p2ed

(parcialillo 2 de ecuaciones)

Problema 1.

```
var('t');X=function('X',t);Y=function('Y',t)
desolve(t^2*diff(X,t,2)-t*diff(X,t)==4*ln(t),X)
```

```
k1*t^2 - log(t)^2 + k2 - log(t) - 1/2
```

Problema 2.

```
eX=diff(X,t)-2*X-Y;eY=diff(Y,t)-2*X-3*Y
desolve_system([eX==2*exp(2*t),eY==3*exp(t)],[X,Y],ics=[0,1,-3])
```

```
[X(t) == -t*e^t + e^(2*t), Y(t) == t*e^t - 2*e^(2*t) - e^t]
```

Problema 3.

```
var('b,z');P(b)=z^4+9*z^3+b*z^2+36*z+16
dP=diff(P(b),z);eP=factor(4*P(b)-z*dP)
fP=9*dP-4*eP;gP=factor((9*eP-16*dP)/z);db=solve([fP==0,gP==0],z,b)
fP;gP;db[2],db[3];show([db[0],db[1]])
```

```
-8*b*z^2 + 18*b*z + 243*z^2 - 432*z + 68
18*b*z + 17*z^2 - 32*b - 432*z + 972
([z == -2, b == 28], [z == 2, b == -44])
```

$$\left[\left[z=-\frac{1}{4}\sqrt{17}-\frac{9}{4}, b=\left(\frac{113}{4}\right)\right], \left[z=\frac{1}{4}\sqrt{17}-\frac{9}{4}, b=\left(\frac{113}{4}\right)\right]\right]$$

```
factor(P(-44)),factor(P(28));factor(P(113/4))
```

```
((z - 2)^2*(z^2 + 13*z + 4), (z + 1)*(z + 2)^2*(z + 4))
1/4*(2*z^2 + 9*z + 8)^2
```

```
factor(P(-62)),factor(P(-28));factor(P(-14)),factor(P(-2))
```

```
((z - 4)*(z - 1)*(z^2 + 14*z + 4), (z^2 - 3*z + 4)*(z^2 + 12*z +
((z^2 - 2*z + 4)*(z^2 + 11*z + 4), (z^2 - z + 4)*(z^2 + 10*z + 4)
```

```
factor(P(8)),factor(P(16));factor(P(22)),factor(P(26))
```

```
((z^2 + 4)*(z^2 + 9*z + 4), (z^2 + z + 4)*(z^2 + 8*z + 4))
((z^2 + 2*z + 4)*(z^2 + 7*z + 4), (z^2 + 3*z + 4)*(z^2 + 6*z + 4)
```

```
v=solve(P(b),z);r0(b)=v[0].right();r1(b)=v[1].right();
r2(b)=v[2].right();r3(b)=v[3].right();show(r1(b))
```

$$\frac{\sqrt{-2\left(\sqrt{-4b+113}+18\right)b+65\sqrt{-4b+113}+1017}\sqrt{2}}{4\left(-4b+113\right)^{\left(\frac{1}{4}\right)}}-\frac{1}{4}\sqrt{-4b+113}-\frac{9}{4}$$

```
var('a,c');bz(z)=solve(P(b),b)[0].right()
factor(imag(bz(a+c*i))*(a^2+c^2)^2)
```

```
-(a^2 + c^2 - 4)*(2*a^3 + 2*a*c^2 + 9*a^2 + 9*c^2 + 8*a)*c
```

```
bz(z=4*i-4),bz(z=-7/2),factor(P(5533/196));factor(P(81/2))
```

```
(81/2, 5533/196, 1/196*(2*z + 7)*(7*z + 8)*(14*z^2 + 61*z + 56))
1/2*(z^2 + 8*z + 32)*(2*z^2 + 2*z + 1)
```

```
n(5533/196),n(113/4),n(57/2)
```

```
(28.2295918367347, 28.2500000000000, 28.5000000000000)
```

```
nr0=r0(-44).n(digits=3);nr1=r1(-44).n(digits=3)
nr2=r2(-44).n(digits=3);nr3=r3(-44).n(digits=3)
ng0=r0(28).n(digits=3);ng1=r1(28).n(digits=3)
ng2=r2(28).n(digits=3);ng3=r3(28).n(digits=3)
qy=solve(P(113/4),z)
ny0=qy[0].right().n(digits=3);ny1=qy[1].right().n(digits=3)
nr0,nr1,nr2,nr3;ng0,ng1,ng2,ng3;ny0,ny1
```

```
(-12.7, -0.315, 2.00, 2.00)
(-4.00, -1.00, -2.00, -2.00)
(-3.28, -1.22)
```

```
n00=r0(-62).n(digits=3);n01=r1(-62).n(digits=3);
n02=r2(-62).n(digits=3);n03=r3(-62).n(digits=3);
n10=r0(-28).n(digits=3);n11=r1(-28).n(digits=3);
n12=r2(-28).n(digits=3);n13=r3(-28).n(digits=3);
n20=r0(-14).n(digits=3);n21=r1(-14).n(digits=3);
n22=r2(-14).n(digits=3);n23=r3(-14).n(digits=3);
n30=r0(-2).n(digits=3);n31=r1(-2).n(digits=3);
n32=r2(-2).n(digits=3);n33=r3(-2).n(digits=3);
n40=r0(8).n(digits=3);n41=r1(8).n(digits=3);
n42=r2(8).n(digits=3);n43=r3(8).n(digits=3);
n50=r0(16).n(digits=3);n51=r1(16).n(digits=3);
n52=r2(16).n(digits=3);n53=r3(16).n(digits=3);
n60=r0(22).n(digits=3);n61=r1(22).n(digits=3);
n62=r2(22).n(digits=3);n63=r3(22).n(digits=3);
n70=r0(26).n(digits=3);n71=r1(26).n(digits=3);
n72=r2(26).n(digits=3);n73=r3(26).n(digits=3);
n80=r0(5533/196).n(digits=3);n81=r1(5533/196).n(digits=3);
n82=r2(5533/196).n(digits=3);n83=r3(5533/196).n(digits=3);
n90=r0(81/2).n(digits=1);n91=r1(81/2).n(digits=1);
n92=r2(81/2).n(digits=1);n93=r3(81/2).n(digits=1)
nf0=r0(57/2).n(digits=2);nf1=r1(57/2).n(digits=2);
nf2=r2(57/2).n(digits=2);nf3=r3(57/2).n(digits=2);
nf0,nf1,nf2,nf3
```

```
(-3.4 - 0.75*I, -1.1 + 0.25*I, -3.4 + 0.75*I, -1.1 - 0.25*I)
```

```
n00,n01,n02,n03;n10,n11,n12,n13;n20,n21,n22,n23;n30,n31,n32,n33
```

```
(-13.7, -0.292, 1.00, 4.00)
(-11.7, -0.343, 1.50 - 1.32*I, 1.50 + 1.32*I)
(-10.6, -0.377, 1.00 - 1.73*I, 1.00 + 1.73*I)
(-9.58, -0.417, 0.500 - 1.94*I, 0.500 + 1.94*I)
```

```
n40,n41,n42,n43;n50,n51,n52,n53;n60,n61,n62,n63;n70,n71,n72,n73
```

```
(-8.53, -0.469, 8.91e-6 - 2.00*I, -8.91e-6 + 2.00*I)
(-7.46, -0.536, -0.500 - 1.94*I, -0.500 + 1.94*I)
(-6.37, -0.628, -1.00 - 1.73*I, -1.00 + 1.73*I)
(-5.24, -0.764, -1.50 - 1.32*I, -1.50 + 1.32*I)
```

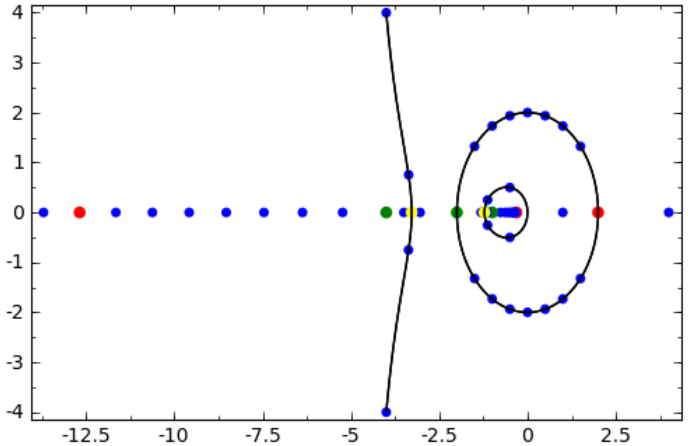
```
n80,n81,n82,n83;n90,n91,n92,n93
```

```
(-3.50, -1.14, -3.04, -1.31)
(-0.47 + 0.59*I, -4.0 - 4.1*I, -4.1 + 4.0*I, -0.41 - 0.50*I)
```

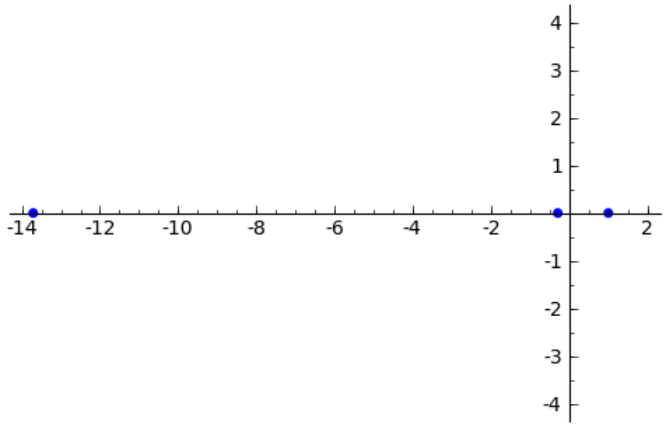
```
A=point([(n00,0),(n01,0),(n02,0),(n03,0)],pointsize=20);
B=point([(nr0,0),(nr1,0),(nr2,0)],pointsize=30,color='red');
C=point([(n10,0),(n11,0),n12,n13],pointsize=20);
D=point([(n20,0),(n21,0),n22,n23],pointsize=20);
F=point([(n30,0),(n31,0),n32,n33],pointsize=20);
G=point([(n40,0),(n41,0),n42,n43],pointsize=20);
H=point([(n50,0),(n51,0),n52,n53],pointsize=20);
K=point([(n60,0),(n61,0),n62,n63],pointsize=20);
M=point([(n70,0),(n71,0),n72,n73],pointsize=20);
N=point([(ng0,0),(ng1,0),(ng2,0)],pointsize=30,color='green');
O=point([(n80,0),(n81,0),(n82,0),(n83,0)],pointsize=20);
P=point([(ny0,0),(ny1,0)],pointsize=30,color='yellow');
Q=point([nf0,nf1,nf2,nf3],pointsize=20);
R=point([(-4,4),(-4,-4),(-0.5,0.5),(-0.5,-0.5)],pointsize=20);
```

```
x,y=var('x,y');ac=(2*x+9)*(x^2+y^2)+8*x
i1=implicit_plot(ac,(x,-4,0),(y,-4,4))
i2=implicit_plot(x^2+y^2-4,(x,-2,2),(y,-2,2))
```

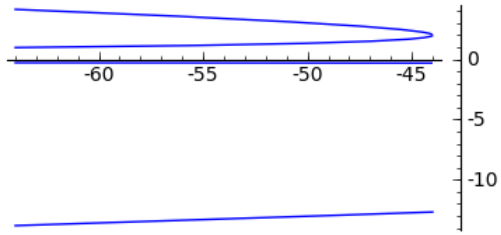
```
A+B+C+D+F+G+H+K+M+N+O+P+Q+R+i1+i2
```



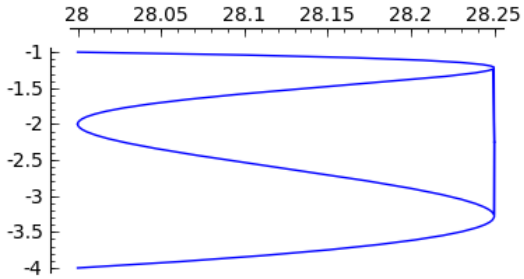

```
T=[A,B,C,D,F,G,H,K,M,N,O,P,Q,R,Q,P,O,N,M,K,H,G,F,D,C,B,A]
da=animate(T,xmin=-14,xmax=2,ymin=-4.2,ymax=4.2)
da.show(delay=100,iterations=1)
```




```
plot([r0(b),r1(b),r2(b),r3(b)],b,-64,-44,figsize=[4,2])
```




```
plot([r0(b),r1(b),r2(b),r3(b)],b,28,113/4,figsize=[4,2])
```




```
var('x');Q.<x>=QQ[x];Q=x^4+9*x^3+20*x^2+36*x+16;
factor(Q),factor(discriminant(Q))
```

```
(x^4 + 9*x^3 + 20*x^2 + 36*x + 16, -1 * 2^13 * 3^2 * 11^2)
```

```
expand(Q-(2*x^2+9*x-sqrt(33)*x+8)*(2*x^2+9*x+sqrt(33)*x+8)/4)
```

```
0
```