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))
```

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

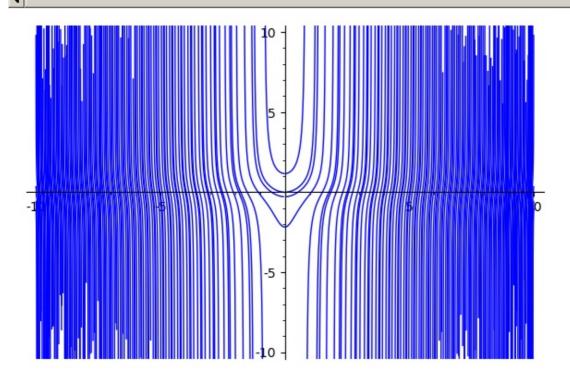
$$\left[Ce^{(2\,x)}\,, exttt{linear}
ight]$$

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)
```

$$egin{aligned} rac{\partial}{\partial x}y\left(x
ight) &= 2\left(y(x)^2+1
ight)x \ rac{1}{2}rctan(y\left(x
ight)) &= rac{1}{2}x^2+C \ \left[y\left(x
ight) &= anig(x^2+2Cig)
ight] \end{aligned}$$

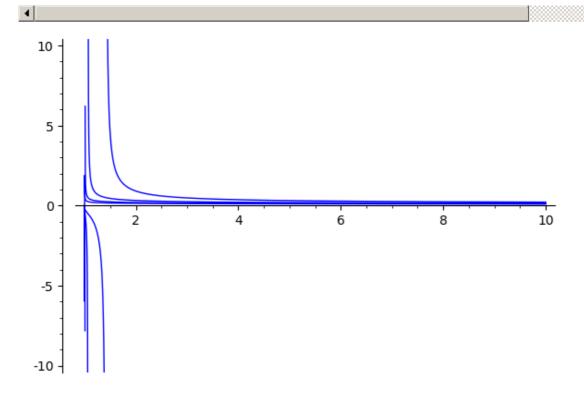
(x,C)



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(q)

$$2 x y(x)^2 + \left(x^2 - 1\right) rac{\partial}{\partial x} y\left(x
ight) = 0$$
 $rac{1}{2 y\left(x
ight)} = C + rac{1}{2} \log(x+1) + rac{1}{2} \log(x-1)$ $\left[y\left(x
ight) = rac{1}{2 C + \log(x+1) + \log(x-1)}
ight]$

(x,C)



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)
```

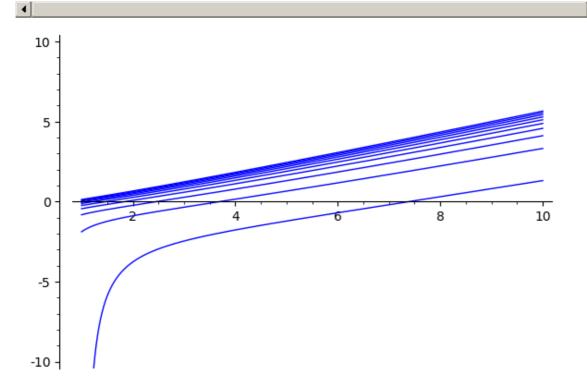
$$2^{2}$$
 θ

$$Cx = e^{\left(rac{2\,x}{x-y(x)}
ight)}$$

$$Cx = e^{\left(rac{2\,x}{x-y(x)}
ight)}$$

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

(x,C)

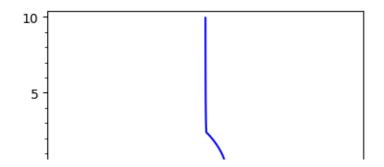


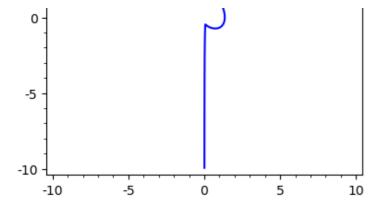
In [110]:

```
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))
```

$$egin{align} rac{\partial}{\partial x}y\left(x
ight) &= -rac{x+y\left(x
ight)}{y\left(x
ight)} \ Cx &= e^{\left(-rac{1}{6}\sqrt{3}\left(\sqrt{3}\log\left(rac{x^2+xy\left(x
ight)+y\left(x
ight)^2}{x^2}
ight)-2rctan\left(rac{\sqrt{3}\left(x+2\left.y\left(x
ight)
ight)}{3\left.x
ight)}
ight)
ight)} \ \end{array}
ight) \end{array}$$

Out[110]:



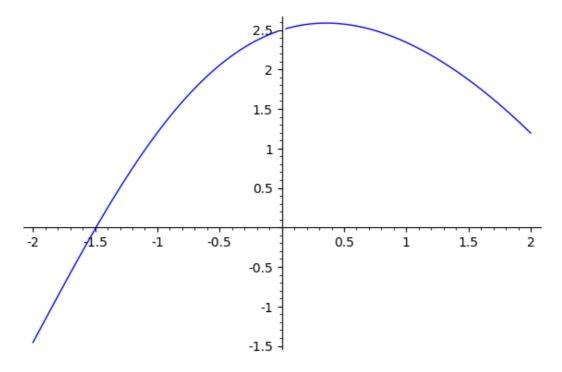


In [129]:

```
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')
```

$$egin{split} y(x) + rac{\partial^2}{(\partial x)^2} y(x) &= \cos(x) + \sin(x) \ K_2\cos(x) - rac{1}{2}(x-1)\cos(x) + K_1\sin(x) + rac{1}{2}x\sin(x) \ -rac{1}{2}(x-1)\cos(x) + rac{1}{2}x\sin(x) + 2\cos(x) + \sin(x) \end{split}$$

Out[129]:

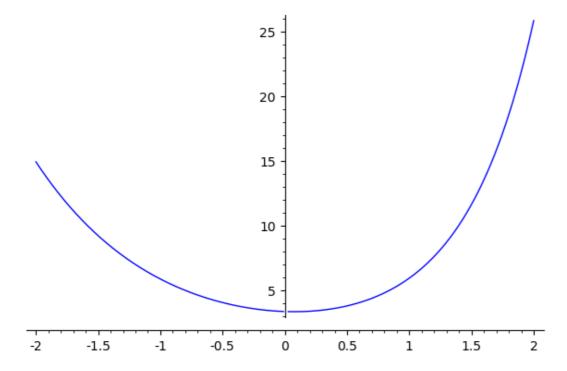


In [138]:

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

$$egin{split} -y\left(x
ight) + rac{\partial^2}{(\partial x)^2}y\left(x
ight) &= e^{(2\,x)} \ K_2 e^{(-\,x)} + K_1 e^x + rac{1}{3}e^{(2\,x)} \ rac{1}{3}e^{(2\,x)} + 2\,e^{(-\,x)} + e^x \end{split}$$

Out[138]:



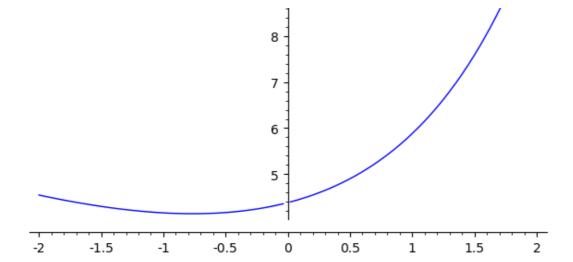
In [141]:

```
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')
```

$$egin{align} -rac{\partial}{\partial x}y\left(x
ight)+rac{\partial^2}{(\partial x)^2}y\left(x
ight)&=rac{1}{e^x+1}\ K_1e^x+e^x\log\Bigl(\left(e^x+1
ight)e^{\left(-x
ight)}\Bigr)+K_2-x+\log(e^x+1)\ &e^x\log\Bigl(\left(e^x+1
ight)e^{\left(-x
ight)}\Bigr)-x+e^x+\log(e^x+1)+2 \end{gathered}$$

Out[141]:





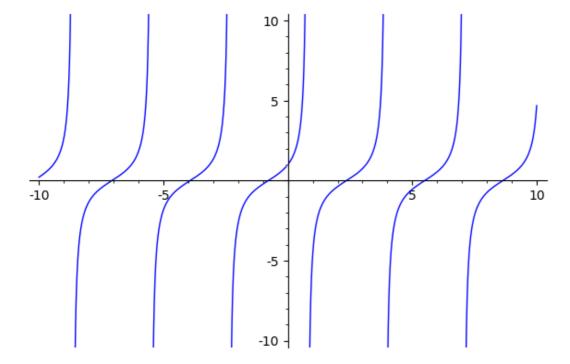
In [150]:

```
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)
```

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

$$\left[y\left(x
ight) = an\!\left(rac{1}{4}\,\pi+x
ight)
ight]$$

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)
```

$$-\sqrt{x^2-1}\sqrt{x+1}\,x - \sqrt{x+1}\,ig(2\,\sqrt{3} - \logig(2\,\sqrt{3} + 4ig)ig) - \sqrt{x+1}\logig(2\,x + 2\,\sqrt{x^2-1}\,ig)$$

Out[145]: $2\sqrt{x-1}$ 0 10 5 0 1.5 2 2.5 3