$$\sum_{k=1}^{\infty} \frac{3^k}{k!} = \sum_{k=1}^{\infty} a_k$$

$$\left| \frac{a_{n+1}}{a_n} \right| = \frac{\frac{3^{n+1}}{(n+1)!}}{\frac{3^n}{n!}} = \frac{3^{n+1}}{(n+1)!} \cdot \frac{n!}{3^n} = \frac{3}{n+1} \xrightarrow{n \to \infty} 0$$

$$(n+1)! = (n+1)\underbrace{(n)(n-1)\cdots(3)(2)}_{n!}$$

$=$

$$\int x^{-1} dx = \int \frac{dx}{x} = \ln|x| + C$$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C, \text{ if } n \neq -1.$$

$$\int x^{-\frac{3}{2}} dx = \frac{x^{-\frac{1}{2}}}{-\frac{1}{2}} + C = -2x^{-\frac{1}{2}} + C$$

$$-\frac{3}{2} + 1 = -\frac{3}{2} + \frac{2}{2} = -\frac{1}{2}$$

$$\int_1^t \frac{\ln(x)}{x^{3/2}} dx = uv\Big|_1^t - \int_1^t v\,du$$

$u = \ln x$ $\quad dv = x^{-\frac{3}{2}} dx$

$du = \frac{1}{x} dx$ $\quad v = -2x^{-\frac{1}{2}}$

$f(x) = \ln x$

$$f'(x) = \frac{1}{x} = \frac{1}{1-1+x} = \frac{1}{1-(1-x)} = \sum_{k=0}^{\infty} (1-x)^k$$

$$\frac{1}{1-*} = \sum_{k=0}^{\infty} *^k = \frac{1}{1-*} \text{ if } -1 < * < 1$$

So $\ln(x) = -\sum_{k=0}^{\infty} \frac{(1-x)^{k+1}}{k+1}$

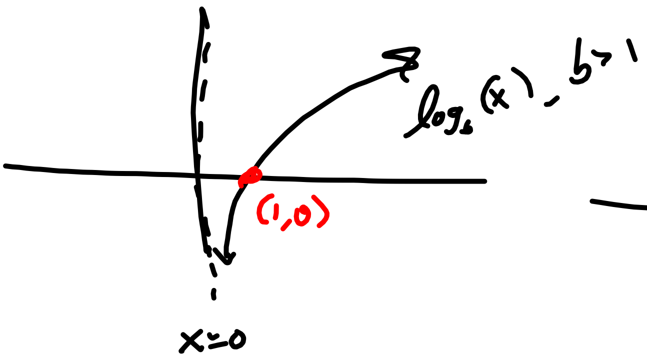
$$\int (1-x)^k\,dx = -\int (1-x)^k(-dx) = -\int u^k\,du = -\frac{u^{k+1}}{k+1} = -\frac{(1-x)^{k+1}}{k+1}$$

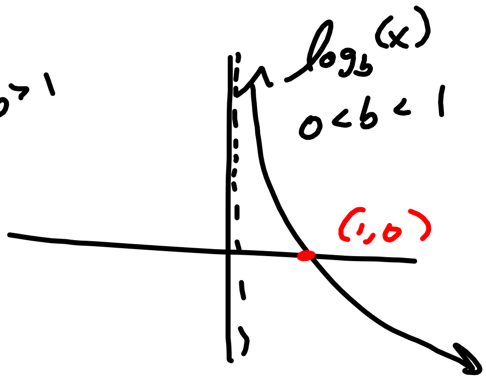
$u = 1-x$

$du = -dx$

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

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





$(x+1)^{2/3}$

$\binom{n}{k} = \frac{n(n-1)\dots(n-k+1)}{k!}$

$k=0$

$n-k+1 = n-(k-1)$

$\binom{\frac{2}{3}}{0} = 1$

$\binom{\frac{2}{3}}{1} = \frac{\frac{2}{3}}{1!} = \frac{2}{3}$

$\binom{\frac{2}{3}}{2} = \frac{\left(\frac{2}{3}\right)\left(-\frac{1}{3}\right)}{2!} = -\frac{1}{9}$

$n-(k-1) = n-1 = \frac{2}{3}-1 = -\frac{1}{3}$

$\binom{\frac{2}{3}}{3} = \frac{\left(\frac{2}{3}\right)\left(-\frac{1}{3}\right)\left(-\frac{4}{3}\right)}{3\cdot 2} = \frac{\frac{8}{27}}{6} = \frac{8}{27}\cdot\frac{1}{6} = \frac{4}{81}$

$\frac{\left(-\frac{1}{9}\right)\left(-\frac{4}{3}\right)}{3} = \frac{4}{81}$

$\binom{\frac{2}{3}}{4} = \frac{4}{81}\cdot\left(-\frac{7}{3}\right)\left(\frac{1}{4}\right) = -\frac{7}{243}$

$\binom{\frac{2}{3}}{5} = \left(-\frac{7}{243}\right)\left(-\frac{\cancel{10}^{\,2}}{3}\right)\left(\frac{1}{\cancel{5}}\right) = \frac{14}{729}$

$\frac{3}{729}$

$(x+1)^{\frac{2}{3}} = 1 + \frac{2}{3} - \frac{1}{9} + \frac{4}{81} - \frac{7}{243}$

$$(x+1)^{\frac{2}{3}} = 1 + \frac{2}{3}x - \frac{1}{9}x^2 + \frac{4}{81}x^3 - \frac{7}{243}x^4$$

Taylor ser:

$f(0) = 1$

$f'(x) = \frac{2}{3}(x+1)^{-\frac{1}{3}}$

$f'(0) = \frac{2}{3}$

$f''(x) = -\frac{2}{9}(x+1)^{-\frac{4}{3}}$

$f''(0) = -\frac{2}{9}$

$f'''(x) = \frac{8}{27}(x+1)^{-\frac{7}{3}}$

$f'''(0) = \frac{8}{27}$

$f^{(4)} = -\frac{56}{81} = f^{(4)}(0)$

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

$$f(x) = \frac{1}{0!} + \frac{\frac{2}{3}}{1!}x - \frac{\frac{2}{9}}{2!}x^2 + \frac{\frac{8}{27}}{\underset{3\cdot 2}{3!}}x^3 - \frac{\frac{56}{81}}{\underset{4\cdot 3\cdot 2}{4!}}x^4 + \cdots$$

$$= 1 + \frac{2}{3}x - \frac{1}{9}x^2 + \frac{4}{81}x^3 - \frac{7}{243}x^4$$

See? It woiks!