Construct a 4th degree polynomial that matches

$y = \ln(1+x)$ at $x = 0$

$\ln(1+x) = c_0 + c_1 x + c_2 x^2 + c_3 x^3 + c_4 x^4$

$\ln(1+0) = c_0$

$0 = c_0$

$\frac{1}{1+x} = c_1 + 2c_2 x + 3c_3 x^2 + 4c_4 x^3$

$1 = c_1 + 0$

$\frac{-1}{(1+x)^2} = 2c_2 + 6c_3 x + 12c_4 x^2$

$\frac{-1}{2} = \cancel{2}c_2 + 0$

$\frac{2}{(1+x)^3} = 6c_3 + 24c_4 x$

$\frac{2}{6} = \cancel{6}c_3 + 0$

$\frac{-6}{(1+x)^4} = 24c_4$

$\frac{-6}{24} = \cancel{24}c_4$

$\ln(1+x) \approx 0 + 1x - \frac{1}{2}x^2 + \frac{2}{6}x^3 - \frac{6}{24}x^4$

$f(x) \approx f(0) + \frac{f'(0)}{1!}x^1 + \frac{f''(0)}{2!}x^2 + \frac{f'''(0)}{3!}x^3 + \frac{f^4(0)}{4!}$

$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} + \dots$

Maclaurin Series

Maclaurin

$\sin x$

$f(0) + \frac{f'(0)}{1!}x^1 + \frac{f''(0)}{2!}x^2 + \frac{f'''(0)}{3!}x^3$

$\sin x = 0 + \frac{1}{1!}x + \frac{0}{2!}x^2 + \frac{-1}{3!}x^3 + \dots$

$f'(x) = \cos x$

$f''(x) = -\sin x$

$f'''(x) = -\cos x$

$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!}$

Maclaurin Series for f(x)

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots$$

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

$$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$$

$$\frac{1}{1-x} = 1 + x + x^2 + x^3 + x^4 + \cdots$$

$$\frac{a_1}{1-r}$$

$$\ln(1+x)$$

$$\frac{1}{1+x}$$

$$\frac{1}{1-(-x)} = 1 - x + x^2 - x^3 + x^4 - x^5 + \cdots$$

$$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$$

Find the Maclaurin series for $f(x) = \sin x$. How many terms are required to approximate sin(7) accurate to the 3rd decimal place?

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$$

$$\sin(7) = 7 - \frac{7^3}{3!} + \frac{7^5}{5!} - \frac{7^7}{7!} + \cdots$$

$$.6569 = 7$$

Maclaurin Series: centered @ $x=0$

$$f(x) = f(0) + \frac{f'(0)}{1!}x^1 + \frac{f''(0)}{2!}x^2 + \frac{f'''(0)}{3!}x^3 + \frac{f^4(0)}{4!}x^4 + \cdots$$

Taylor Series: centered @ $x=a$

$$f(x) = f(a) + \frac{f'(a)}{1!}(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \cdots$$

Taylor Series for sinx centered @ $x = \frac{\pi}{2}$

$\sin\left(\frac{\pi}{2}\right)$

$$= 1 + \frac{0}{1!}\left(x - \frac{\pi}{2}\right) + \frac{-1}{2!}\left(x - \frac{\pi}{2}\right)^2$$

$f'(x) = \cos x$

$f''(x) = -\sin x$