Taylor Series: Example

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Find the value of $f(6)$ given that $f(4) = 125, f'(4) = 74, f''(4) = 30, f'''(4) = 6$ and all other higher derivatives of $f(x)$ at $x = 4$ are zero. Also, from $x = 4$ and $x = 6$, all derivatives exist and are continuous.

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

$x = 4$, $\quad x+h = 6 \Rightarrow 4+h = 6 \Rightarrow h = 2$

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

$$= f(4) + 2f'(4) + 2f''(4) + \frac{8}{6}f'''(4)$$

$$= 125 + 2(74) + 2(30) + \frac{8}{6}(6)$$

$f(6) = 341$

END

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