0.1 Integrals

0.1.1 Cosine and sine

$\arccos(\theta)$, $\arcsin(\theta)$ and difficulty of inversing

In order to determine τ we need inverse functions for $\cos(\theta)$ or $\sin(\theta)$.

These are the $\arccos(\theta)$ and $\arcsin(\theta)$ functions respectively.

However this is not easily calculated. Instead we look for another function.

0.1.2 Calculating $\arctan(\theta)$

So we want a function to inverse this. This is the $\arctan(\theta)$ function.

If $y = \tan(\theta)$, then:

$\theta = \arctan(y)$

We know the derivative for $\tan(\theta)$ is:

$\frac{\delta}{\delta\theta} \tan(\theta) = 1 + \tan^2(\theta)$

$\frac{\delta y}{\delta\theta} = 1 + y^2$

So

$\frac{\delta\theta}{\delta y} = \frac{1}{1+y^2}$

$\frac{\delta}{\delta y} \arctan(y) = \frac{1}{1+y^2}$

So the value for $\arctan(k)$ is:

$\arctan(k) = \arctan(a) + \int_a^k \frac{\delta}{\delta y} \arctan(y)\delta y$

$\arctan(k) = \arctan(a) + \int_a^k \frac{1}{1+y^2}\delta y$

What do we know about this function? We know it can map to multiple values of θ because the underlying $\sin(\theta)$ and $\cos(\theta)$ functions also loop.

We know that one of the results for $\arctan(0)$ is 0.