In [1]:
```
#Find the radius of curvature  alog(sec(x/a))
import numpy as np
from sympy import *
x, a = symbols('x, a')
y=a*log(sec(x/a))
dy=simplify(diff(y,x))
d2y=simplify(diff(y,x,2))
r=((1+dy**2)**(3/2))/d2y
print('the radius of curvature is',r)
display(r)
```

```
the radius of curvature is a*(tan(x/a)**2 + 1)**1.5*cos(x/a)**2
```

$$a\left(\tan^2\left(\frac{x}{a}\right)+1\right)^{1.5}\cos^2\left(\frac{x}{a}\right)$$

In [2]:
```
#Finding the angle between the radius vector and the tangent:  R=a(1+cost) at t
from sympy import *
a,t=symbols('a,t')
R=a*(1+cos(t))
dRdt=diff(R,t)
R=R.subs(t,pi/3)
dRdt=dRdt.subs(t,pi/3)
PHI=atan(R/dRdt)
if PHI<0:
    PHI=PHI+pi
print('The angle between the radius vector and the tangent =',PHI)
display(PHI)
```

```
The angle between the radius vector and the tangent = 2*pi/3
```

$$\frac{2\pi}{3}$$

In [3]:
```
#Find the angle between the curves r=a(1-cost) and r=2a(cost) at t=acos(1/3)
from sympy import *
a,t=symbols('a,t')
R=a*(1-cos(t))
dRdt=diff(R,t)
R=R.subs(t,acos(1/3))
dRdt=dRdt.subs(t,acos(1/3))
PHI=atan(R/dRdt)
if PHI<0:
    PHI=PHI+pi
r=2*a*cos(t)
drdt=diff(r,t)
r=r.subs(t,acos(1/3))
drdt=drdt.subs(t,acos(1/3))
phi=atan(r/drdt)
if phi<0:
    phi=phi+pi
print('The angle of intersection =',abs(PHI-phi))
display(abs(PHI-phi))
```

```
The angle of intersection = -0.955316618124509 + pi
```

$$-0.955316618124509 + \pi$$

In [ ]: