## MATH203 Calculus

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# Taylor series

### Taylor series

If a function has derivatives of all order at x=c, then the series  $f(c)+(x-c)f'(c)+\frac{(x-c)^2}{2!}f''(c)+\cdots+\frac{(x-c)^n}{n!}f^n(c)+\cdots=\sum_{c=0}^{\infty}\frac{(x-c)^n}{n!}f^n(c)$  is called Taylor series for f(x) at x=c.

### Maclaurin series

If a function has derivatives of all order at x=0, then the series

$$f(0) + xf'(0) + \frac{x^2}{2!}f''(0) + \dots + \frac{x^n}{n!}f^n(0) + \dots = \sum_{n=0}^{\infty} \frac{x^n}{n!}f^n(0)$$
 is called

Maclaurin series for f(x) at x = 0.



# **Examples**

Find Maclaurin series which represents the following functions for every real number x:

- (1):  $f(x) = e^x$
- (2):  $f(x) = \sin(x)$
- (3):  $f(x) = \cos(x)$
- (4):  $f(x) = \ln(1+x)$
- (5):  $f(x) = \tan^{-1}(x)$
- (6):  $f(x) = \sinh(x)$
- (7):  $f(x) = \cosh(x)$
- (8):  $f(x) = x^2 \sin(x)$
- (9):  $f(x) = \cos(x^2)$

#### Solution: