In [140]:

```
reset()
x=var('x')
y=function('y')(x)
eqd=diff(y,x)==2*y
show(eqd)
desolve(eqd,y)
show(desolve(eqd,y,show_method=True))
```

$$\frac{\partial}{\partial x}y(x)=2\,y(x)$$

$$\left[Ce^{(2\,x)}\,,\mathtt{linear}\right]$$

In [49]:

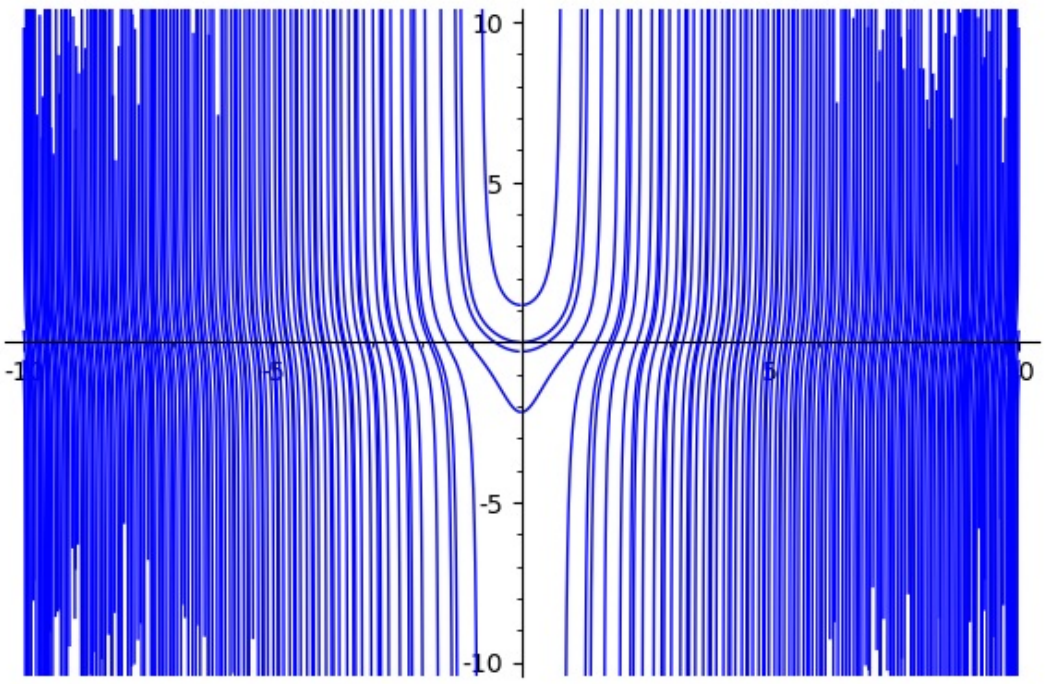
```
x=var('x')
y=function('y')(x)
eqd=diff(y,x)==2*x*(1+y^2)
show(eqd)
s=desolve(eqd,y)
show(s)
ans1=solve(s,y(x))
show(ans1)
ysol(x,_C)=ans1[0].rhs()
show(ysol)
g=plot(ysol(x,0),x,-10,10,detect_poles='True',ymin=-10,ymax=10)
for i in [1..3]:
    g=g+plot(ysol(x,i),x,-10,10,detect_poles='True',ymin=-10,ymax=10)
show(g)
```

$$\frac{\partial}{\partial x}y(x)=2\left(y(x)^2+1\right)x$$

$$\frac{1}{2}\arctan(y(x))=\frac{1}{2}x^2+C$$

$$\left[y(x)=\tan\left(x^2+2\,C\right)\right]$$

$$(x,C)\qquad\mapsto$$



In [89]:

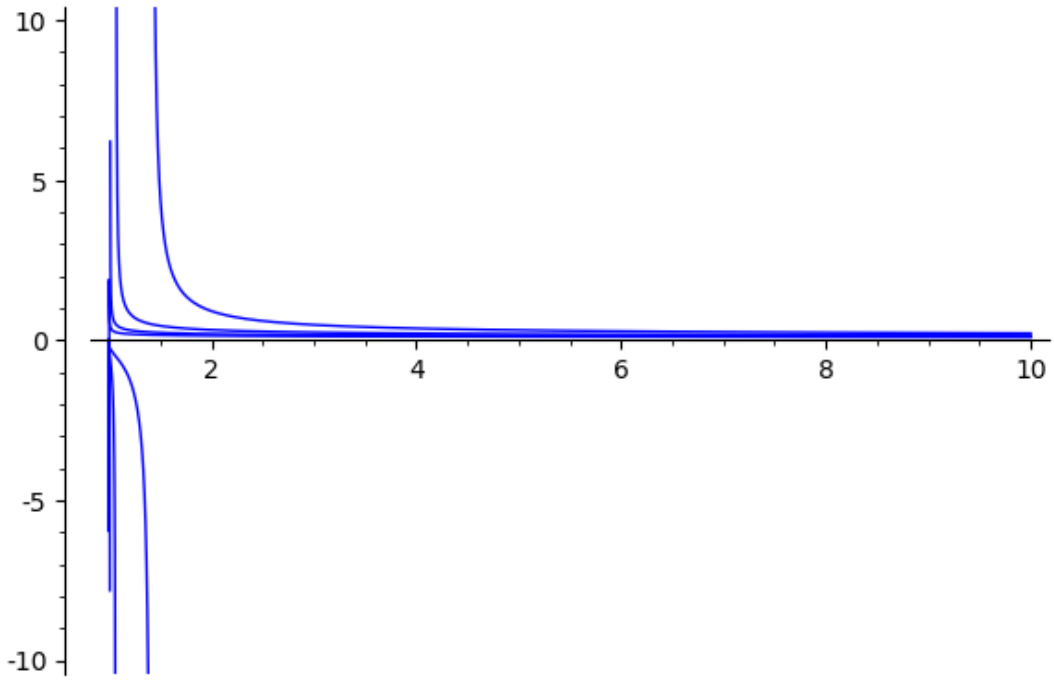
```
x=var('x')
y=function('y')(x)
eqd=(x^2-1)*diff(y,x)+2*x*y^2 == 0
show(eqd)
s=desolve(eqd,y)
show(s)
ans1=solve(s,y(x))
show(ans1)
sol(x,_C)=ans1[0].rhs()
show(sol)
g=plot(sol(x,0),x,1,10,detect_poles='True',ymin=-10,ymax=10)
for i in [1..3]:
    g=g+plot(sol(x,i),x,1,10,detect_poles='True',ymin=-10,ymax=10)
show(g)
```

$$2xy(x)^2+\left(x^2-1\right)\frac{\partial}{\partial x}y(x)=0$$

$$\frac{1}{2y(x)}=C+\frac{1}{2}\log(x+1)+\frac{1}{2}\log(x-1)$$

$$\left[y(x)=\frac{1}{2C+\log(x+1)+\log(x-1)}\right]$$

$$(x,C)\qquad\mapsto$$



In [93]:

```
x=var('x')
y=function('y')(x)
eqd=2*x^2*diff(y,x)==x^2+y^2
show(eqd)
s=desolve(eqd,y)
show(s)
ans1=solve(s,y(x))
show(ans1)
sol1(x,_C)=ans1[1].rhs()
show(sol1)
g=plot(sol1(x,1),x,1,10,detect_poles='True',ymin=-10,ymax=10)
for i in [2..10]:
    g=g+plot(sol1(x,i),x,1,10,detect_poles='True',ymin=-10,ymax=10)
show(g)
```

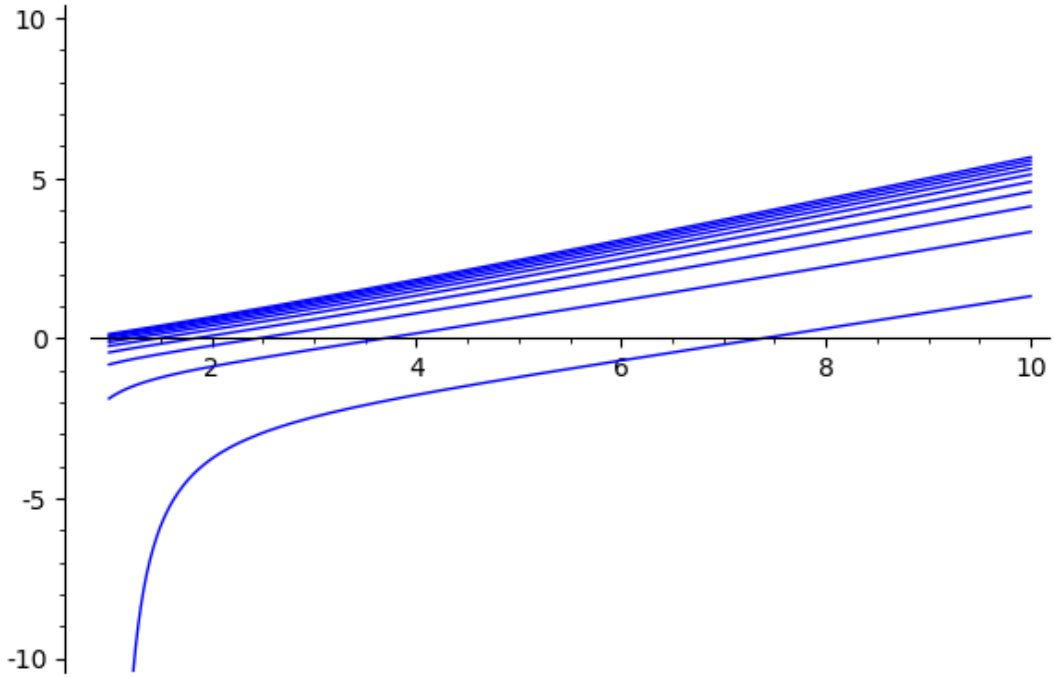
$$2x^2\frac{\partial}{\partial x}y(x)=x^2+y(x)^2$$

$$2x\ \frac{\partial}{\partial x}y(x) - x^{-} + y(x)$$

$$Cx = e^{\left(\frac{2x}{x-y(x)}\right)}$$

$$\left[y(x) = \frac{x\log\left(-\frac{1}{\sqrt{Cx}}\right) + x}{\log\left(-\frac{1}{\sqrt{Cx}}\right)}, y(x) = \frac{x\log(Cx) - 2x}{\log(Cx)}\right]$$

$$(x, C) \qquad \mapsto$$



In [110]:

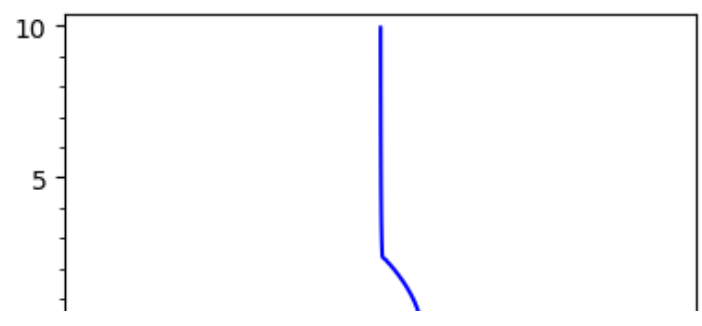
```
x=var('x')
y=function('y')(x)
eqd=diff(y,x)==-(x+y)/y
show(eqd)
s=desolve(eqd,y)
show(s)
ans1=solve(s,y(x))
show(ans1)
yy=var('yy')
f(x,yy,_C)=s.substitute(y(x)==yy)
implicit_plot(f(x,yy,1),(x,-10,10),(yy,-10,10))
```

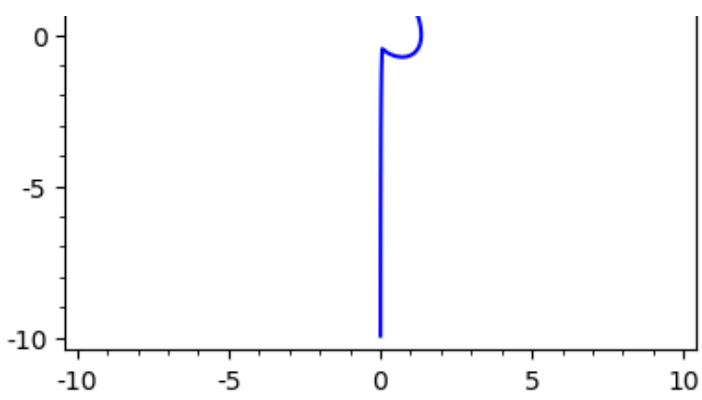
$$\frac{\partial}{\partial x}y(x) = -\frac{x + y(x)}{y(x)}$$

$$Cx = e^{\left(-\frac{1}{6}\sqrt{3}\left(\sqrt{3}\log\left(\frac{x^2+xy(x)+y(x)^2}{x^2}\right) - 2\arctan\left(\frac{\sqrt{3}(x+2y(x))}{3x}\right)\right)\right)}$$

[]

Out[110]:





In [129]:

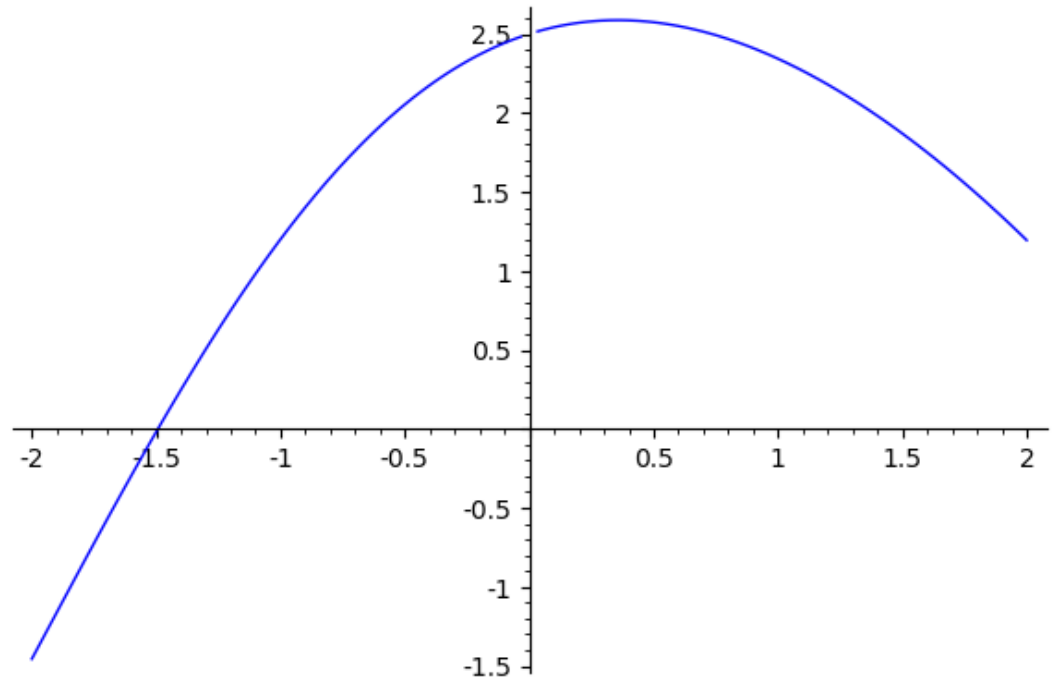
```
x=var('x')
y=function('y')(x)
eqd=diff(y,x,2)+y==sin(x)+cos(x)
show(eqd)
s=desolve(eqd,y)
show(s)
ans1=solve(x,y(x))
_K1,_K2=var('_K1,_K2')
sol1=s.substitute(_K1==1,_K2==2)
show(sol1)
plot(sol1,x,-2,2,detect_poles='True')
```

$$y(x)+\frac{\partial^2}{(\partial x)^2}y(x)=\cos(x)+\sin(x)$$

$$K_2\cos(x)-\frac{1}{2}(x-1)\cos(x)+K_1\sin(x)+\frac{1}{2}x\sin(x)$$

$$-\frac{1}{2}(x-1)\cos(x)+\frac{1}{2}x\sin(x)+2\cos(x)+\sin(x)$$

Out[129]:



In [138]:

```
x=var('x')
y=function('y')(x)
eqd=diff(y,x,2)-y==e^(2*x)
show(eqd)
s=desolve(eqd,y)
show(s)
```

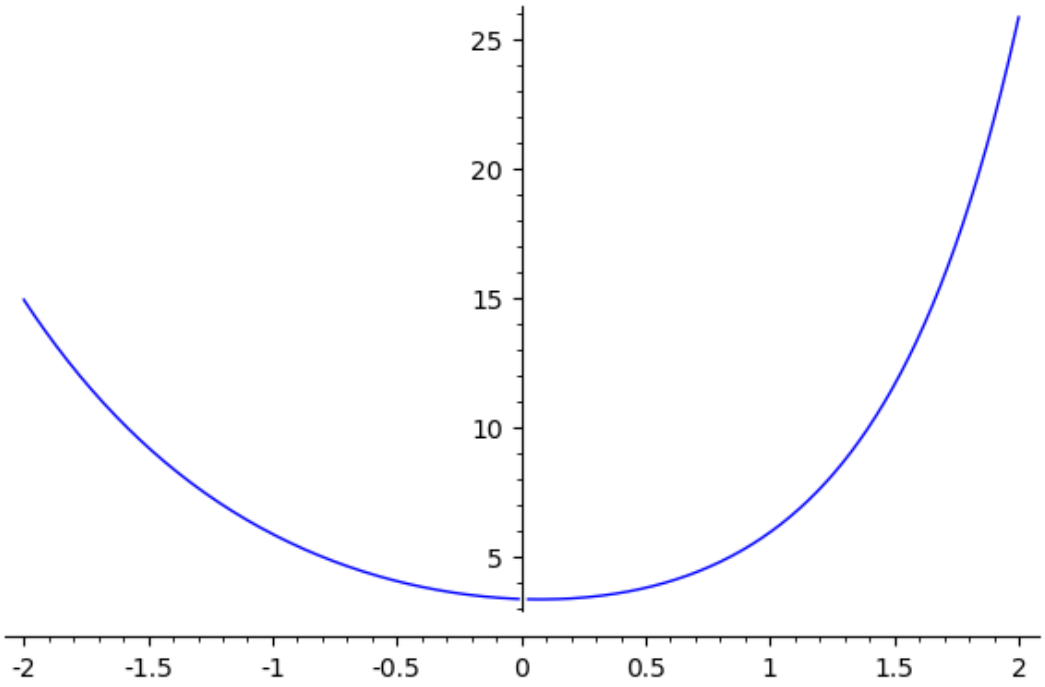
```
ans1=solve(x,y(x))
_K1,_K2=var('_K1,_K2')
sol1=s.substitute(_K1==1,_K2==2)
show(sol1)
plot(sol1,x,-2,2,detect_poles='True')
```

$$-y(x)+\frac{\partial^2}{(\partial x)^2}y(x)=e^{(2x)}$$

$$K_2e^{(-x)}+K_1e^x+\frac{1}{3}e^{(2x)}$$

$$\frac{1}{3}e^{(2x)}+2e^{(-x)}+e^x$$

Out[138]:



In [141]:

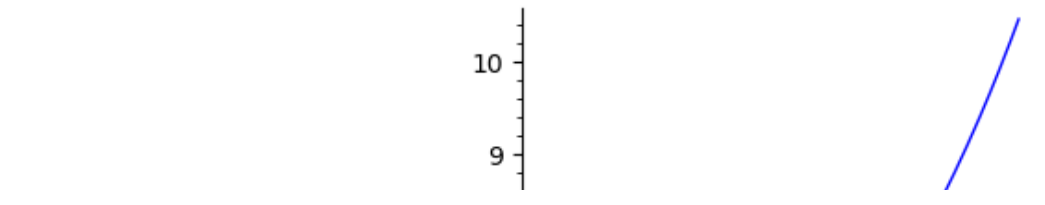
```
x=var('x')
y=function('y')(x)
eqd=diff(y,x,2)-diff(y,x)==1/(1+e^x)
show(eqd)
s=desolve(eqd,y)
show(s)
ans1=solve(x,y(x))
_K1,_K2=var('_K1,_K2')
sol1=s.substitute(_K1==1,_K2==2)
show(sol1)
plot(sol1,x,-2,2,detect_poles='True')
```

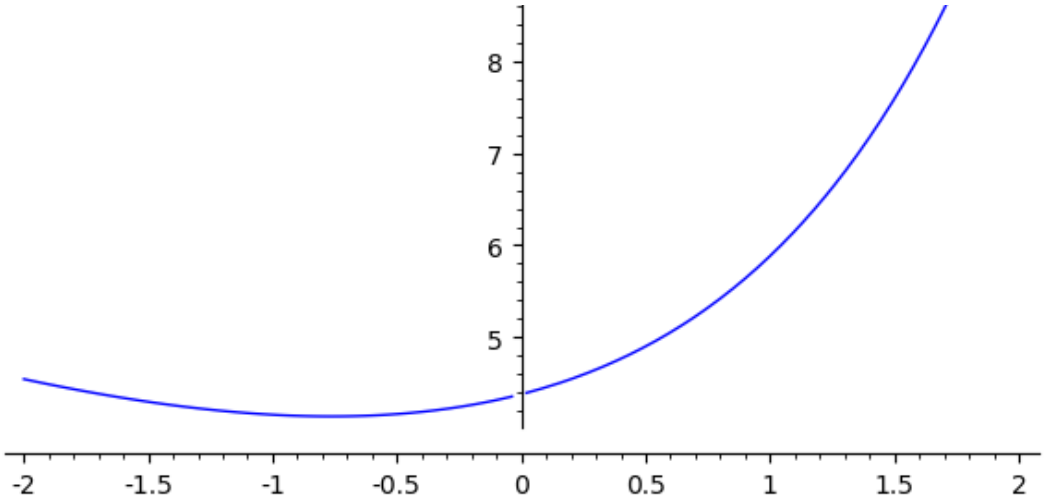
$$-\frac{\partial}{\partial x}y(x)+\frac{\partial^2}{(\partial x)^2}y(x)=\frac{1}{e^x+1}$$

$$K_1e^x+e^x\log\left(\left(e^x+1\right)e^{(-x)}\right)+K_2-x+\log(e^x+1)$$

$$e^x\log\left(\left(e^x+1\right)e^{(-x)}\right)-x+e^x+\log(e^x+1)+2$$

Out[141]:





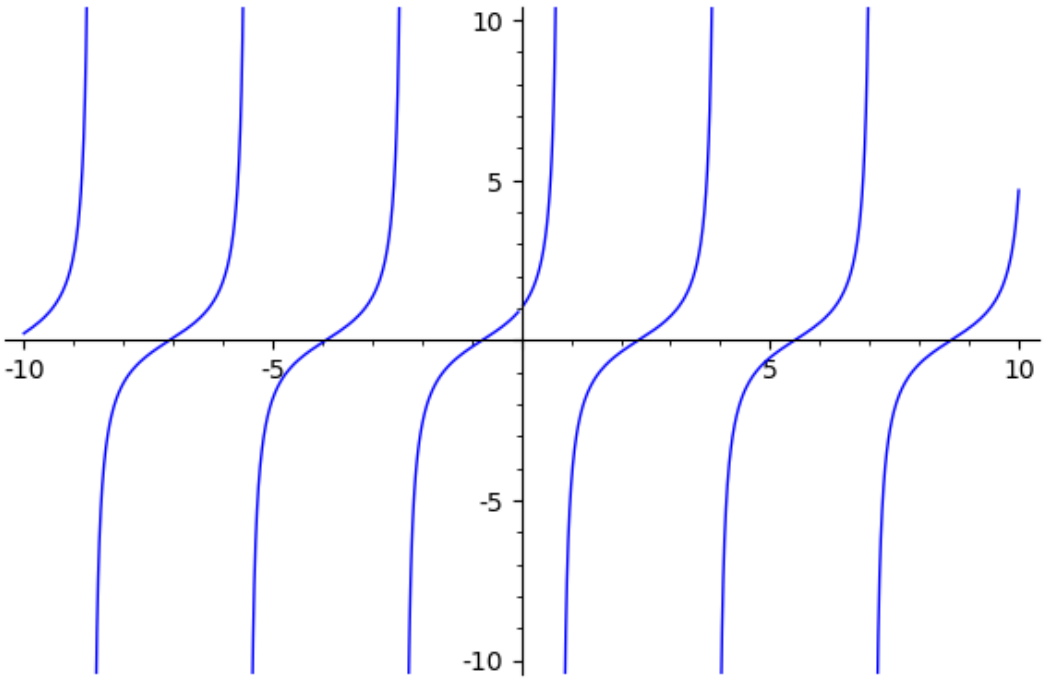
In [150]:

```
x=var('x')
y=function('y')(x)
eqd=diff(y,x)==1+y^2
s=desolve(eqd,y,ics=[0,1])
show(s)
sol=solve(s,y(x))
show(sol)
ans1=sol[0].rhs()
plot(ans1,x,-10,10,detect_poles='True',ymin=-10,ymax=10)
```

$$\arctan(y(x)) = \frac{1}{4}\pi + x$$

$$\left[y(x) = \tan\left(\frac{1}{4}\pi + x\right)\right]$$

Out[150]:



In [145]:

```
x=var('x')
y=function('y')(x)
eqd=diff(y,x)==1/(1-x^2)*y+1+x
s=desolve(eqd,y,ics=[2,0])
show(s)
plot(s,x,1,3,detect_poles='True',ymin=-10,ymax=10)
```

$$\sqrt{x^2-1}\sqrt{x+1}\,x - \sqrt{x+1}\left(2\sqrt{3} - \log\left(2\sqrt{3}+4\right)\right) \quad - \sqrt{x+1}\log\left(2x + 2\sqrt{x^2-1}\right)$$

$$\frac{}{2\sqrt{x-1}}$$

Out[145]: