



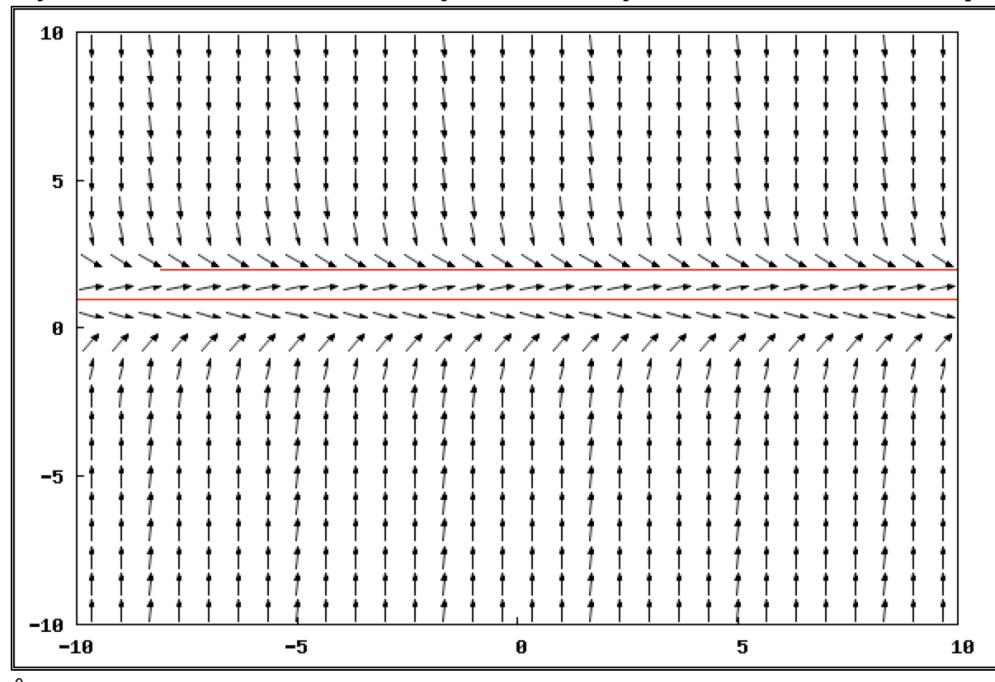
```
--> load("/Users/Visheshsaharan/Downloads/MATH280.mac")$  
MATH280.mac: help(MATH280) for contents
```

```
--> load("/Users/Visheshsaharan/Downloads/laplaceInv.mac")$
```

```
--> load("/Users/Visheshsaharan/Documents/eulermethod.mac")$
```

1A

```
--> wxdrawdf(-y^3+3*y^2-2*y,soln_at(0,1),soln_at(1,1),soln_at(2,2));  
Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font
```



(%t11)

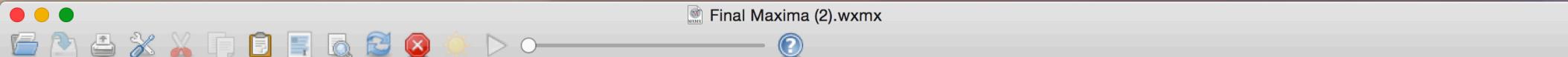
(%o11) 0

1B

Welcome to wxMaxima

Maxima is calculating

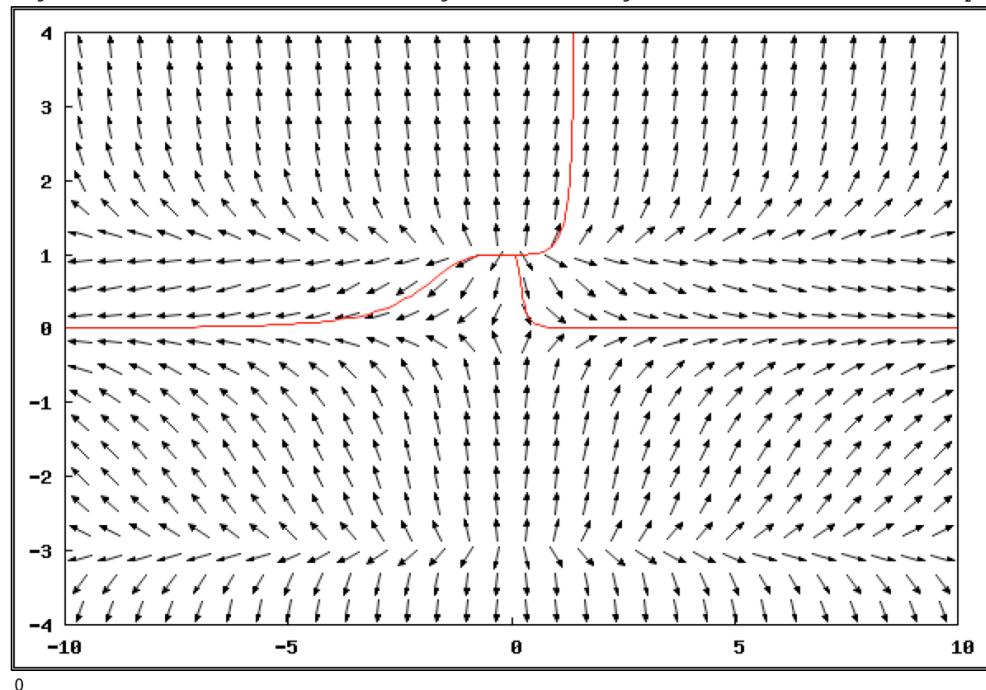




1B

```
--> g:[v,y^3+2*y^2-3*y];
(%o12) [ v, y^3+2 y^2-3 y ]
```

```
--> wxdrawdf(g,[v,-10,10],[y,-4,4],soln_at(0.3,0.3),soln_at(1.1,1.3),soln_at(-3.2,0.2));
Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font
```



1C/D

```
--> A1:[a*s-b*w,-y*s*w];
(%o35) [ a s-b w, -s w y ]
```

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Maxima is calculating



```

1C/D
--> A1:[a*s-b*w,-y*s*w];
(%o35) [ a s - b w , - s w y ]

--> eq1:solve(modell,[s,w]);
(%o36) [ [ s = 0 , w = 0 ] ]

--> M:matrix([diff(A1[1],s),diff(A1[1],w)],[diff(A1[2],s), diff(A1[2],w)]);
(%o31) ⎡ a -b
          ⎣ -w y -s y

--> subst(eq1[1],M);
(%o33) ⎡ a -b
          ⎣ 0 0

--> eigenvalues(%);
(%o34) [ [ a , 0 ], [ 1 , 1 ] ]

2ABC
--> kill(all);
remvalue: help doesn't appear to be a known variable; just unbind it anyway.
(%o0) done

--> eq2:'diff(v,t)=-g-c*v;
(%o71) v  $\frac{d}{dt}$  v = -c v - g

--> A:odesolve(eq2,v,t);
(%o72) v = %e^{-c t} \left( \frac{g \% e^{c t}}{c} \right)

--> sol:ic1(A,v=0,t=0);
(%o103) v = - \frac{\% e^{-c t} (g \% e^{c t} - g)}{c}

```





```
--> expand(sol);
(%o23) v =  $\frac{g e^{-ct}}{c} - \frac{g}{c}$ 
```

2E

```
--> eq3:'diff(v,t)=-g-c*v^3;
(%o91) v \frac{d}{dt} = -c v^3 - g
```

```
--> B:odesolve(eq3,v,t);
Is c g positive or negative? positive;
(%o93) 
$$\frac{3 \operatorname{i} \log\left(\frac{(\sqrt{3} \operatorname{i} + 1) g^{1/3} - 2 c^{1/3} v}{2 c^{1/3} v + (\sqrt{3} \operatorname{i} - 1) g^{1/3}}\right) + \sqrt{3} \log(c^{2/3} v^2 - c^{1/3} g^{1/3} v + g^{2/3}) - 2 \sqrt{3} \log\left(\frac{c^{1/3} v + g^{1/3}}{c^{1/3}}\right)}{2^{3/2} c^{1/3} g^{2/3}} = t + %c$$

```

```
--> sol2:ic1(B,v=0,t=0);
(%o39) 
$$\frac{3 \operatorname{i} \log\left(\frac{(\sqrt{3} \operatorname{i} + 1) g^{1/3} - 2 c^{1/3} v}{2 c^{1/3} v + (\sqrt{3} \operatorname{i} - 1) g^{1/3}}\right) + \sqrt{3} \log(c^{2/3} v^2 - c^{1/3} g^{1/3} v + g^{2/3}) - 2 \sqrt{3} \log\left(\frac{c^{1/3} v + g^{1/3}}{c^{1/3}}\right)}{2^{3/2} c^{1/3} g^{2/3}} = \frac{18 c^{1/3} g^{2/3} t + 2 \log(g) - 6 \log\left(\frac{g^{1/3}}{c^{1/3}}\right) + 3^{3/2} \operatorname{i} \log\left(-\frac{2}{\sqrt{3} \operatorname{i} + 1}\right)}{18 c^{1/3} g^{2/3}}$$

```

```
--> kill(all);
(%o0) done
```

3

```
--> sol1:odesolve('diff(y,t,2)+4*'diff(y,t,1)+4*y=0,y,t);
(%o5) y = (%k2 t + %k1) e^{-2t}
```

```
--> sol2:odesolve('diff(y,t,2)+4*'diff(y,t,1)+4*y=cos(t),y,t);
(%o6) y = 
$$\frac{4 \sin(t) + 3 \cos(t)}{25} + (%k2 t + %k1) e^{-2t}$$

```

```
--> ic2(sol2,t=0,y=0,'diff(y,t)=1);
4 \sin(t) + 3 \cos(t) / 3 t^3
```





3

```
--> sol1:odesolve('diff(y,t,2)+4*'diff(y,t,1)+4*y=0,y,t);
(%o5) y=(%k2 t + %k1) %e^-2 t
```

```
--> sol2:odesolve('diff(y,t,2)+4*'diff(y,t,1)+4*y=cos(t),y,t);
(%o6) y=  $\frac{4 \sin(t) + 3 \cos(t)}{25} + (%k2 t + %k1) %e^{-2 t}$ 
```

```
--> ic2(sol2,t=0,y=0,'diff(y,t)=1);
(%o8) y=  $\frac{4 \sin(t) + 3 \cos(t)}{25} + \left(\frac{3}{5}t - \frac{3}{25}\right) %e^{-2 t}$ 
```

5AB

```
--> sol1:eulermethod(-9.8-v,0,1,1,20)$
```

```
--> eq1: 'diff(v,t)=-g-c*v;
(%o59) v \frac{d}{dt} = -c v - g
```

```
--> params:[g=9.8,c=1];
(%o108) [ g=9.8 , c=1 ]
```

```
--> A1:subst(params,eq1);
(%o110) v \frac{d}{dt} = -v - 9.8
```

```
--> A2:odesolve(A1,v,t);
rat: replaced 9.8 by 49/5 = 9.8 rat: replaced 9.8 by 49/5 = 9.8 rat: replaced 9.8 by 49/5 = 9.8
(%o111) v=%e^-t \left( %c - \frac{49 \%e^t}{5} \right)
```

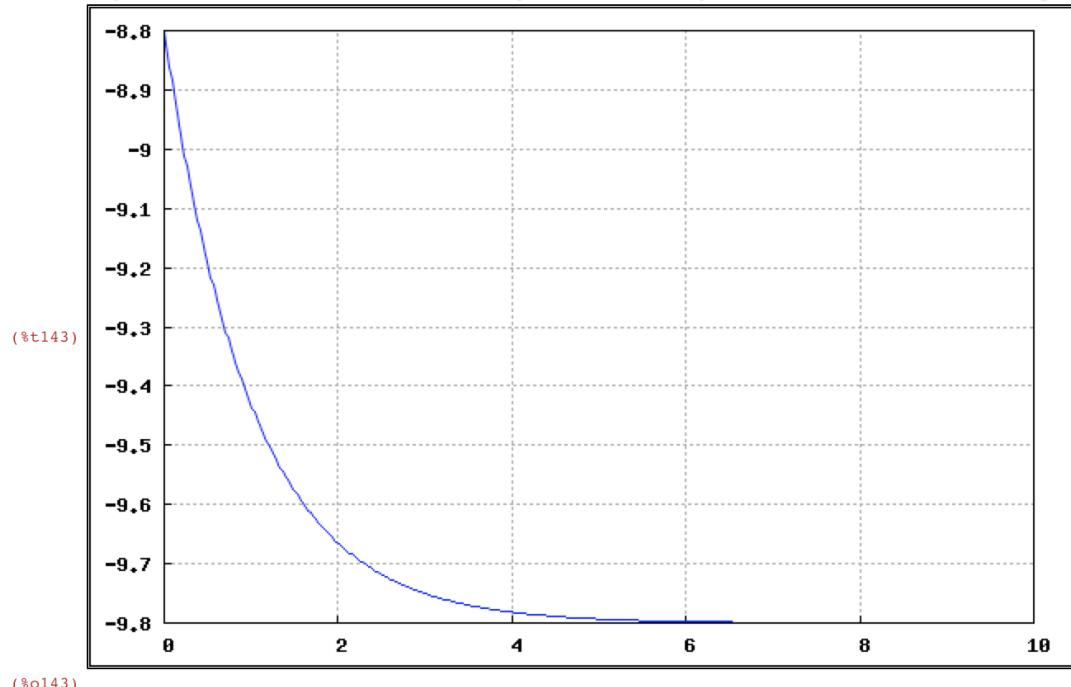
```
--> A3:rhs(A2);
(%o112) %e^-t \left( %c - \frac{49 \%e^t}{5} \right)
```

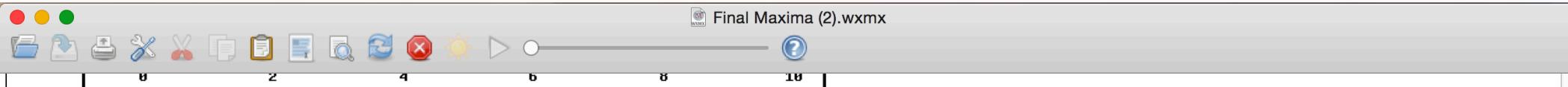


```
--> A2:odesolve(A1,v,t);
rat: replaced 9.8 by 49/5 = 9.8 rat: replaced 9.8 by 49/5 = 9.8 rat: replaced 9.8 by 49/5 = 9.8
(%o111) v=%e^-t  $\left( \frac{49}{5} \cdot \frac{e^t}{c} \right)$ 
```

```
--> A3:rhs(A2);
(%o112) %e^-t  $\left( \frac{49}{5} \cdot \frac{e^t}{c} \right)$ 
```

```
--> wxdraw2d(explicit(%e^-t-9.8,t,0,10),grid=on);
Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font
```

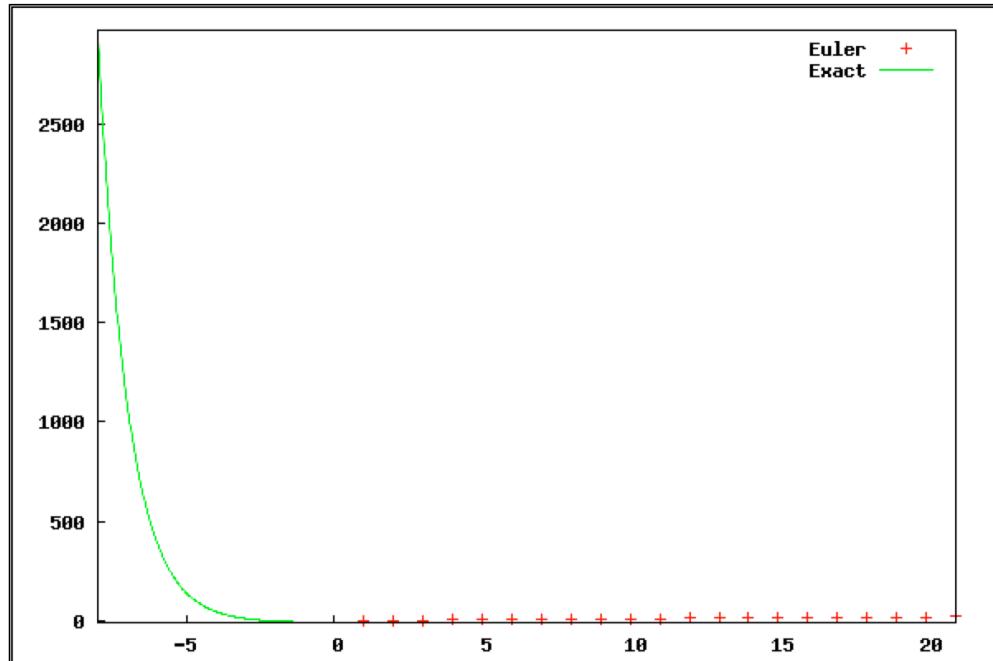




(%o143)

```
--> wxdraw2d(key="Euler",color=red,points(soll[1]),color=green,key="Exact",
            explicit(%e^-t-9.8,t,-8,10));
```

Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font



(%t146)

(%o146)

5CD

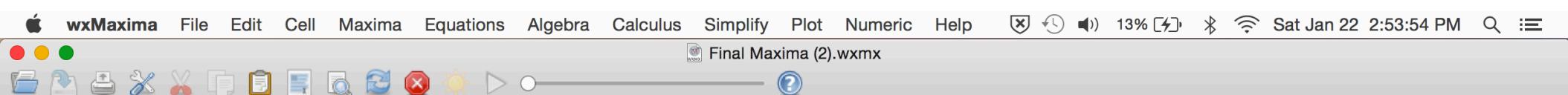
```
--> f:[v,cos(t)-4*v-4*y];
(%o74) [ v, -4 y-4 v+cos(t)]
```

```
--> s1:rkf45(f,[y,v],[0.25,0.2],[t,0,25],report=true)$
----- Info: rkf45: Integration points selected: 286      Total number of iterations: 301      Bad steps corrected:
```

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```
5CD
--> f:[v,cos(t)-4*v-4*y];
(%o74) [v, -4 y-4 v+cos(t)]

--> s1:rkf45(f,[y,v],[0.25,0.2],[t,0,25],report=true)$
----- Info: rkf45: Integration points selected: 286      Total number of iterations: 301      Bad steps corrected:
16      Minimum estimated error: 2.278598882625432 10^-8      Maximum estimated error: 7.437678279618282 10^-7 Minimum integration step taken: 0.03676684826627508
Maximum integration step taken: 0.1604506979617147 ----

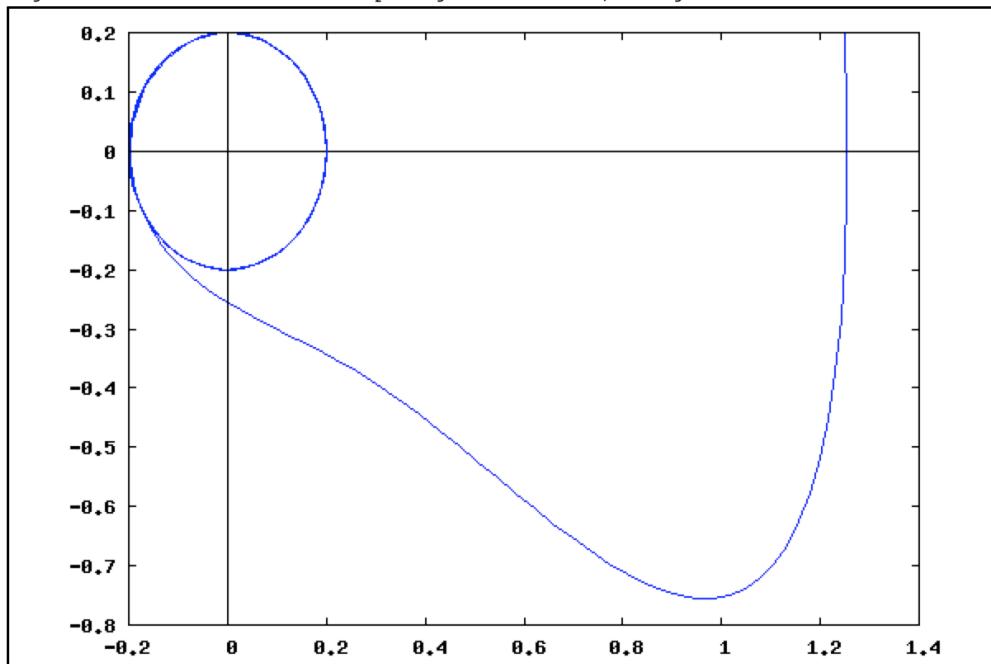
--> s2:rkf45(f,[y,v],[1.25,0.2],[t,0,25],report=true)$
----- Info: rkf45: Integration points selected: 299      Total number of iterations: 309      Bad steps corrected:
11      Minimum estimated error: 2.49462903696424 10^-8      Maximum estimated error: 8.722006218820982 10^-7 Minimum integration step taken: 0.03069399236892642
Maximum integration step taken: 0.1580530060466578 ----

--> wxphaseplot2d(s1);
wxphaseplot2d(s2);
Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font
fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font
(%t121)
```



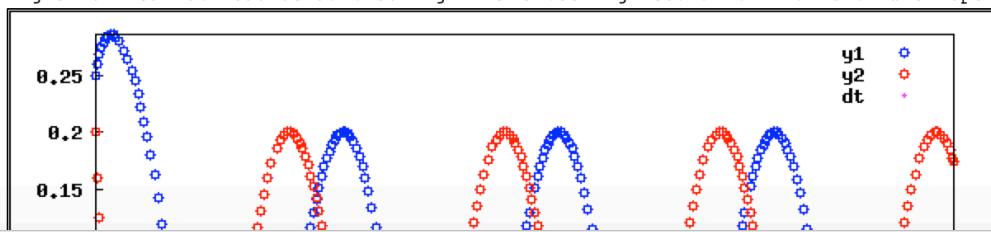


(%o121) Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font
fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font



(%o122)

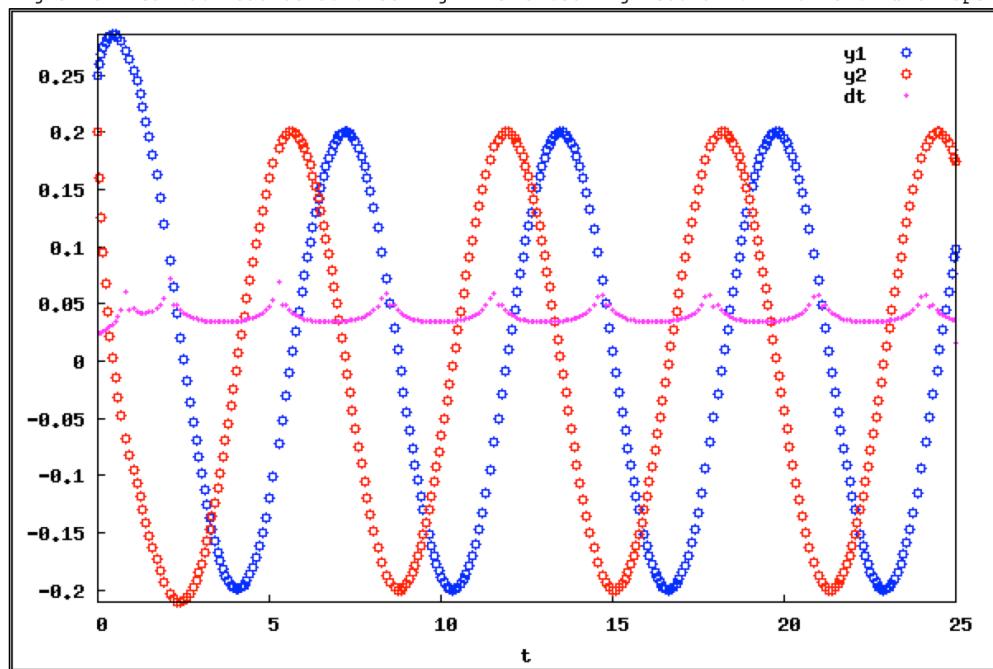
--> wxtimeplot(s1);
Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font





(%o122)

```
--> wxtimeplot(s1);  
Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font
```



(%o123)

(%o123)

```
--> wxtimeplot(s2);  
Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font
```



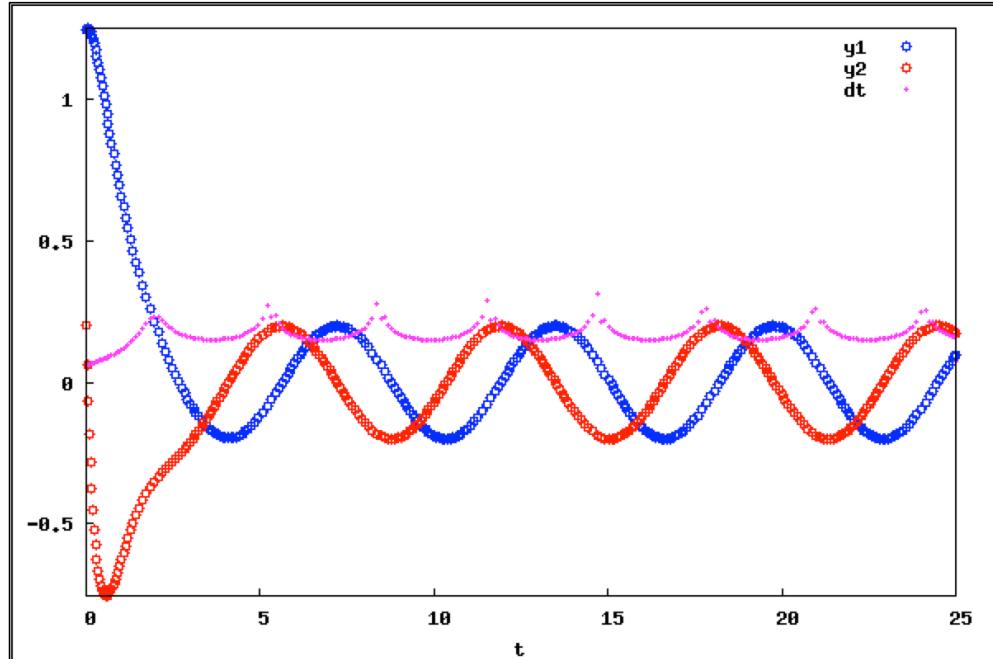
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(%o123)

--> wxtimeplot(s2);
Fontconfig error: Cannot load default config file fontconfig: Couldn't find font. when opening font "arial", using internal non-scalable font



(%o131)