# Calculus

## L'Hospital Rule

① $\lim\limits_{x \to 0} \dfrac{e^{x} - e^{-x}}{\sin x}$

② $\lim\limits_{x \to 0} \dfrac{1 - \cos^2 x}{\sin x^2}$

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$$\lim_{x \to 0} \frac{e^x - e^{-x}}{\sin x} = \frac{f(x)}{g(x)}$$

$$\frac{e^0 - e^0}{\sin 0} = \left(\frac{0}{0}\right) \text{ form.}$$

So By L'hospital Rule.

$$\lim_{x \to 0} \frac{f'(x)}{g'(x)} = \lim_{x \to 0} \frac{e^x - e^{-x}(-1)}{\cos x}$$

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$$\frac{e^0 + e^0}{\cos 0} = \frac{1+1}{1} = 2 \text{ Ans}$$

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(2) $$\lim_{x \to 0} \frac{1 - \cos^2 x}{\sin x^2} \quad \left(\frac{0}{0}\right) \text{ form}$$

By L' hospital Rule

$$\lim_{x \to 0} \frac{0 - \cancel{2} \cos x \, (-\sin x)}{\cos x^2 \, (\cancel{2} x)}$$

$$\lim_{x\to 0} \frac{\sin x \cos x}{x \cos x^2}$$

$$\lim_{x\to 0} \frac{\sin x}{x} \lim_{x\to 0} \frac{\cos x}{\cos x^2}$$

$$\left[\because \lim_{x\to 0} \frac{\sin x}{x} = 1\right]$$

$$1 \cdot 1 = 1 \text{ Ans.}$$

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