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0.1 Taylor series

$f(x)$ can be estimated at point c by identifying its repeated differentials at point c .

The coefficients of an infinite number of polynomials at point c allow this.

$$f(x) = \sum_{i=0}^{\infty} a_i (x - c)^i$$

$$f'(x) = \sum_{i=1}^{\infty} a_i (x - c)^{i-1} i$$

$$f''(x) = \sum_{i=2}^{\infty} a_i (x - c)^{i-2} i(i-1)$$

$$f^j(x) = \sum_{i=j}^{\infty} a_i (x - c)^{i-j} \frac{i!}{(i-j)!}$$

For $x = c$ only the first term in the series is non-zero.

$$f^j(c) = \sum_{i=j}^{\infty} a_i (c - c)^{i-j} \frac{i!}{(i-j)!}$$

$$f^j(c) = a_j j!$$

So:

$$a_j = \frac{f^j(c)}{j!}$$

So:

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