

find area and circumfrence of an ellipse using polar coordinates

$$x = a \cos[t]$$

$$y = b \sin[t]$$

$$a \cos[t]$$

$$b \sin[t]$$

~~$$\text{Solve}[\text{Tan}[\text{theta}] == b/a \text{Tan}[t], \text{theta}]$$~~

Solve::ifun : Inverse functions are being used by Solve, so some solutions may not be found.

$$\{\{\text{theta} \rightarrow \text{ArcTan}\left[\frac{b \text{Tan}[t]}{a}\right]\}\}$$

$$\text{First}[\text{First}[\%3]]$$

$$\text{theta} \rightarrow \text{ArcTan}\left[\frac{b \text{Tan}[t]}{a}\right]$$

$$D[\text{Last}[\%4], t]$$

$$\frac{b \sec[t]^2}{a \left(1 + \frac{b^2 \text{Tan}[t]^2}{a^2}\right)}$$

$$\text{Simplify}[\%5 * (x^2 + y^2)]$$

$$a b$$

$$\%5 * \text{Sqrt}[x^2 + y^2]$$

$$\frac{b \sec[t]^2 \sqrt{a^2 \cos[t]^2 + b^2 \sin[t]^2}}{a \left(1 + \frac{b^2 \text{Tan}[t]^2}{a^2}\right)}$$

$$\text{Simplify}[\%7]$$

$$\frac{\sqrt{2} a b}{\sqrt{a^2 + b^2 + (a^2 - b^2) \cos[2 t]}}$$

$$4 * \text{Integrate}[\%8, \{t, 0, \pi/2\}]$$

$$\frac{4 a b \sqrt{\frac{b^2}{a^2}} \text{EllipticK}\left[\frac{a^2 - b^2}{a^2}\right]}{\sqrt{b^2}}$$

$$\text{circ} = 4 * b * \text{EllipticK}[1 - b^2/a^2]$$

$$4 b \text{EllipticK}\left[1 - \frac{b^2}{a^2}\right]$$

$$\text{EllipticK}[0]$$

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