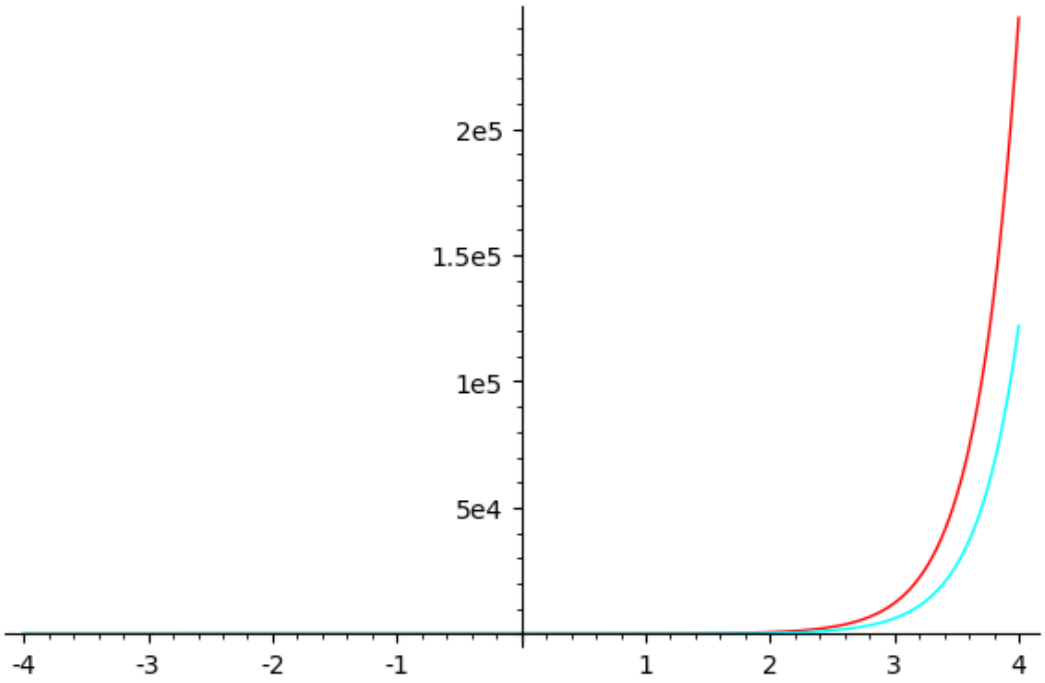
In [19]:

```
t=var('t')
x=function('x')(t)
y=function('y')(t)
eq1=diff(x,t)==x+4*y
eq2=diff(y,t)==x+y
syst=[eq1, eq2]
C1,C2=var('C1,C2')
sol=desolve_system(syst, [x, y], [0, C1, C2])
show(sol)
sol_x(t,C1,C2)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t, 1, 1), t, -4, 4, color='red')
sol_y(t,C1,C2)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t, 1, 1), t, -4, 4, color='cyan')
show(reprx+repry)
```

$$\left[x\left(t\right)=\frac{1}{2}\left(C_1+2\,C_2\right)e^{\left(3\,t\right)}+\frac{1}{2}\left(C_1-2\,C_2\right)e^{\left(-t\right)},y\left(t\right)=\frac{1}{4}\left(C_1+2\,C_2\right)e^{\left(3\,t\right)}-\frac{1}{4}\left(C_1-2\,C_2\right)e^{\left(-t\right)}\right]$$

$$\left(t,C_1,C_2\right)\mapsto$$

$$\left(t,C_1,C_2\right)\mapsto$$



In [48]:

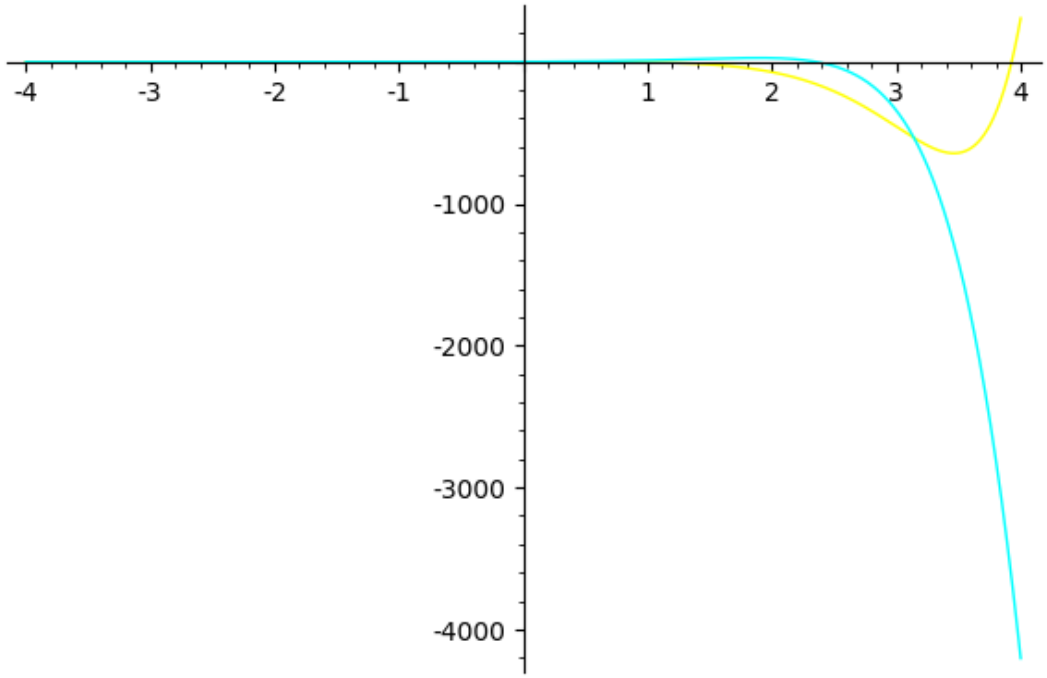
```
t=var('t')
x=function('x')(t)
y=function('y')(t)
eq1=diff(x,t)==2*x-y
eq2=diff(y,t)==x+2*y
syst=[eq1, eq2]
C1,C2=var('C1,C2')
sol=desolve_system(syst, [x, y], [0, C1, C2])
show(sol)
sol_x(t,C1,C2)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t, 1, 1), t, -4, 4, color='yellow')
```

```
sol_y(t,C1,C2)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t, 1, 1), t, -4, 4, color='cyan')
show(reprx+repry)
```

$$\left[x\left(t\right)=\left(C_{1}\cos\left(t\right)-C_{2}\sin\left(t\right)\right)\,e^{\left(2\,t\right)},y\left(t\right)=\left(C_{2}\cos\left(t\right)+C_{1}\sin\left(t\right)\right)\,e^{\left(2\,t\right)}\right]$$

$$\left(t,C_{1},C_{2}\right)\mapsto$$

$$\left(t,C_{1},C_{2}\right)\mapsto$$



In [40]:

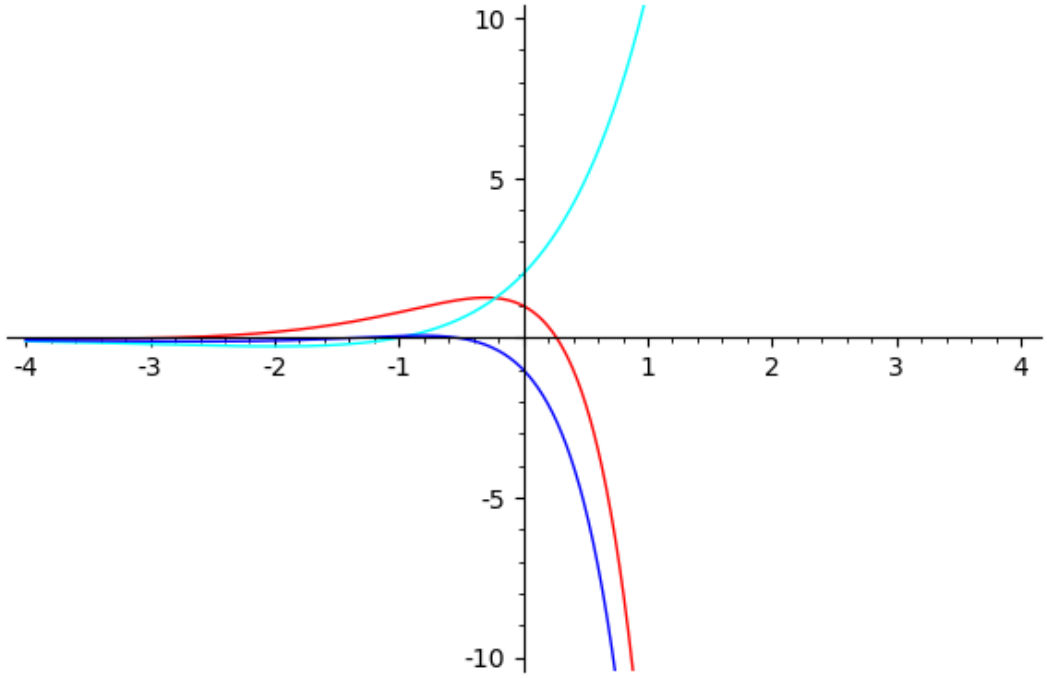
```
t=var('t')
x=function('x')(t)
y=function('y')(t)
z=function('z')(t)
eq1=diff(x,t)==x-y+z
eq2=diff(y,t)==x+y-z
eq3=diff(z,t)==-y+2*z
syst=[eq1, eq2, eq3]
C1,C2,C3=var('C1,C2,C3')
sol=desolve_system(syst, [x, y, z], [0, C1, C2, C3])
show(sol)
sol_x(t,C1,C2,C3)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t, 1, 2, -1), t, -4, 4, color='red',ymin=-10,ymax=10)
sol_y(t,C1,C2,C3)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t, 1, 2, -1), t, -4, 4, color='cyan',ymin=-10,ymax=10)
sol_z(t,C1,C2,C3)=sol[2].rhs()
show(sol_z)
reprz=plot(sol_z(t, 1, 2, -1), t, -4, 4, color='blue',ymin=-10,ymax=10)
show(reprx+repry+reprz)
```

$$\left[x\left(t\right)=C_{1}te^{t}-C_{3}te^{t}-\left(C_{1}+C_{2}-2\,C_{3}\right)\,e^{\left(2\,t\right)}+\left(2\,C_{1}+C_{2}-2\,C_{3}\right)\,e^{t},y\left(t\right)=C_{1}te^{t}-C_{3}te^{t}+C_{2}e^{t},z\left(t\right)\right.$$

$$\left(t,C_{1},C_{2},C_{3}\right)\mapsto$$

$$\left(t,C_{1},C_{2},C_{3}\right)\mapsto$$

$(t, C_1, C_2, C_3) \mapsto$



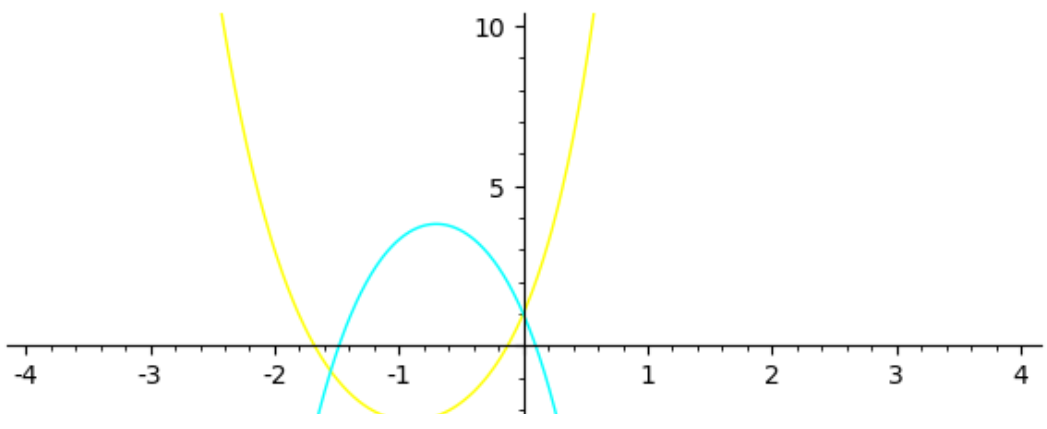
In [49]:

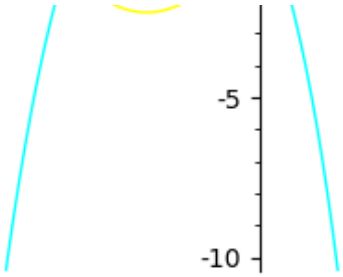
```
t=var('t')
x=function('x')(t)
y=function('y')(t)
eq1=diff(x,t)==5*x+3*y+1
eq2=diff(y,t)==-6*x-4*y+e^(-t)
syst=[eq1, eq2]
C1,C2=var('C1,C2')
sol=desolve_system(syst, [x, y], [0, C1, C2])
show(sol)
sol_x(t,C1,C2)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t, 1, 1), t, -4, 4, color='yellow',ymin=-10,ymax=10)
sol_y(t,C1,C2)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t, 1, 1), t, -4, 4, color='cyan',ymin=-10,ymax=10)
show(reprx+repry)
```

$$\left[x(t)=\frac{1}{3}\left(6C_1+3C_2+4\right)\ e^{(2t)}\ -\frac{1}{3}\left(3C_1+3C_2-2\right)\ e^{(-t)}-te^{(-t)}-2, y(t)=-\frac{1}{3}\left(6C_1+3C_2+4\right)\ e^{(2t)}\right.$$

$(t, C_1, C_2) \mapsto$

$(t, C_1, C_2) \mapsto$





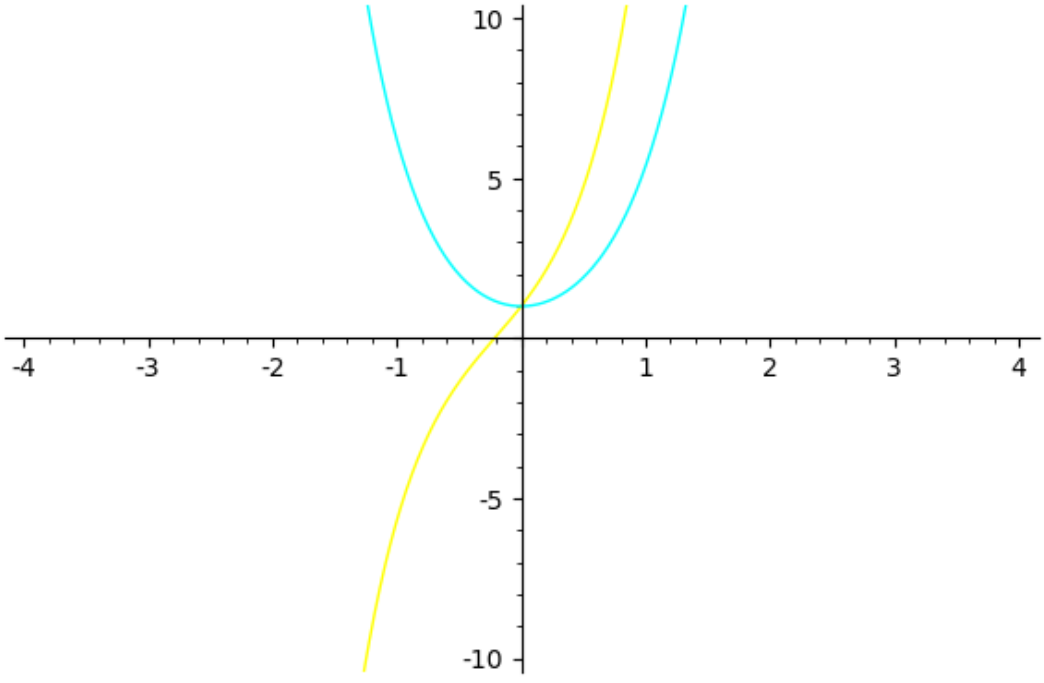
In [47]:

```
t=var('t')
x=function('x')(t)
y=function('y')(t)
eq1=diff(x,t)==x+3*y+cos(t)
eq2=diff(y,t)==x-y+2*t
syst=[eq1, eq2]
C1,C2=var('C1,C2')
sol=desolve_system(syst, [x, y], [0, C1, C2])
show(sol)
sol_x(t,C1,C2)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t, 1, 1), t, -4, 4, color='yellow',ymin=-10,ymax=10)
sol_y(t,C1,C2)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t, 1, 1), t, -4, 4, color='cyan',ymin=-10,ymax=10)
show(reprx+repry)
```

$$\left[x\left(t\right)=\frac{3}{40}\left(10\,C_1+10\,C_2+9\right)\,e^{\left(2\,t\right)}+\frac{1}{40}\left(10\,C_1-30\,C_2-19\right)\,e^{\left(-2\,t\right)}-\frac{3}{2}\,t-\frac{1}{5}\cos\left(t\right)+\frac{1}{5}\sin\left(t\right),y\left(t\right)=-\frac{1}{4}\right.$$

$$\left(t,C_1,C_2\right)\mapsto$$

$$\left(t,C_1,C_2\right)\mapsto$$



In [46]:

```
t=var('t')
x=function('x')(t)
y=function('y')(t)
z=function('z')(t)
```

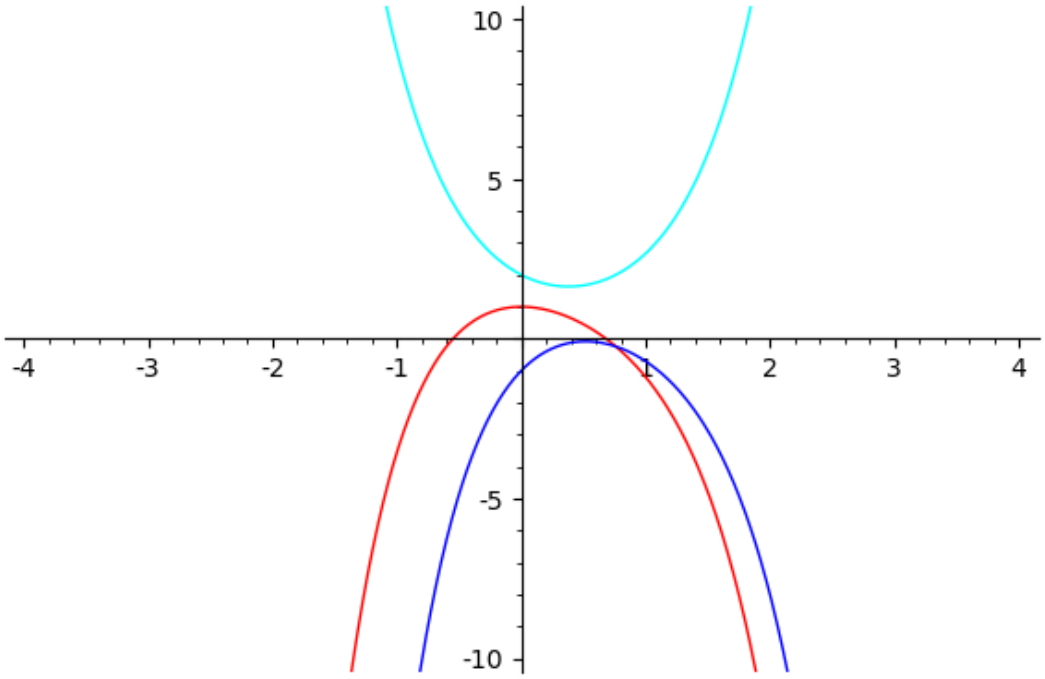
```
eq1=diff(x,t)==x-2*y-2*z+e^(-t)
eq2=diff(y,t)==-2*x+y+2*z
eq3=diff(z,t)==2*x-y-3*z+e^(-t)
syst=[eq1, eq2, eq3]
C1,C2,C3=var('C1,C2,C3')
sol=desolve_system(syst, [x, y, z], [0, C1, C2, C3])
show(sol)
sol_x(t,C1,C2,C3)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t, 1, 2, -1), t, -4, 4, color='red',ymin=-10,ymax=10)
sol_y(t,C1,C2,C3)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t, 1, 2, -1), t, -4, 4, color='cyan',ymin=-10,ymax=10)
sol_z(t,C1,C2,C3)=sol[2].rhs()
show(sol_z)
reprz=plot(sol_z(t, 1, 2, -1), t, -4, 4, color='blue',ymin=-10,ymax=10)
show(reprx+repry+reprz)
```

$$\left[x(t)=\frac{1}{3}\sqrt{3}(2C_1-C_2-2C_3)\ \sinh(\sqrt{3}t)-C_2\cosh(\sqrt{3}t)+(C_1+C_2)\,e^{(-t)}+te^{(-t)},y(t)=-\frac{1}{3}\sqrt{3}(2C_1\right.$$

$$(t,C_1,C_2,C_3)\mapsto$$

$$(t,C_1,C_2,C_3)\mapsto$$

$$(t,C_1,C_2,C_3)\mapsto$$



In [55]:

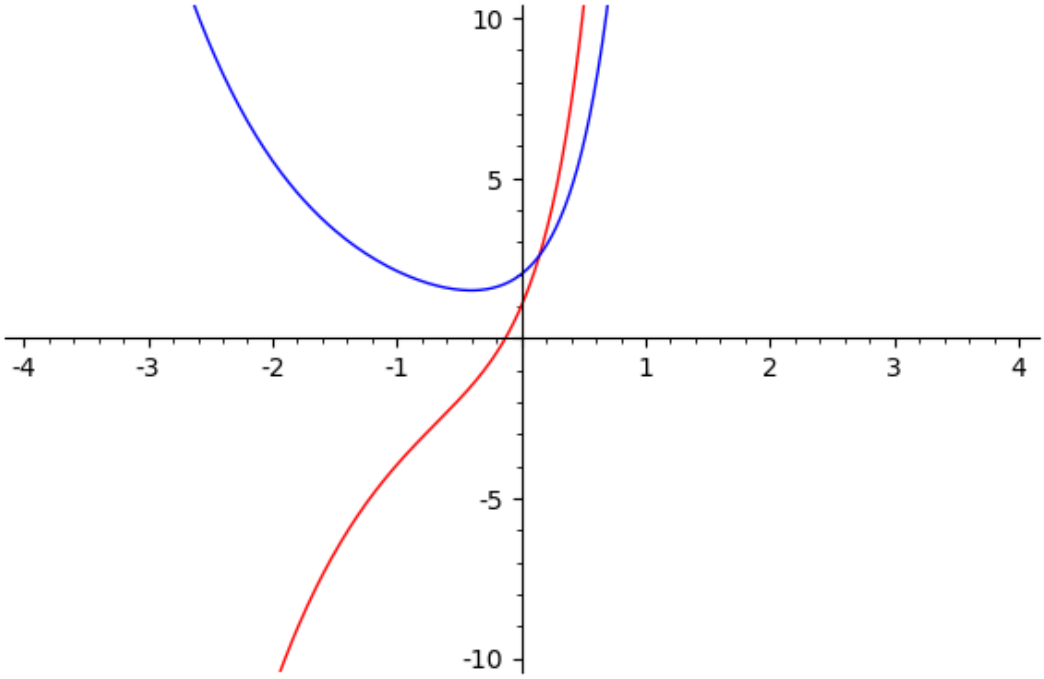
```
t=var('t')
x=function('x')(t)
y=function('y')(t)
eq1=diff(x,t)==x+4*y
eq2=diff(y,t)==x+y
syst=[eq1, eq2]
sol=desolve_system(syst, [x, y], [0, 1, 2])
show(sol)
sol_x(t)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t), t, -4, 4, color='red',ymin=-10,ymax=10)
sol_y(t)=sol[1].rhs()
```

```
show(sol_y)
repry=plot(sol_y(t), t, -4, 4, color='blue',ymin=-10,ymax=10)
show(reprx+repry)
```

$$\left[x\left(t\right)=\frac{5}{2}e^{\left(3t\right)}-\frac{3}{2}e^{\left(-t\right)},y\left(t\right)=\frac{5}{4}e^{\left(3t\right)}+\frac{3}{4}e^{\left(-t\right)}\right]$$

$$t \mapsto$$

$$t \mapsto$$



In [57]:

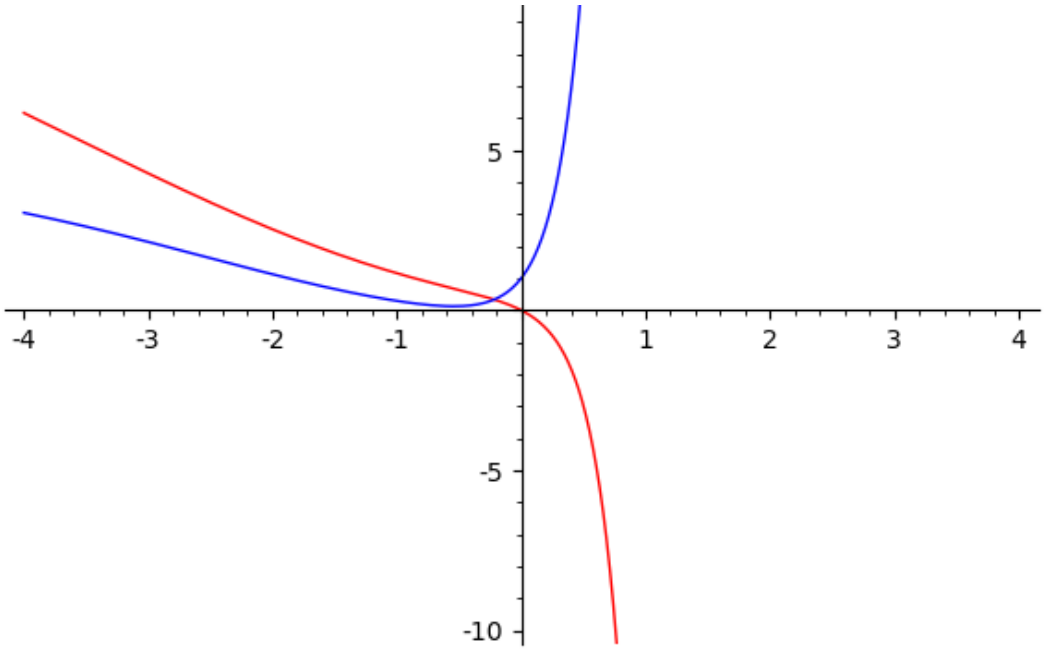
```
t=var('t')
x=function('x')(t)
y=function('y')(t)
eq1=diff(x,t)==x-y+t-1
eq2=diff(y,t)==-2*x+4*y+cos(t)
syst=[eq1, eq2]
sol=desolve_system(syst, [x, y], [0, 0, 1])
show(sol)
sol_x(t)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t), t, -4, 4, color='red',ymin=-10,ymax=10)
sol_y(t)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t), t, -4, 4, color='blue',ymin=-10,ymax=10)
show(reprx+repry)
```

$$\left[x\left(t\right)=-\frac{1}{13}\left(10\sqrt{17}\sinh\left(\frac{1}{2}\sqrt{17}t\right)-33\cosh\left(\frac{1}{2}\sqrt{17}t\right)\right)\ e^{\left(\frac{5}{2}t\right)}-2t-\frac{1}{26}\cos(t)+\frac{5}{26}\sin(t)-\frac{5}{2},y($$

$$t \mapsto$$

$$t \mapsto$$

10



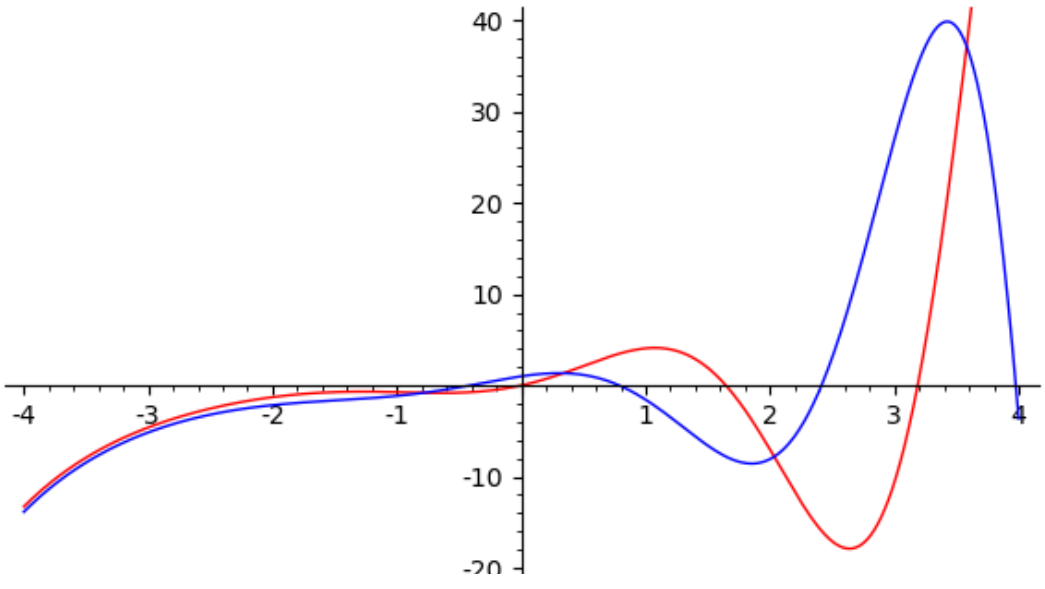
In [64]:

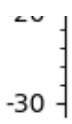
```
t=var('t')
x=function('x')(t)
y=function('y')(t)
eq1=diff(x,t)==x+2*y+e^(-t)
eq2=diff(y,t)==-2*x+y+1
syst=[eq1, eq2]
sol=desolve_system(syst, [x, y], [0, 0, 1])
show(sol)
sol_x(t)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t), t, -4, 4, color='red',ymin=-30,ymax=30)
sol_y(t)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t), t, -4, 4, color='blue',ymin=-30,ymax=40)
show(reprx+repry)
```

$$\left[x\left(t\right)=-\frac{1}{20}\left(3\cos\left(2\,t\right)-29\sin\left(2\,t\right)\right)\,e^{t}-\frac{1}{4}\,e^{\left(-t\right)}+\frac{2}{5},y\left(t\right)=\frac{1}{20}\left(29\cos\left(2\,t\right)+3\sin\left(2\,t\right)\right)\,e^{t}-\frac{1}{4}\,e^{\left(-t\right)}-\frac{1}{5}\right.$$

$$t\mapsto$$

$$t\mapsto$$





In [69]:

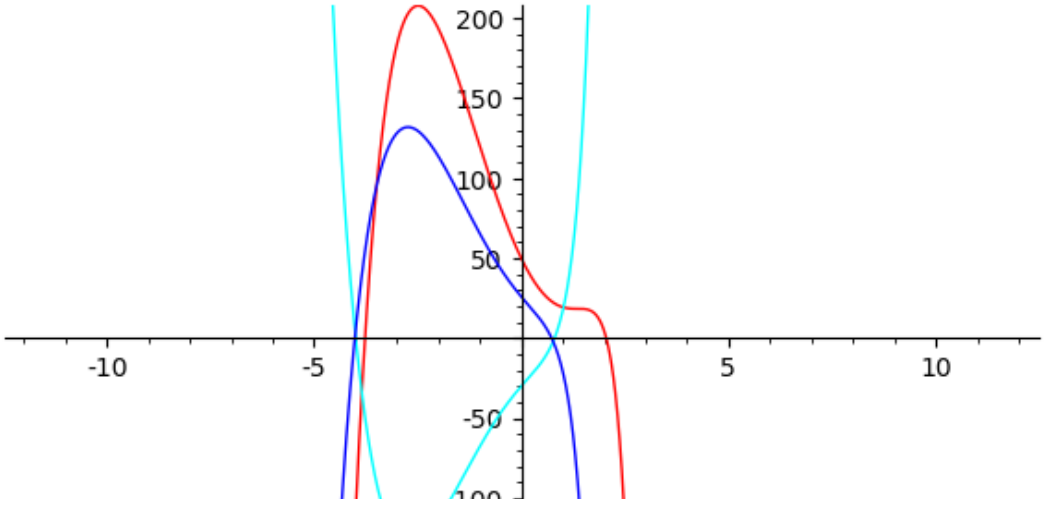
```
t=var('t')
x=function('x')(t)
y=function('y')(t)
z=function('z')(t)
eq1=diff(x,t)==-x+e*y+3*z+27*t^2
eq2=diff(y,t)==2*x-2*y-5*z+3*t
eq3=diff(z,t)==-2*x+3*y+6*z+3
syst=[eq1, eq2, eq3]
sol=desolve_system(syst, [x, y, z], [0, 50, -30, 26])
show(sol)
sol_x(t)=sol[0].rhs()
show(sol_x)
reprx=plot(sol_x(t), t, -12, 12, color='red',ymin=-200,ymax=200)
sol_y(t)=sol[1].rhs()
show(sol_y)
repry=plot(sol_y(t), t, -12, 12, color='cyan',ymin=-200,ymax=200)
sol_z(t)=sol[2].rhs()
show(sol_z)
reprz=plot(sol_z(t), t, -12, 12, color='blue',ymin=-200,ymax=200)
show(reprx+repry+reprz)
```

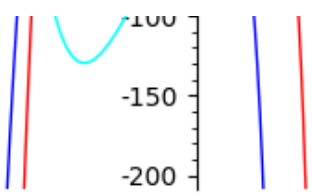
$$\left[x\left(t\right)=-2\left(\frac{\left(\frac{120\,e^{5}-308\,e^{4}-750\,e^{3}+2529\,e^{2}-2484\,e+891}{8\,e^{4}-44\,e^{3}+90\,e^{2}-81\,e+27}-\frac{2\left(120\,e^{4}-670\,e^{3}+1251\,e^{2}-1080\,e+378\right)}{8\,e^{4}-44\,e^{3}+90\,e^{2}-81\,e+27}\right)\sinh\left(t\sqrt{2\,e-2}\right)}{\sqrt{2\,e-2}}-\right.$$

t

t

t





In [ ]:

```
```