

## Worksheet #38: Taylor and Maclaurin Power Series

### Basic Definitions:

(1) If  $f$  has derivatives of all orders at  $c$ , then the **Taylor series for  $f$  about  $x = c$**  is

$$\sum_{k=0}^{\infty} \frac{f^{(k)}(c)}{k!} (x-c)^k = f(c) + f'(c)(x-c) + \frac{f''(c)}{2!} (x-c)^2 + \frac{f'''(c)}{3!} (x-c)^3 + \dots$$

(2) In the special case where  $c = 0$ , we call it the **Maclaurin series for  $f$**  and the series becomes:

$$\sum_{k=0}^{\infty} \frac{f^{(k)}(0)}{k!} (x-0)^k = f(0) + f'(0)x + \frac{f''(0)}{2!} x^2 + \frac{f'''(0)}{3!} x^3 + \dots$$

Note:  $0! = 1$  and  $1! = 1$  when expanding the terms in the formula for  $k!$

1. Find the first four nonzero terms of the Taylor Series for  $f(x) = \cos(2x)$  about  $x = \frac{\pi}{8}$ .
2. Find the first four nonzero terms of the Taylor Series for  $f(x) = \sin(x)$  about  $x = \frac{\pi}{4}$ .
3. Find the first four nonzero terms of the Maclaurin Series for  $f(x) = e^x$ .
4. Find the first four nonzero terms of the Maclaurin Series for  $f(x) = \sin(x)$ .