Power series expansions

We start by examining the power series expansion of the functions e^x, sin x, and cos x. The power series of a function is commonly derived from the Taylor series of a function for the case where $a = 0$. This case, where $a = 0$ is called the MacLaurin Series. The Taylor series:

$$\sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!}(x-a)^n$$

The case where $a = 0$ is the MacLaurin Series:

$$\sum_{n=0}^{\infty} \frac{f^{(n)}(0)}{n!}(x)^n$$

These series are used to approximate the values of functions around a certain point. That is all I'll say about that. The power series of e^x; cos x and sin x comes from their MacLaurin Series representation:

$$e^x = \sum_{n=1}^{\infty} \frac{x^n}{n!} = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots$$

$$sinx = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!}x^{2n+1} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \ldots$$

$$cosx = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!}x^{2n} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \ldots$$

Arctan:

$$\sum_{n=0}^{\infty}(-1)^n \frac{x^{2n+1}}{2n+1}.$$