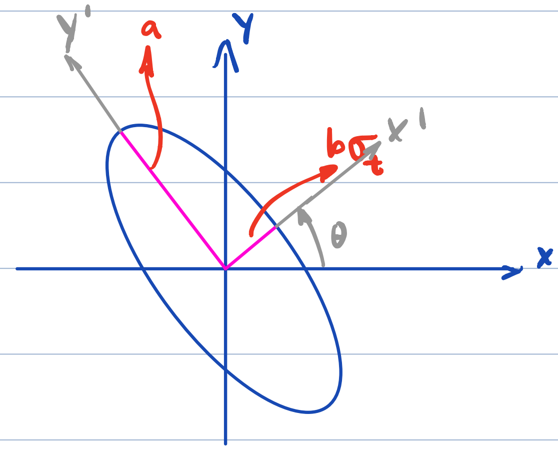
DETERMINATION OF t_w

The Gaussian function is



$$\left(\frac{x'}{b}\right)^2 + \left(\frac{y'}{a}\right)^2 = 1$$

while we have

$$x' = x\cos\theta + y\sin\theta$$

$$y' = -x\sin\theta + y\cos\theta$$

The Gaussian equation then becomes

$$\frac{1}{b^2}(x\cos\theta + y\sin\theta)^2 + \frac{1}{a^2}(-x\sin\theta + y\cos\theta)^2$$

$$= \frac{1}{b^2}\left(x^2\cos^2\theta + 2xy\sin\theta\cos\theta + y^2\sin^2\theta\right) + \frac{1}{b^2}\left(x^2\sin^2\theta - 2xy\sin\theta\cos\theta + y^2\cos^2\theta\right)$$

$$= x^2\left(\frac{\cos^2\theta}{a^2} + \frac{\sin^2\theta}{b^2}\right) + y^2\left(\frac{\sin^2\theta}{b^2} + \frac{\cos^2\theta}{a^2}\right) + 2xy\sin\theta\cos\theta\left(\frac{1}{b^2} - \frac{1}{a^2}\right)$$

$$= 1$$

If we now set $y = 0$, we find

$$x = \frac{\pm ab}{\sqrt{a^2\sin^2\theta + b^2\cos^2\theta}}$$

→ set a & b to $\sigma_{y'}$ & $\sigma_{x'}$.