§9.7 APPLICATION OF TAYLOR AND MACLAURIN SERIES

Indeterminate Forms

Example 1. Calculate the following limits.

i. $\lim_{x\to 0}\frac{x-sinx}{x^3}$ ii. $\lim_{x\to 0}\frac{(e^{2x}-1)ln(1+x^3)}{(1-cos3x)^2}$.

i. $\lim_{x\to 0}\frac{x-sinx}{x^3}\ \ [\frac{0}{0}]$

$=\lim_{x\to 0}\frac{x-(x-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}+...)}{x^3}=\lim_{x\to 0}\frac{\frac{x^3}{3!}-\frac{x^5}{5!}+\frac{x^7}{7!}-...}{x^3}=\lim_{x\to 0}(\frac{1}{3!}-\frac{x^2}{5!}+\frac{x^4}{7!}-...)=\frac{1}{3!}=\frac{1}{6}$.

ii. $\lim_{x\to 0}\frac{(e^{2x}-1)ln(1+x^3)}{(1-cos3x)^2}\ \ [\frac{0}{0}]$

$=\lim_{x\to 0}\frac{(1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+...-1)(x^3-\frac{x^6}{2}+\frac{x^9}{3}-...)}{(1-(1-\frac{(3x)^2}{2!}+\frac{(3x)^4}{4!}-\frac{(3x)^6}{6!}+...))^2}=\lim_{x\to 0}\frac{2x^4+2x^5+...}{(\frac{9}{2}x^2-\frac{3^4}{4!n}x^4+...)^2}=\frac{2}{(\frac{9}{2})^2}=\frac{8}{81}$