Equation for circles intersection

In[52]:= `Xsol = Flatten[Solve[((x - d)^2 + y^2 == R^2) /. {y^2 -> (r^2 - x^2)}, x]]`

Out[52]= $\left\{ x \rightarrow \dfrac{d^2 + r^2 - R^2}{2\,d} \right\}$

In[53]:= `Ysol = FullSimplify[Flatten[Solve[(y^2 + x^2 == r^2) && x < r && x > -r /. Xsol, y]]]`

Out[53]= $\left\{ y \rightarrow -\dfrac{1}{2}\sqrt{-\dfrac{(d-r-R)\,(d+r-R)\,(d-r+R)\,(d+r+R)}{d^2}} \quad \text{if} \quad \boxed{condition\ \oplus} \right.,$

$\left. y \rightarrow \dfrac{1}{2}\sqrt{-\dfrac{(d-r-R)\,(d+r-R)\,(d-r+R)\,(d+r+R)}{d^2}} \quad \text{if} \quad \boxed{condition\ \oplus} \right\}$

Test cases

In[54]:= `Solve[{x^2 + y^2 == 1, (x - 1)^2 + y^2 == 1}, {x, y}]`

Out[54]= $\left\{ \left\{ x \rightarrow \dfrac{1}{2},\ y \rightarrow -\dfrac{\sqrt{3}}{2} \right\},\ \left\{ x \rightarrow \dfrac{1}{2},\ y \rightarrow \dfrac{\sqrt{3}}{2} \right\} \right\}$

In[55]:= `ArcTan[`$\dfrac{1}{2}, \dfrac{\sqrt{3}}{2}$`] - (`$\dfrac{1}{2} \times \dfrac{\sqrt{3}}{2}$`) + ArcTan[`$\dfrac{1}{2}, \dfrac{\sqrt{3}}{2}$`] - (`$\dfrac{1}{2} \times \dfrac{\sqrt{3}}{2}$`)`

Out[55]= $-\dfrac{\sqrt{3}}{2} + \dfrac{2\,\pi}{3}$

In[56]:= `Solve[{x^2 + y^2 == 1, (x - `$\dfrac{3}{2}$`)^2 + y^2 == 1}, {x, y}]`

Out[56]= $\left\{ \left\{ x \rightarrow \dfrac{3}{4},\ y \rightarrow -\dfrac{\sqrt{7}}{4} \right\},\ \left\{ x \rightarrow \dfrac{3}{4},\ y \rightarrow \dfrac{\sqrt{7}}{4} \right\} \right\}$

In[57]:= `N[`$\dfrac{\sqrt{3}}{2}$`, 50]`

Out[57]= `0.86602540378443864676372317075293618347140262690519`

In[58]:= `N[`$\dfrac{\sqrt{7}}{4}$`, 50]`

Out[58]= `0.66143782776614764762540393840981510642756479577061`

In[59]:= `N[`$-\dfrac{\sqrt{3}}{2} + \dfrac{2\,\pi}{3}$`, 50]`

Out[59]= `1.2283696986087568455447057514333990726600436393449`

In[60]:= `N[π, 50]`

Out[60]= `3.1415926535897932384626433832795028841971693993751`

In[61]:= $N\left[\frac{\pi}{2}, 50\right]$

Out[61]= 1.5707963267948966192313216916397514420985846996876

In[62]:= $N\left[\frac{\pi}{4}, 50\right]$

Out[62]= 0.78539816339744830961566084581987572104929234984378

In[63]:= $N\left[\frac{1}{\sqrt{2}}, 50\right]$

Out[63]= 0.70710678118654752440084436210484903928483593768847