 then
  s:=0; else s:=args[2]; end if; if nargs<3 then t:=100; else
  t:=args[3]; end if; u:=0.5; for i to s do u:=r*u*(1-u) end do;
  L:=NULL; for i to t do L:=L,[i,u]; u:=r*u*(1-u) end do;
  plot([L],style=point); end proc:
> chaos:=proc() global f; local u,v,L,i,r,s,t,g; r:=args[1]; if
  nargs<2 then s:=0; else s:=args[2]; end if; if nargs<3 then
  t:=100; else t:=args[3]; end if; if nargs<4 then g:=f else
  g:=args[4] end if; u:=0.5; for i to s do u:=f(r,u) end do;
  L:=NULL; for i to t do v:=f(r,u); L:=L,[u,g(r,u)]; u:=v end do;
  display({plot([L],style=point),fplot(r,g)}); end proc:
> f:=(r,x)->r*x*(1-x);
```

$$f := (r, x) \to r\,x\,(1 - x)$$

```
> f2:=(r,x)->f(r,f(r,x));
```

$$f2 := (r, x) \to \mathrm{f}(r, \mathrm{f}(r, x))$$

```
> cycle2:=simplify((f2(r,x)-x)/(f(r,x)-x));
```

$$cycle2 := r^2 x^2 - r^2 x + r - r x + 1$$

```
> derivee:=rem(diff(f2(r,x),x),cycle2,x);
```

$$derivee := -r^2 + 2r + 4$$

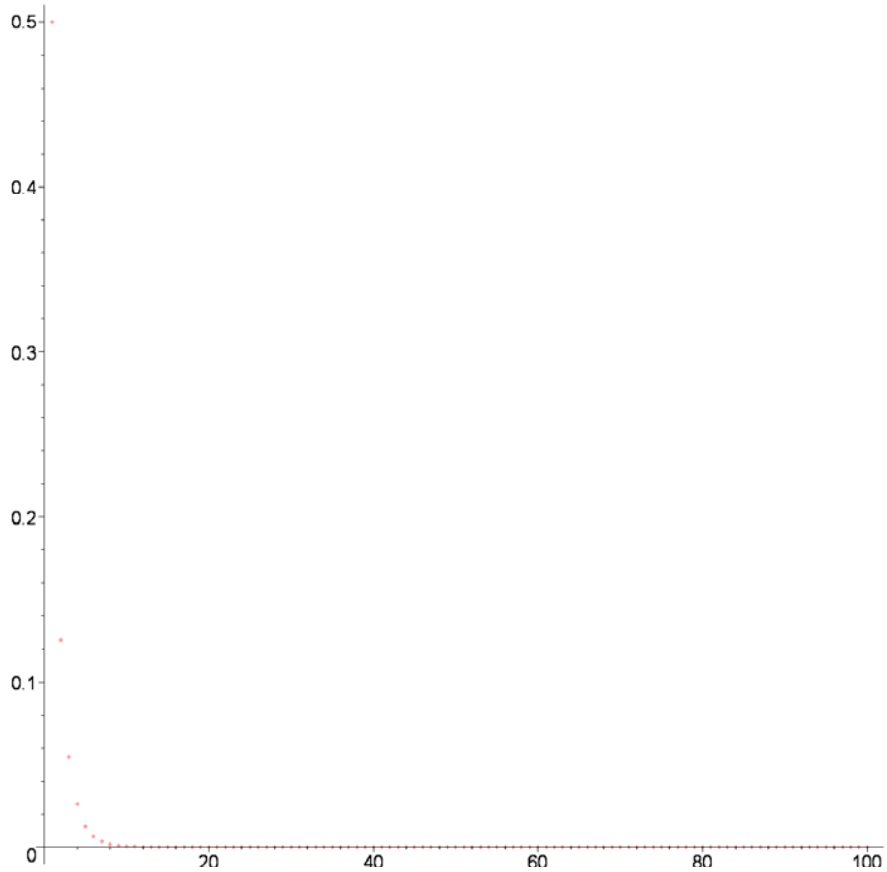
```
> solve(derivee=1);
```

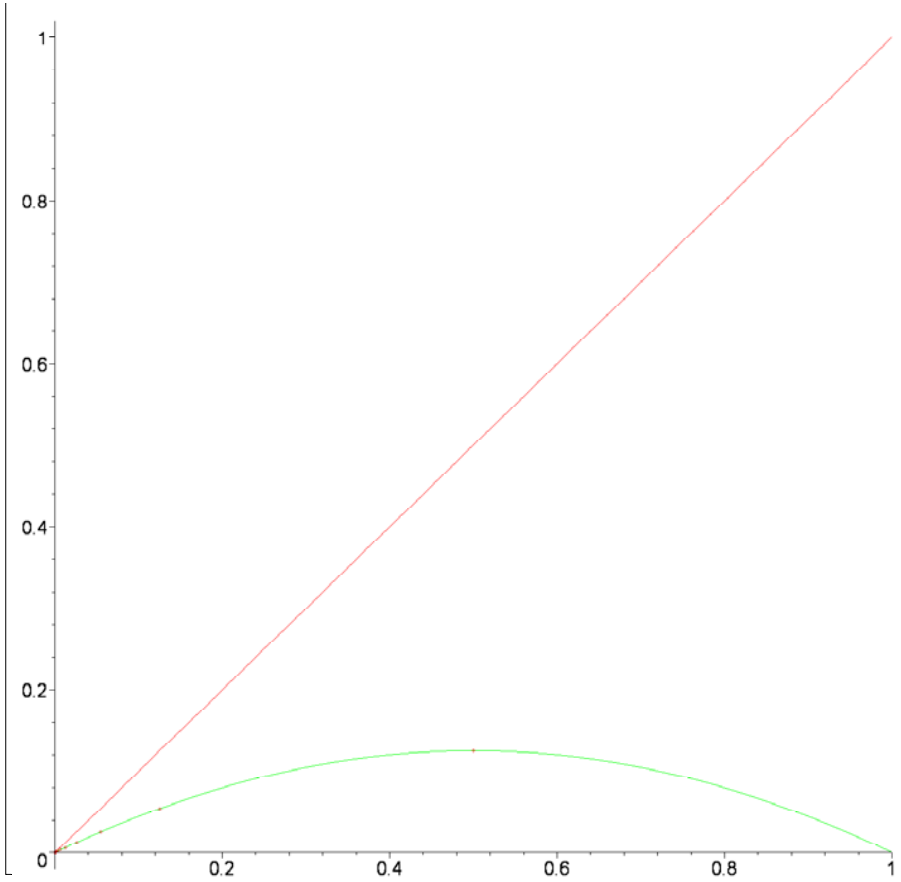
$$-1, 3$$

```
> solve(derivee=-1);
```

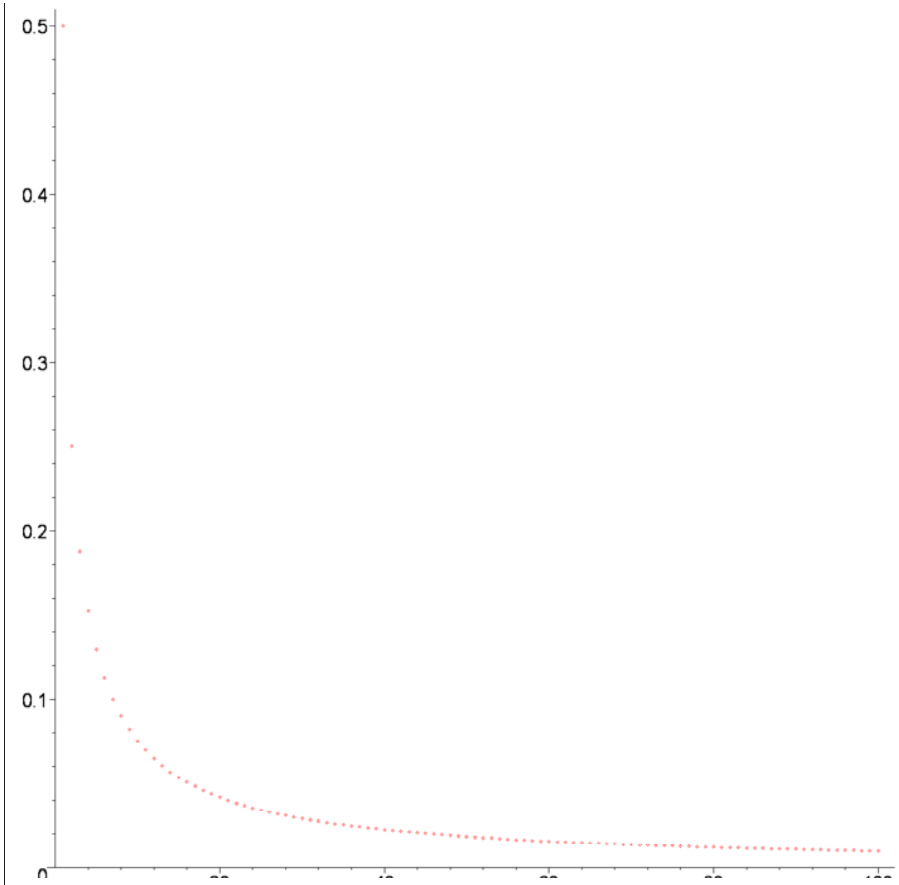
$$1 - \sqrt{6}, 1 + \sqrt{6}$$

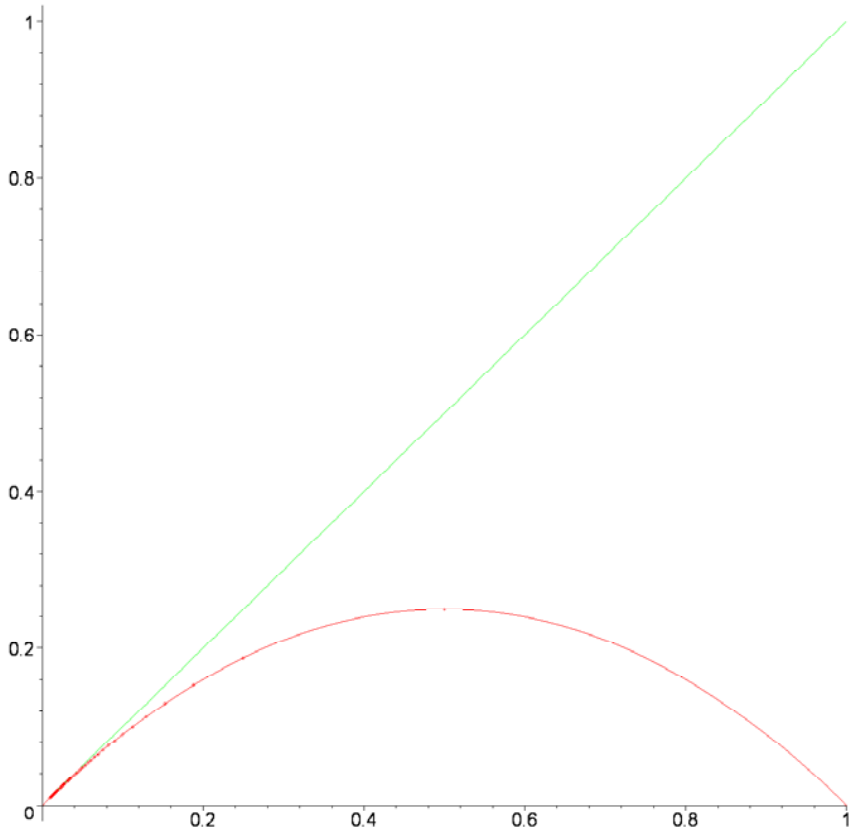
```
> suite(0.5);chaos(0.5);
```



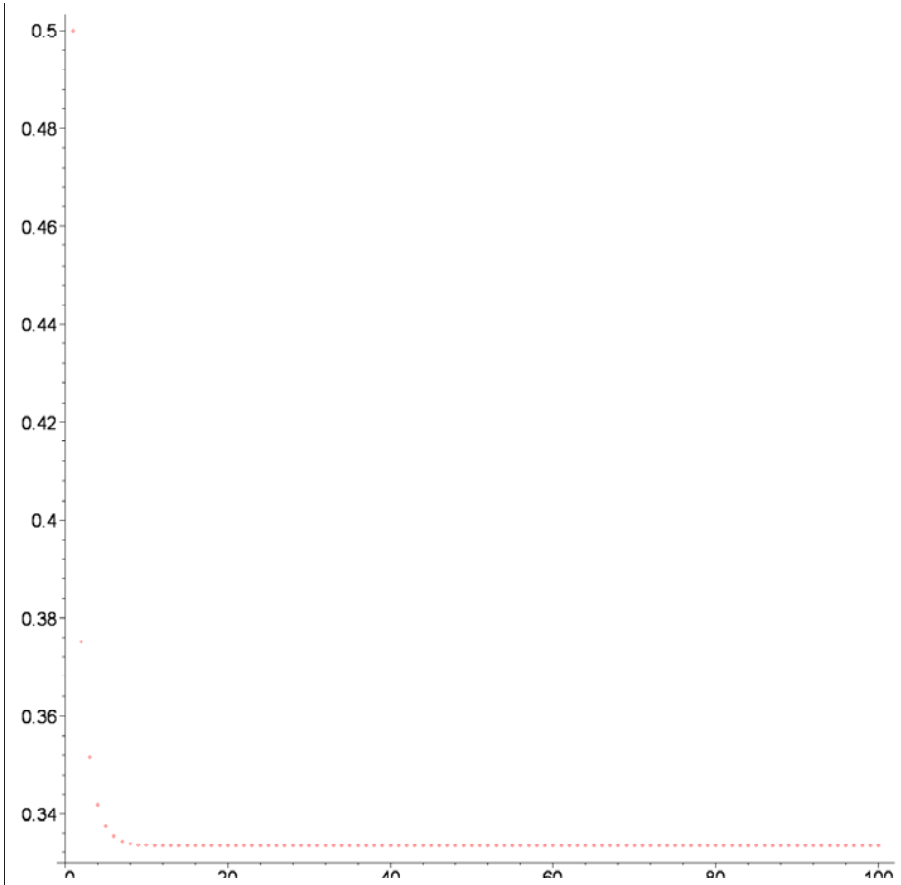


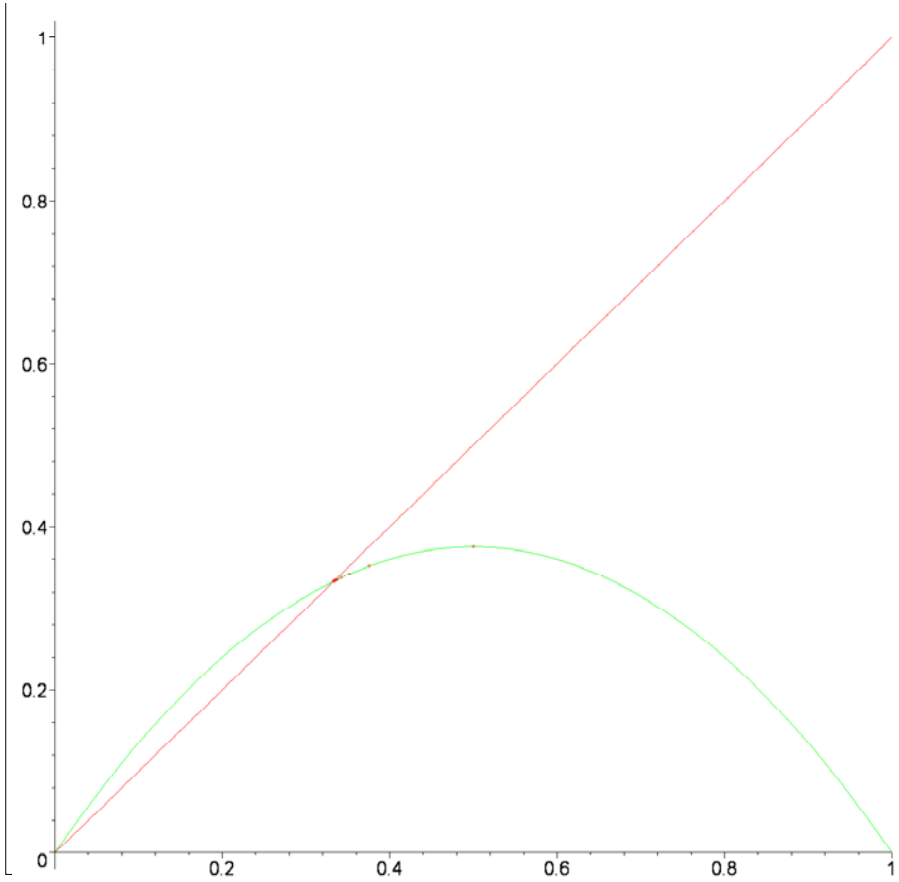

```
> suite(1);chaos(1);
```



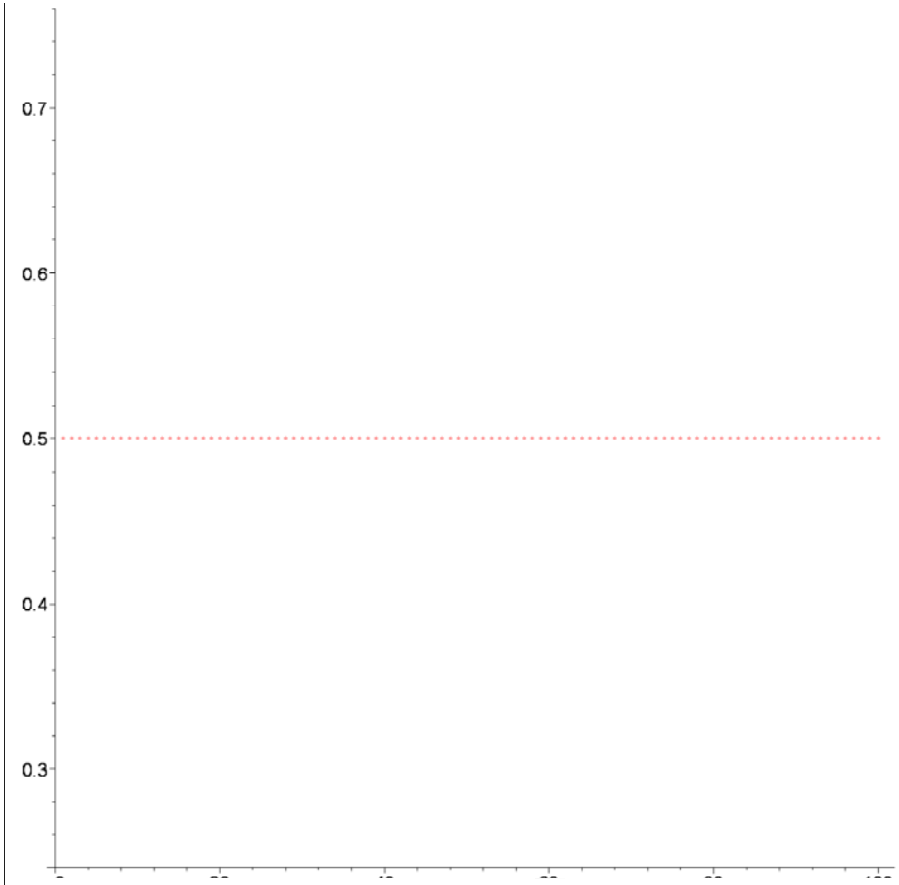


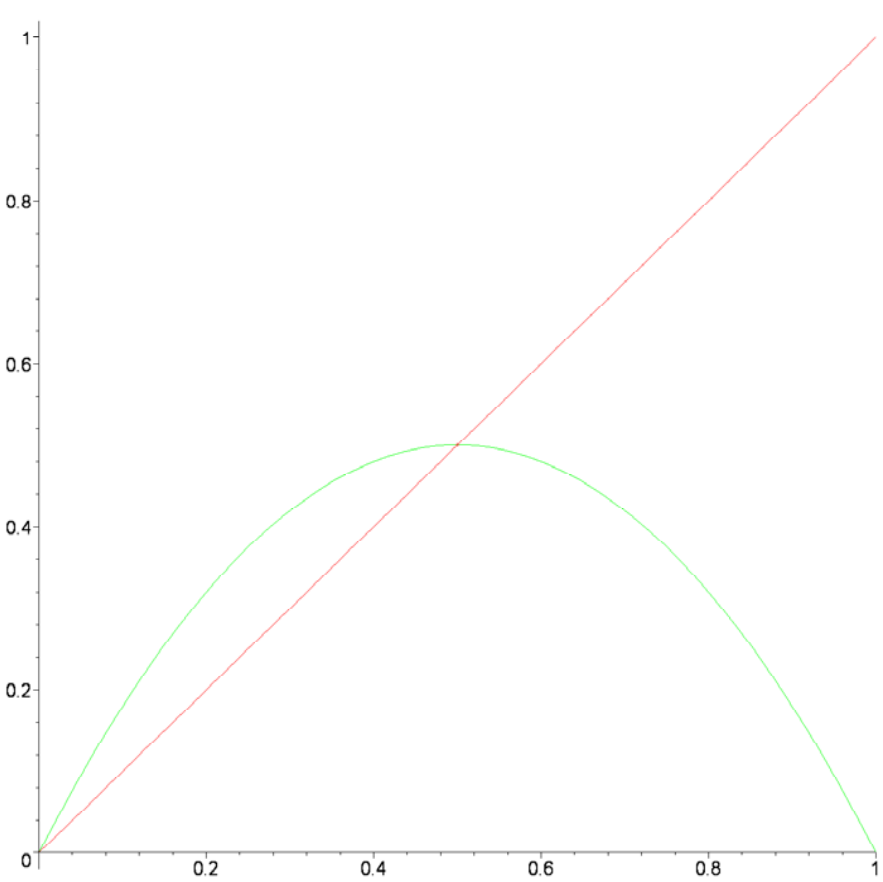

```
> suite(1.5);chaos(1.5);
```



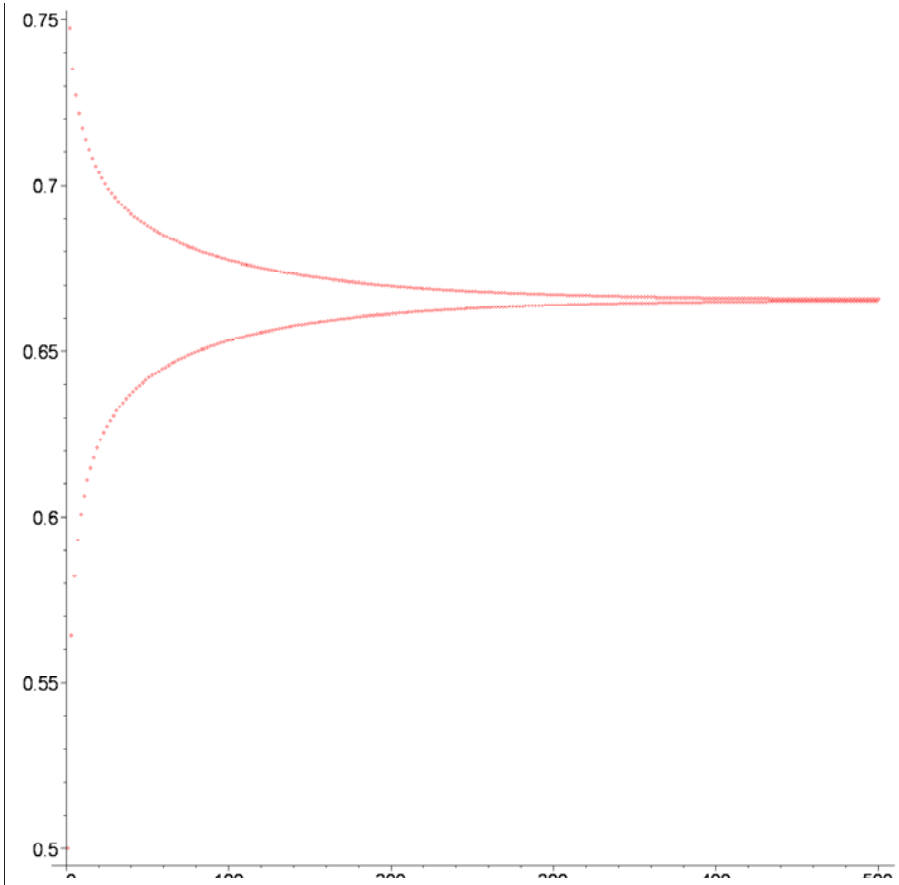


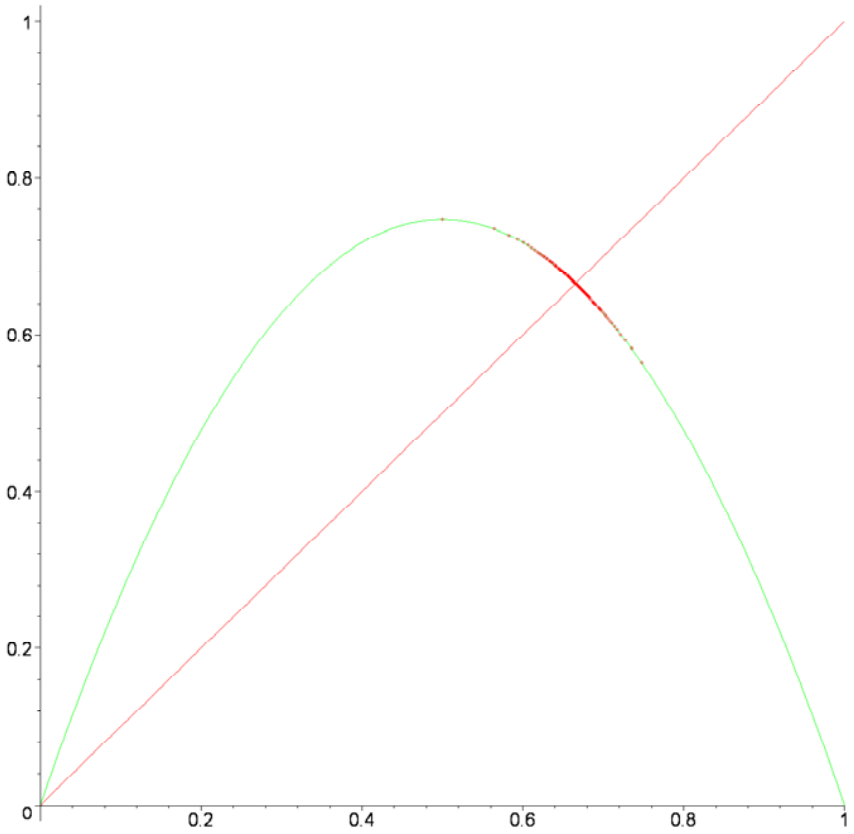

```
> suite(2);chaos(2);
```



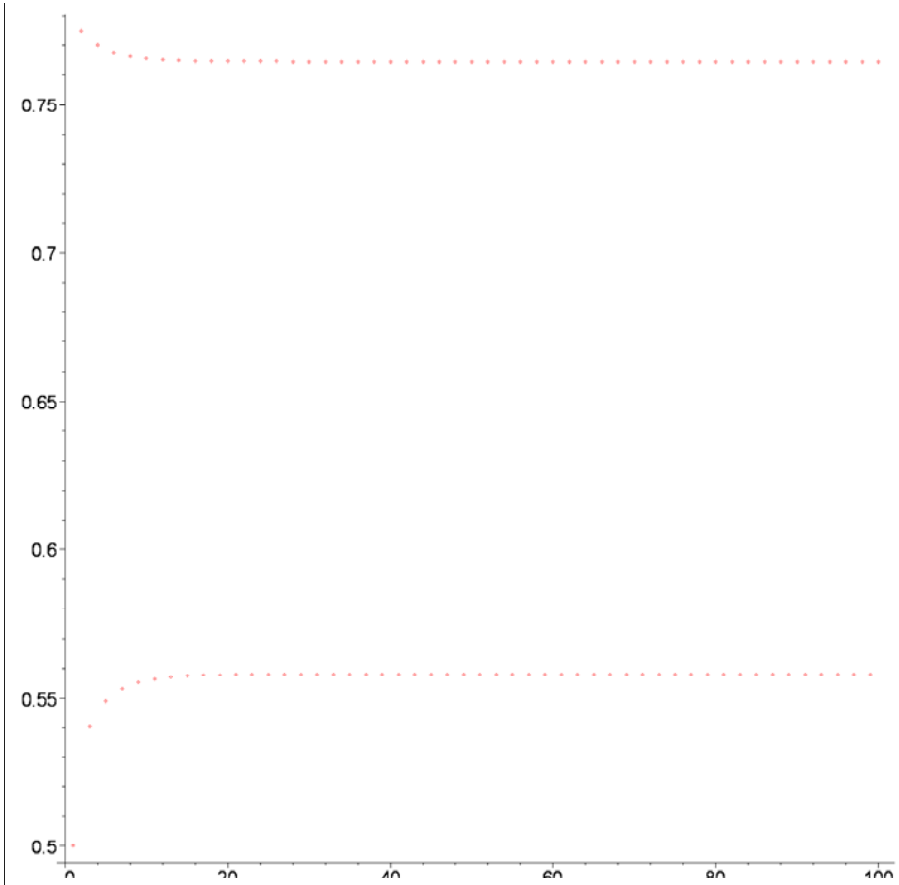


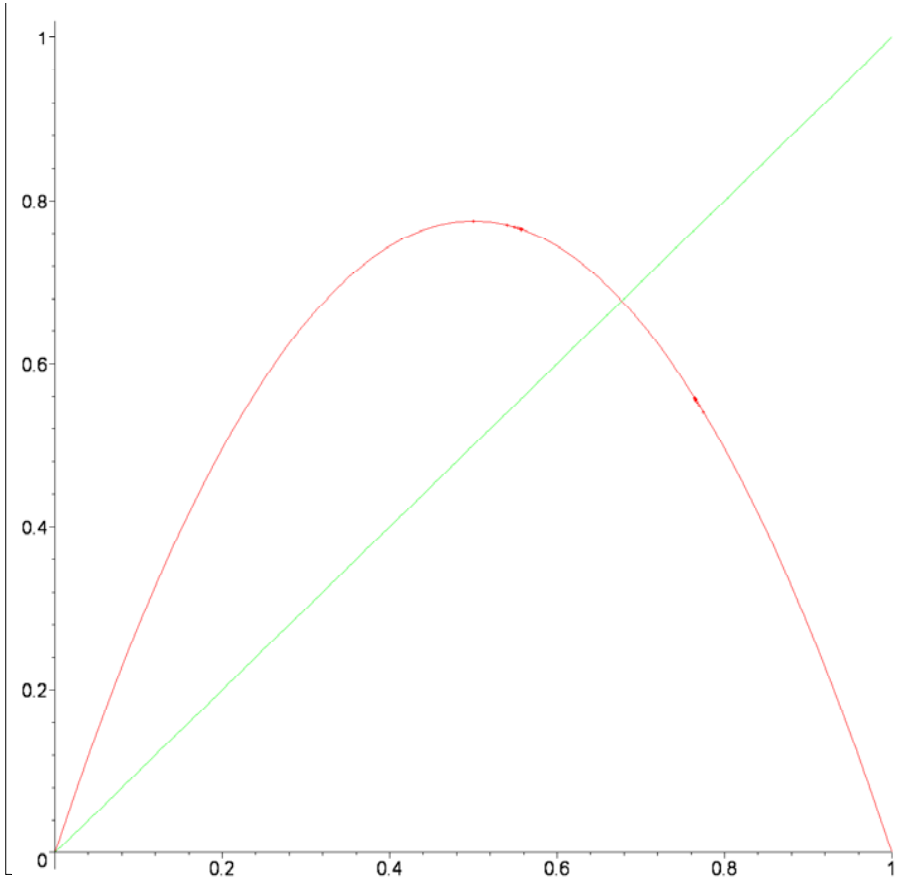

```
> suite(2.99,0,500);chaos(2.99,0,500);
```



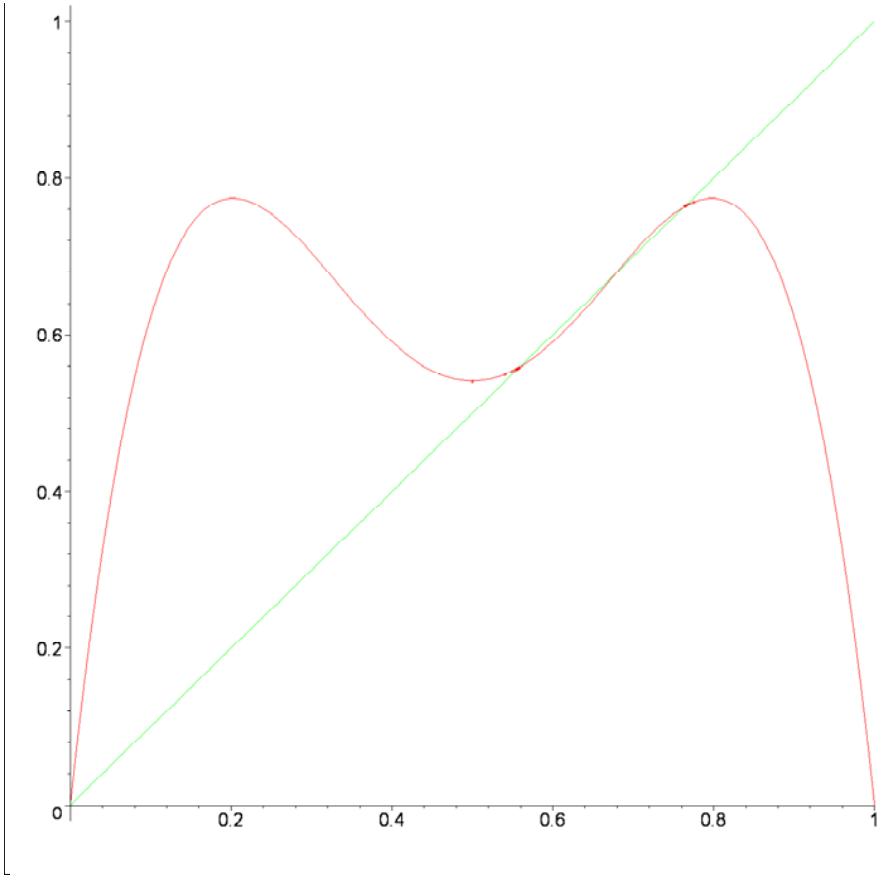



```
> suite(3.1);chaos(3.1);
```

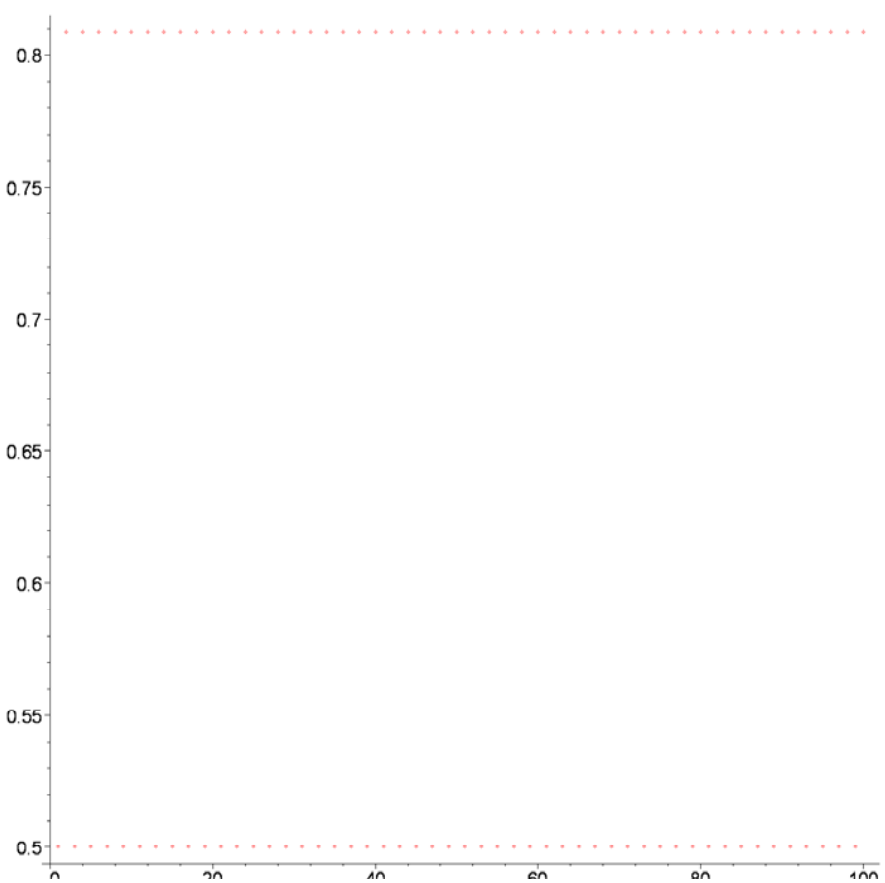


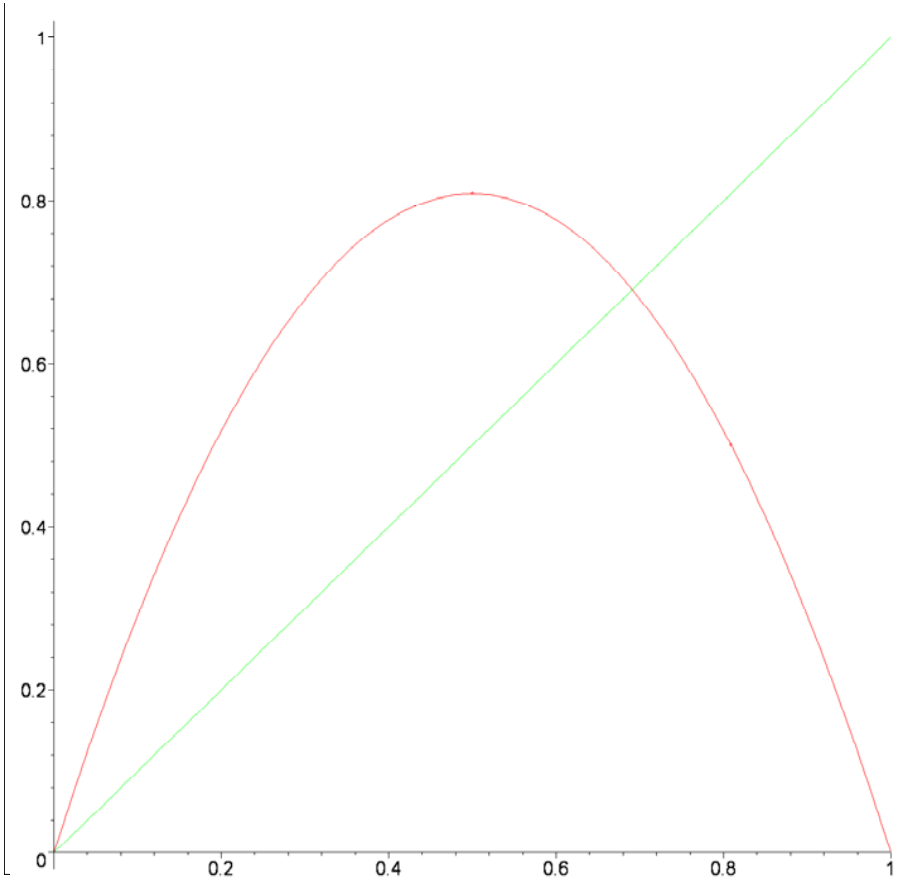



```
> chaos(3.1,0,100,f2);
```

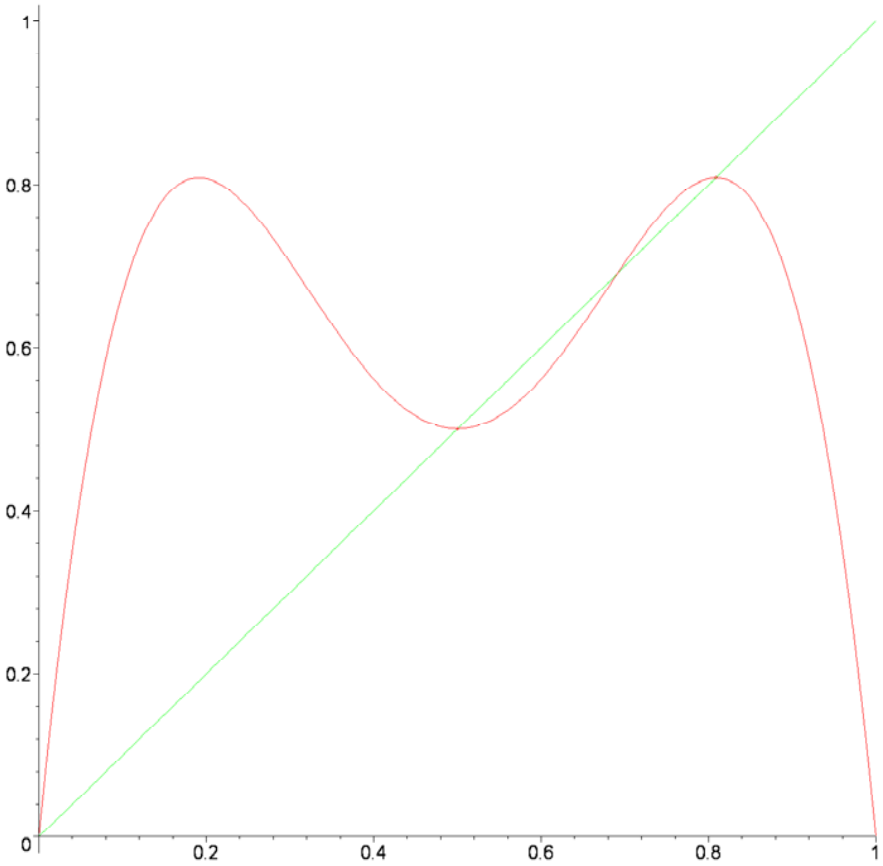



```
> suite(1+5.^(1/2));chaos(1+5.^(1/2));
```

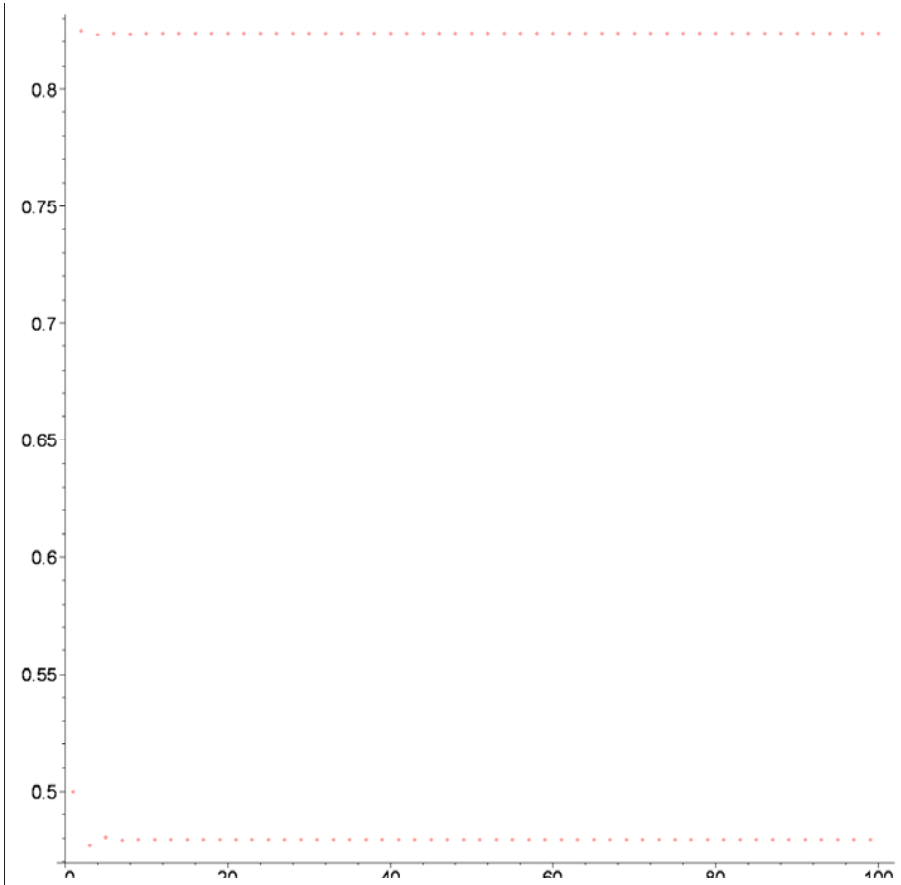


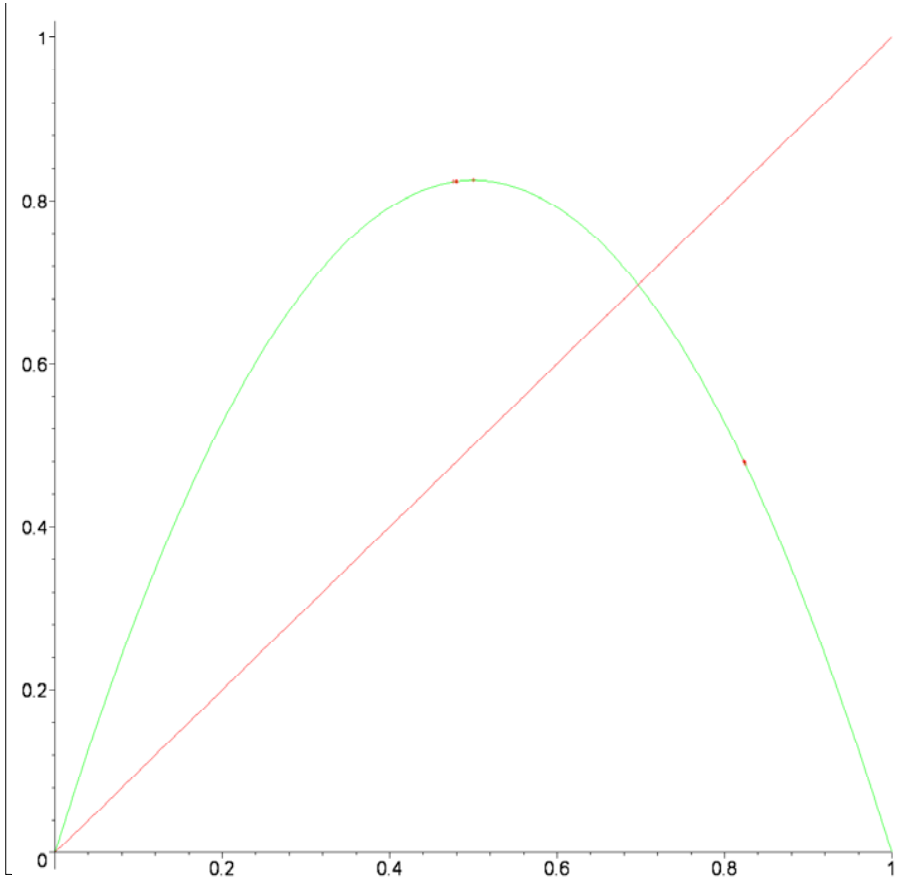



```
> chaos(1+5.^(1/2),0,100,f2);
```

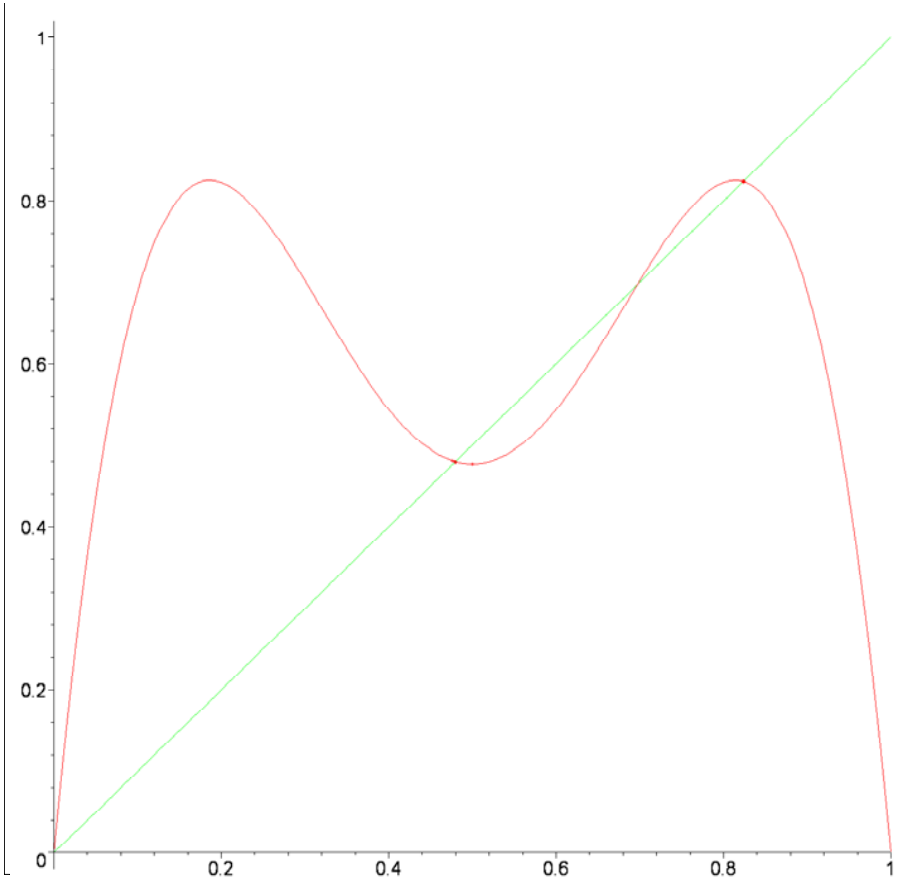



```
> suite(3.3);chaos(3.3);
```

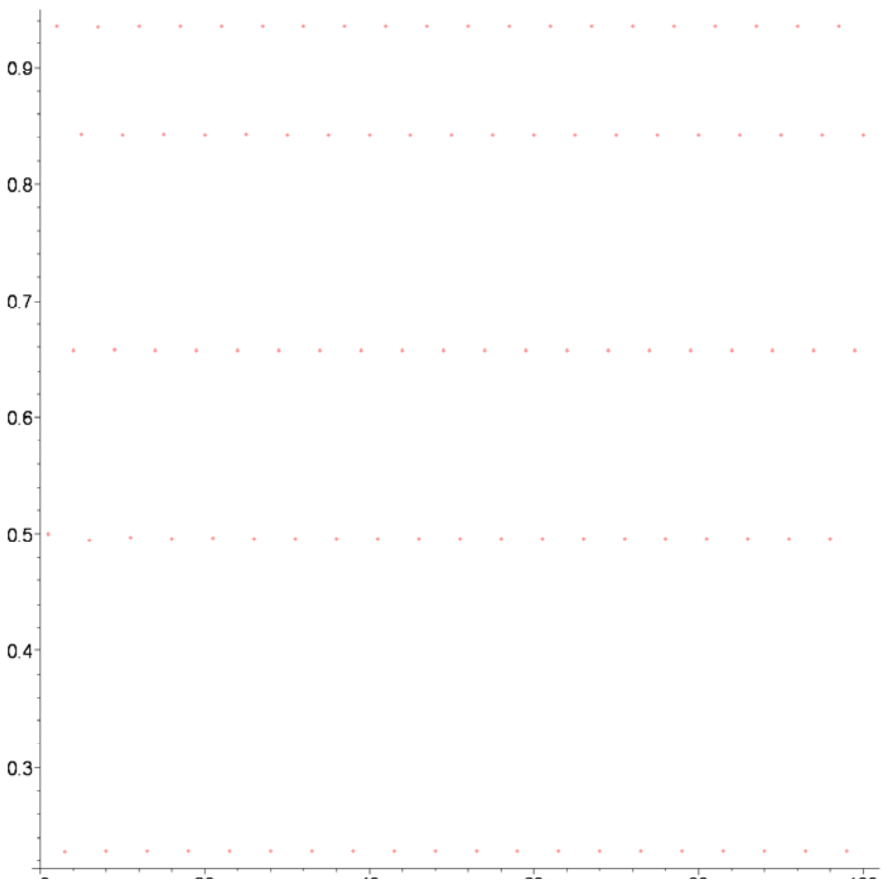


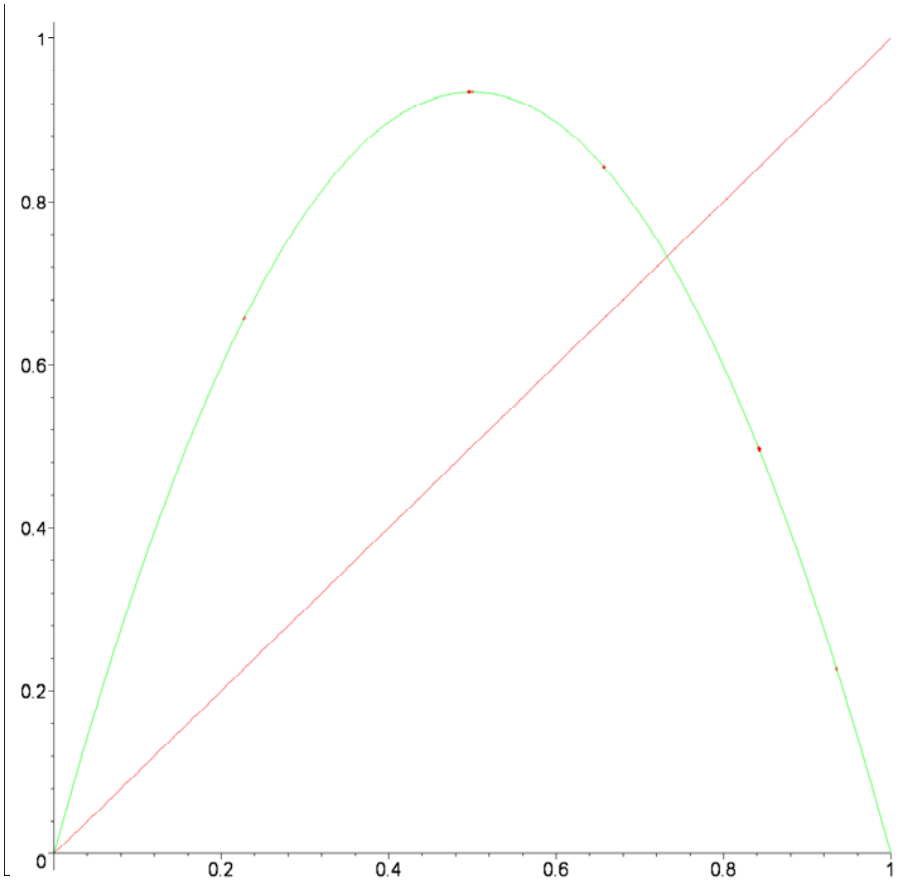



```
> chaos(3.3,0,100,f2);
```

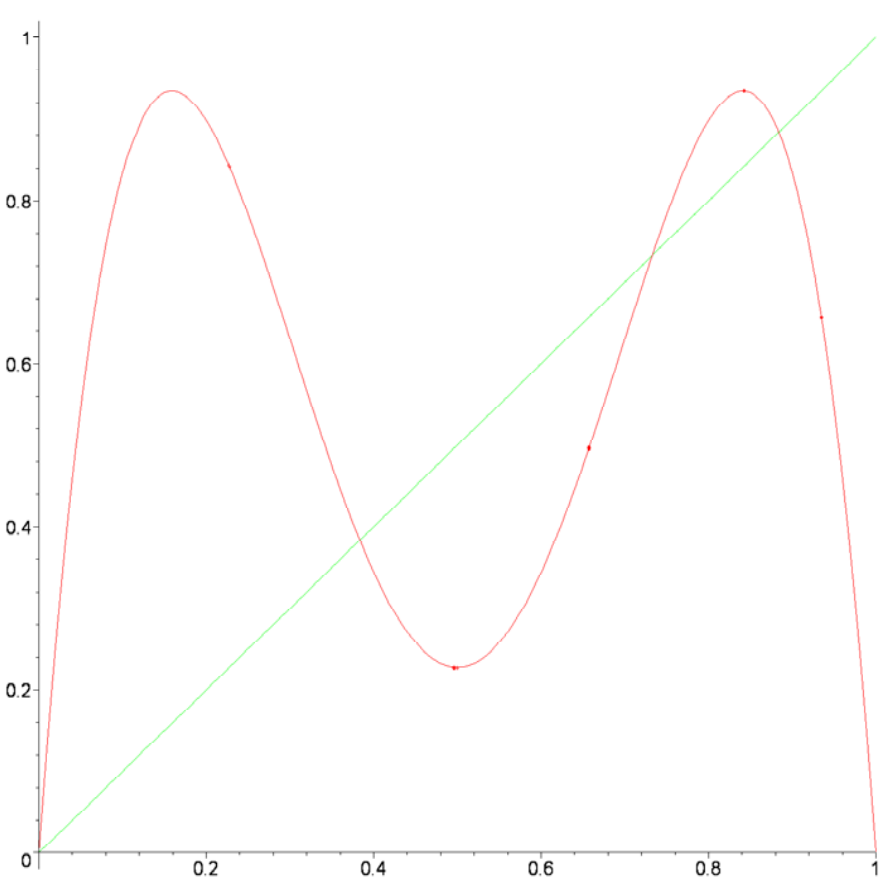



```
> suite(3.74);chaos(3.74);
```

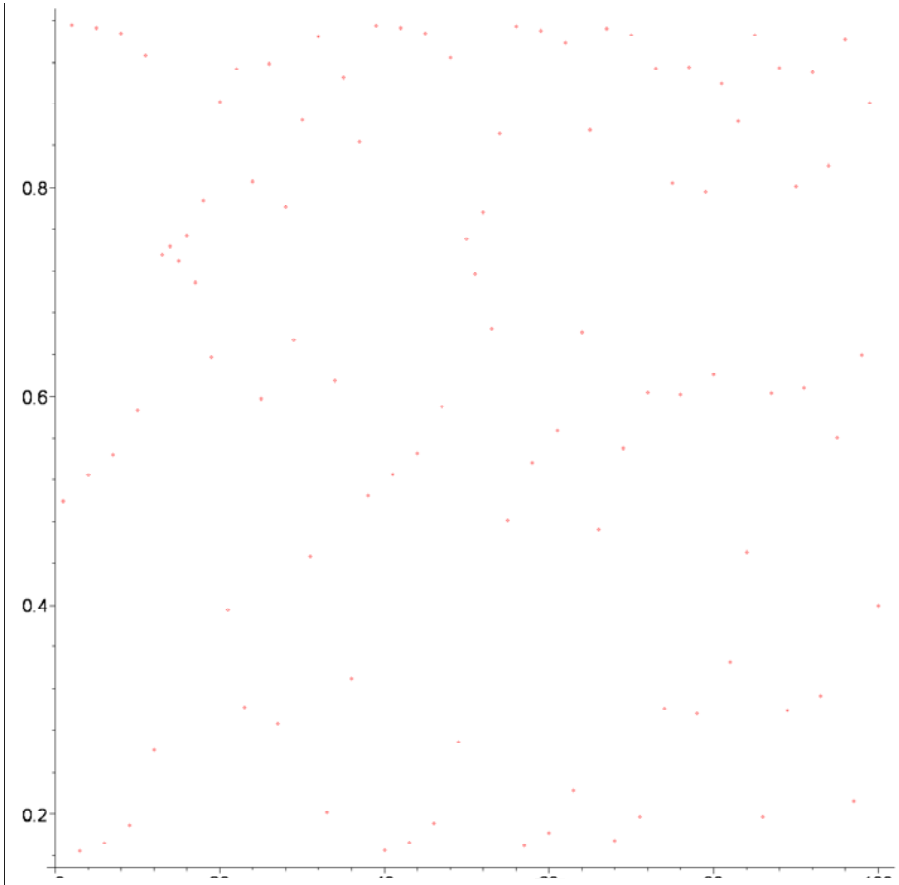


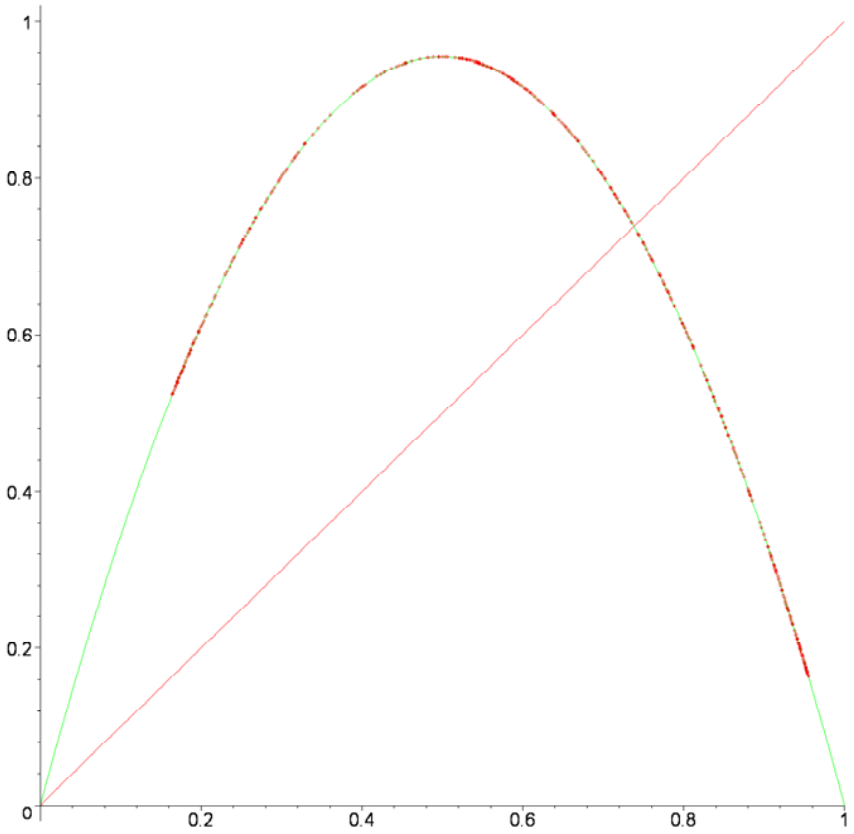



```
> chaos(3.74,0,100,f2);
```

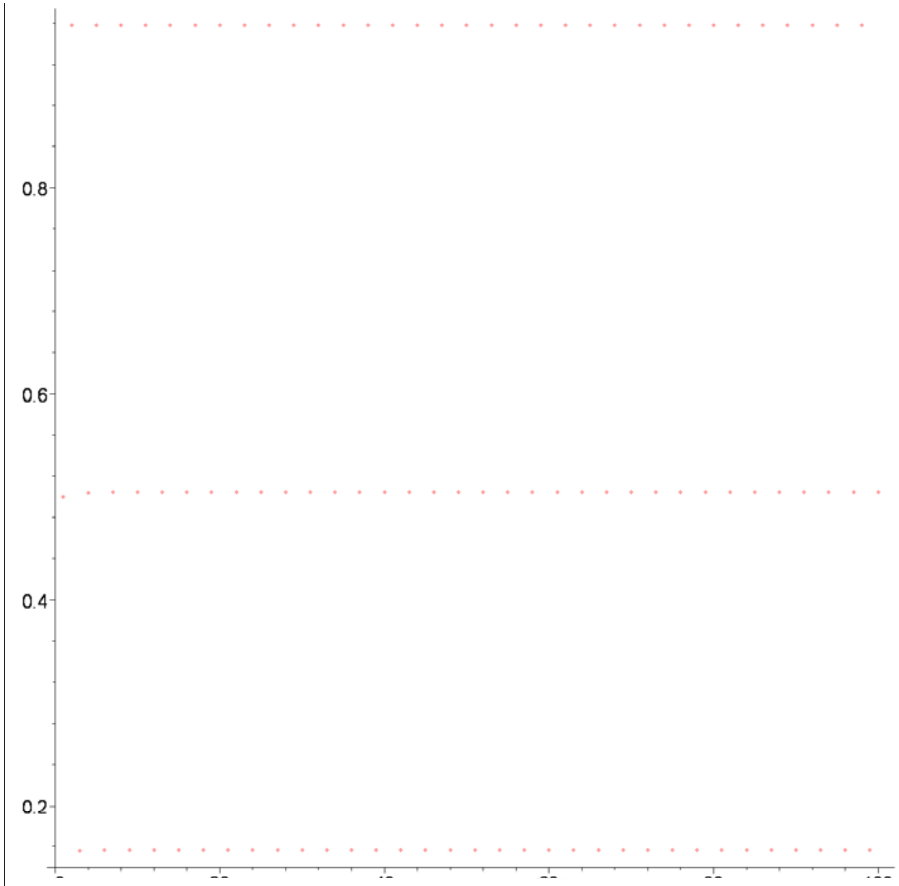


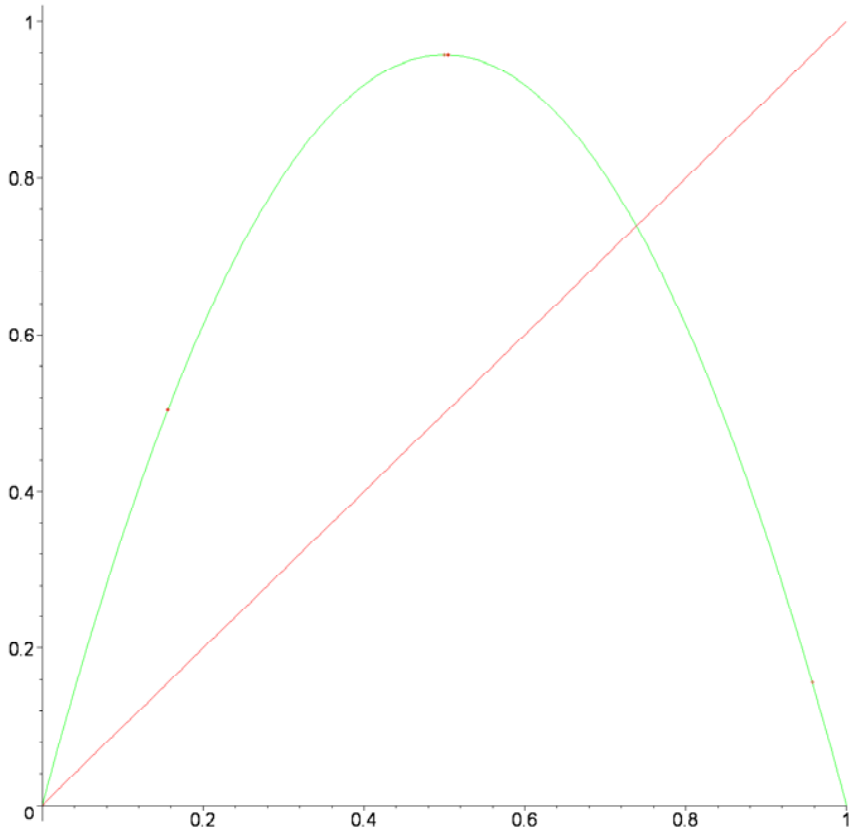

```
> suite(3.82);chaos(3.82,0,500);
```



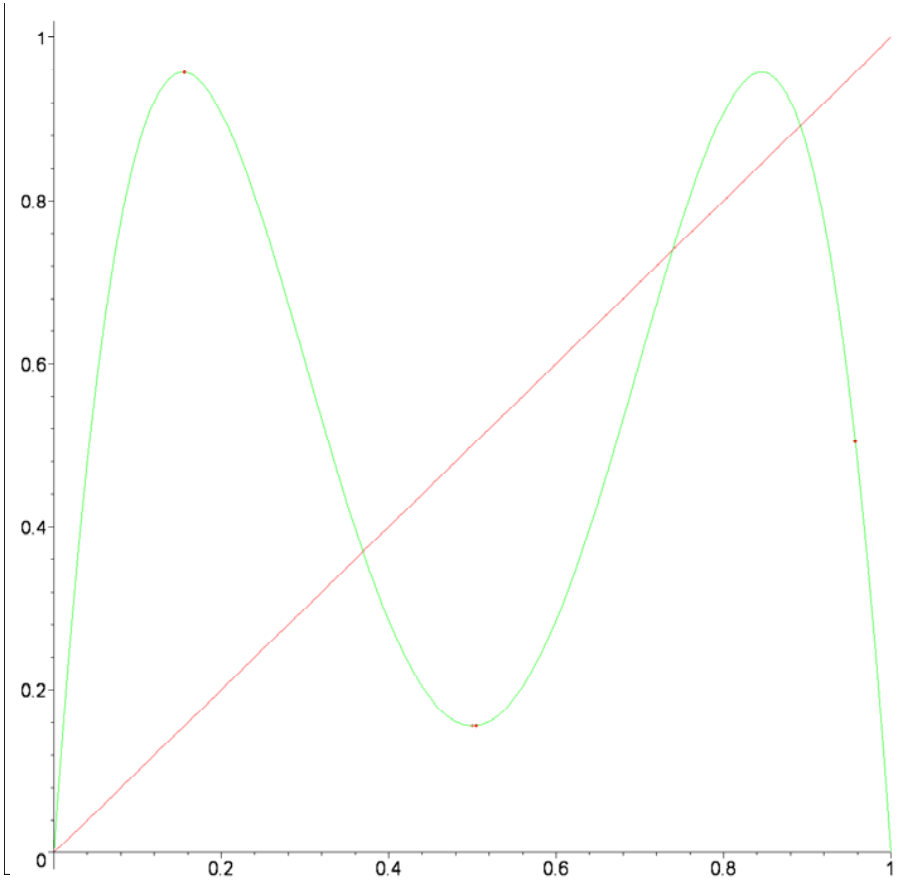



```
> suite(3.83);chaos(3.83);
```

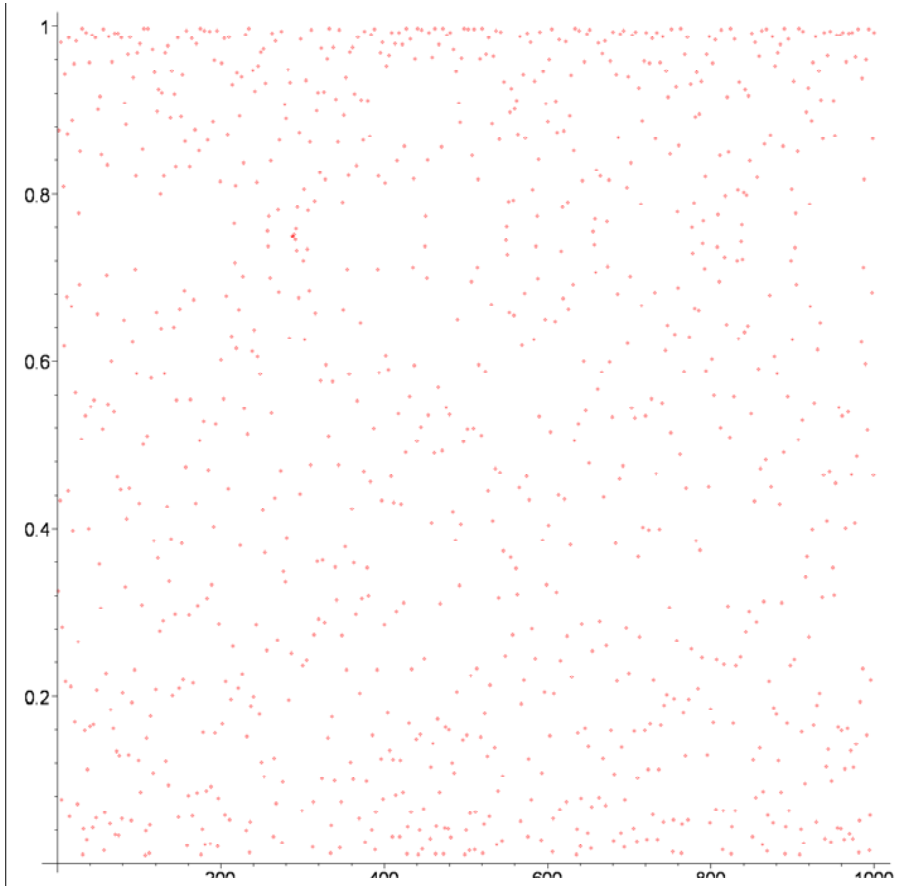


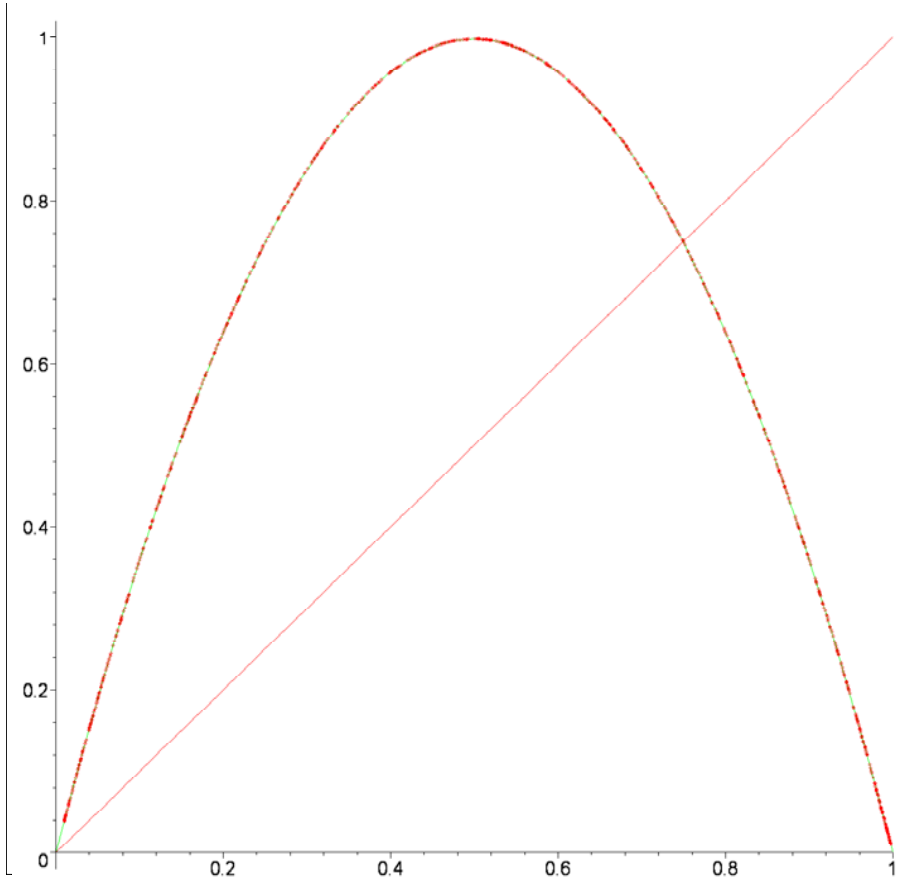



```
> chaos(3.83,0,100,f2);
```

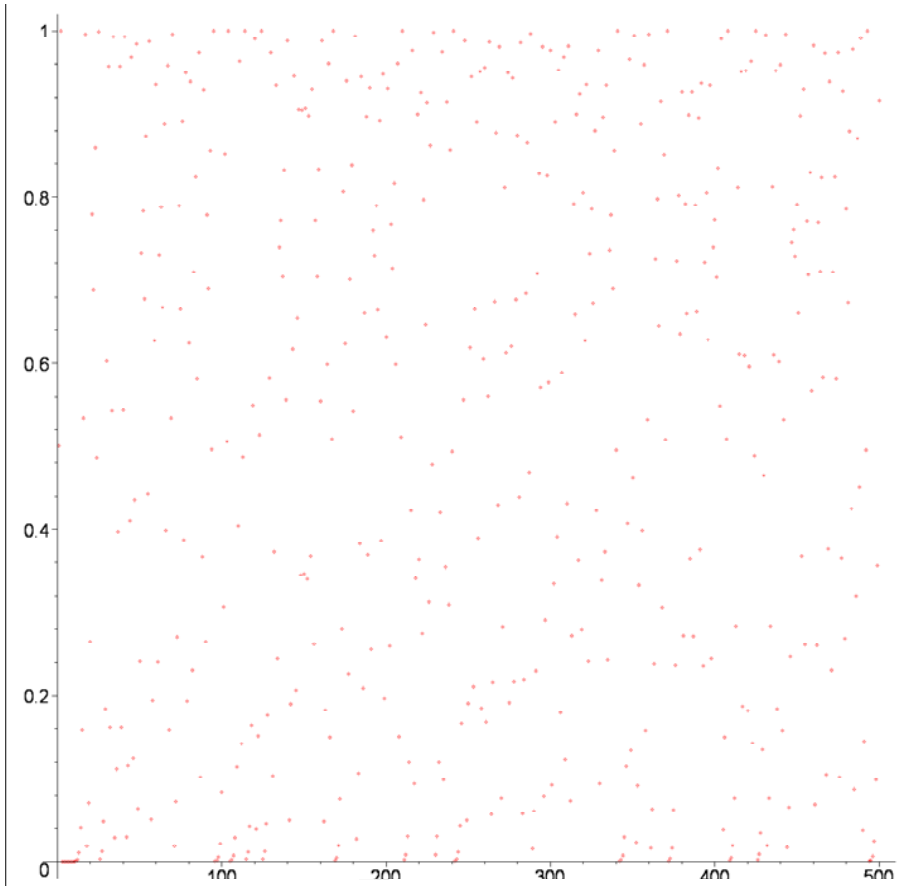


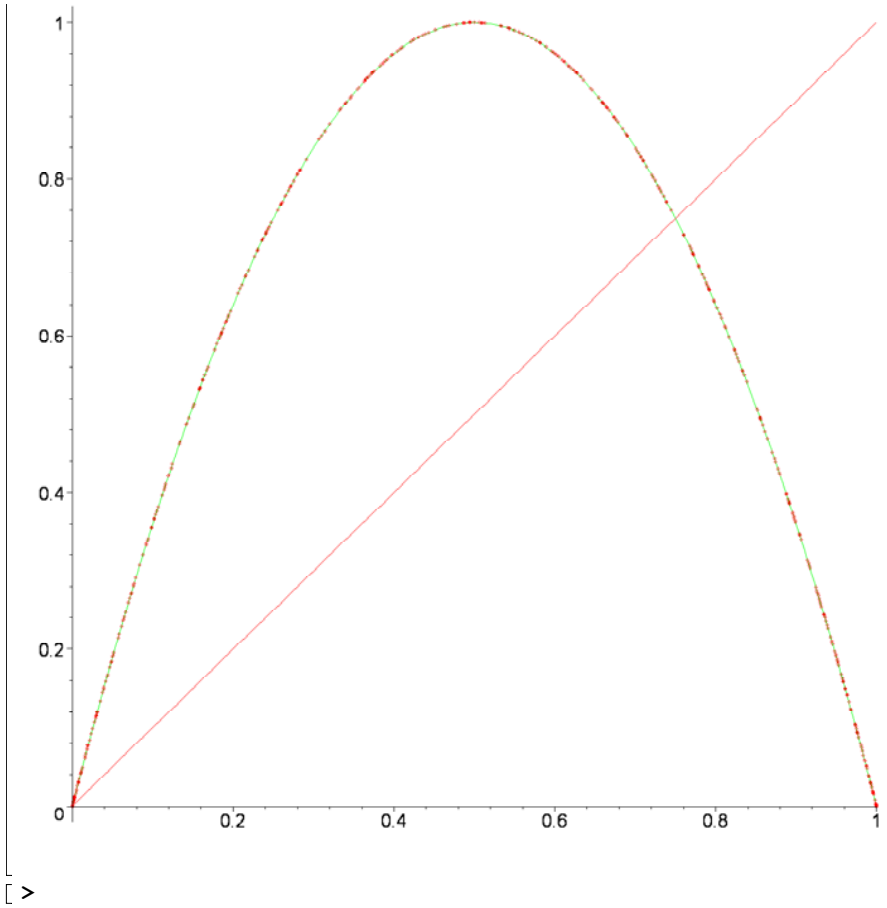

```
> suite(3.99,100,1000);chaos(3.99,100,1000);
```






```
> suite(3.99999999,0,500);chaos(3.99999999,0,500);
```


1
0.8
0.6
0.4
0.2
0
100
200
300
400
500


1
0.8
0.6
0.4
0.2
0
0.2
0.4
0.6
0.8
1

[>