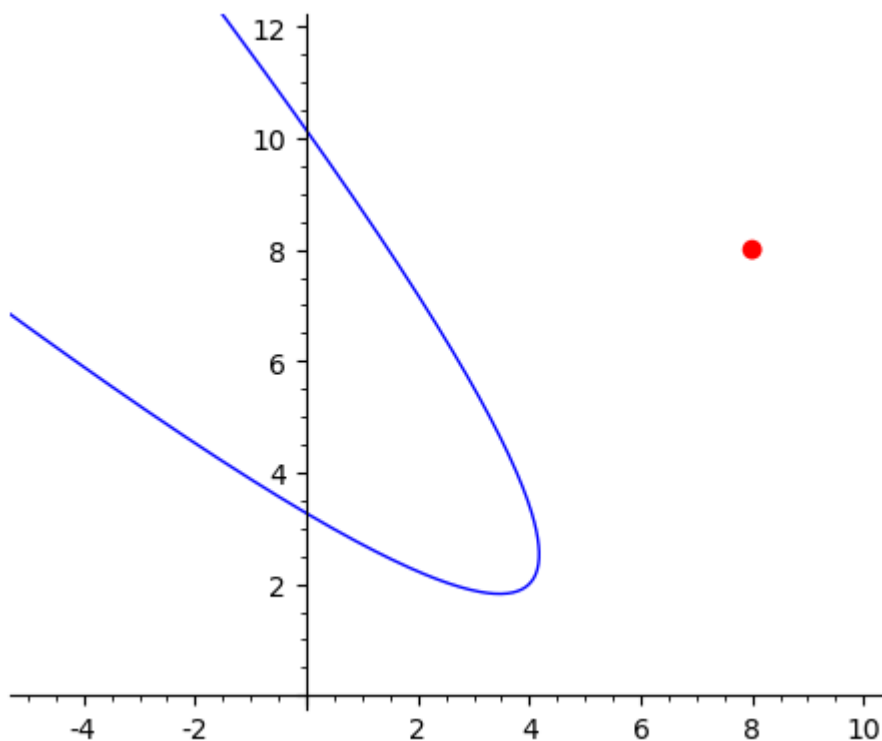


```

In [1]: ptx=8
pty=8
c1=4
c2=2
r1=1
r2=1
alpha=pi/4
x(t)=r1*cos(alpha)*t-r2*sin(alpha)*t^2+c1
y(t)=r1*sin(alpha)*t+r2*cos(alpha)*t^2+c2
p1=parametric_plot( (x(t), y(t)), (t, -4, 4) )
p2=point((ptx,pty), rgbcolor='red', pointsize=50)
(p1+p2).show(xmin=-5,xmax=10,ymin=0,ymax=12)

```

Out[1]:



```

In [2]: DS(t)=(x(t)-ptx)^2+(y(t)-pty)^2
t0=(diff(DS(t),t)==0).find_root(-4,4,t)
show(t0)

```

Out[2]: 1.722449728138516

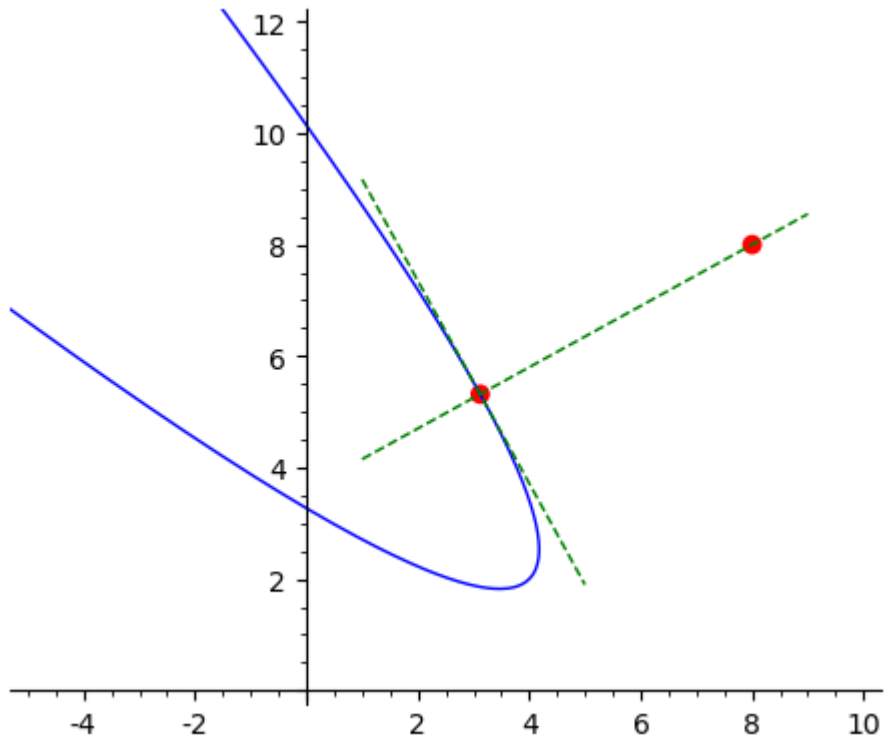
```

In [3]: var('yy xx')
xdash(t)=diff(x(t),t)
ydash(t)=diff(y(t),t)
m(t)=ydash(t)/xdash(t)
tangent(xx)=solve((yy-y(t0))/(xx-x(t0))==m(t0),yy)[0].rhs()
normal(xx)=solve((yy-y(t0))/(xx-x(t0))=(-1/m(t0)),yy)[0].rhs()

```

```
In [4]: p3=point((x(t0),y(t0)), rgbcolor='red', pointsize=50)
p4=plot(tangent(xx),xx,1,5, rgbcolor='green', linestyle = "dashed")
p5=plot(normal(xx),xx,1,9, rgbcolor='green', linestyle = "dashed")
(p1+p2+p3+p4+p5).show(xmin=-5,xmax=10,ymin=0,ymax=12)
```

Out[4]:



In [0]: