HS HW #2 Temirlan Zholaman

Calculus

ex 1 | 5.3

$$f(x) = e^{\left(-\frac{1}{2\sigma^2}(x-\mu)^2\right)}, \quad \sigma, \mu - \text{const}$$

find $f'(x)$

$$f'(x) = \left(e^{\left(-\frac{1}{2\sigma^2}(x-\mu)^2\right)}\right)' = \quad \to \text{Chain Rule}$$

$$= e^{-\frac{1}{2\sigma^2}(x-\mu)^2} \cdot \left(-\frac{1}{2\sigma^2}(x-\mu)^2\right)' =$$

$$= e^{\left(-\frac{1}{2\sigma^2}(x-\mu)^2\right)} \cdot \left(-\frac{1}{2\sigma^2} \cdot 2(x-\mu)\right) =$$

$$= e^{-\frac{1}{2\sigma^2}(x-\mu)^2)} \cdot \left(-\frac{1}{\sigma^2} \cdot (x-\mu)\right)$$

$$= -\frac{e^{\left(-\frac{1}{2\sigma^2}(x-\mu)^2\right)} \cdot (x-\mu)}{\sigma^2}$$

$\boxed{\text{end}}$

ex 2 | find T_∞ for $f(x) = \ln x$, $x_0 = 1$

$f(x) = \ln x$ $\quad$ $f(x_0) = 0$ $\quad$ $T_n = \sum_{k=0}^{n} \frac{f^{(k)}(x_0)}{k!}(x-x_0)^k$

$f'(x) = x^{-1}$ $\quad$ $f'(x_0) = 1$

$f''(x) = -1x^{-2}$ $\quad$ $f''(x_0) = -1$

$f'''(x) = 2x^{-3}$ $\quad$ $f'''(x_0) = 2$

$f^{4}(x) = -6x^{-4}$ $\quad$ $f^{4}(x_0) = -6$

$$\text{so } T_n = \sum_{k=0}^{n} \frac{f^{(k)}(x_0)}{k!}(x-x_0)^k = \frac{0}{1}(x-1)^0 + \frac{1}{1!}(x-1)^1 +$$

$$+ \frac{-1}{2!}(x-1)^2 + \frac{2}{3!}(x-1)^3 + \frac{-6}{4!}(x-1)^4 =$$

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

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

$\boxed{\text{end}}$