Maths Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 15

Limits

Standard limits

$$\lim_{x\to 0}\frac{\sin x}{x}=1,\qquad \lim_{x\to 0}\frac{\tan x}{x}=1,\qquad \lim_{x\to 0}\frac{1-\cos x}{x^2}=\frac{1}{2}$$

$$\lim_{x\to 0}\frac{e^x-1}{x}=1,\qquad \lim_{x\to 0}\frac{a^x-1}{x}=\ln a,\qquad \lim_{x\to 0}\frac{\ln(1+x)}{x}=1$$

$$\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1},\qquad \lim_{x\to 0}\frac{(1+x)^n-1}{x}=n$$

1^∞ form

$$\lim_{x\to a}f(x)=1,\ \lim g(x)=\infty\ \Rightarrow\ \lim f(x)^{g(x)}=e^{\lim g(x)\,(f(x)-1)}$$

$$\lim_{x\to 0}(1+x)^{1/x}=e,\qquad \lim_{x\to\infty}\left(1+\frac{a}{x}\right)^x=e^a$$

Expansions and L'Hospital's rule

SERIES

$$e^x=1+x+\frac{x^2}{2!}+\cdots,\qquad \ln(1+x)=x-\frac{x^2}{2}+\frac{x^3}{3}-\cdots$$

$$\sin x=x-\frac{x^3}{3!}+\cdots,\qquad \cos x=1-\frac{x^2}{2!}+\frac{x^4}{4!}-\cdots,\qquad \tan x=x+\frac{x^3}{3}+\cdots$$

L'HOSPITAL

$$\frac{0}{0}\text{ or }\frac{\infty}{\infty}:\ \lim\frac{f(x)}{g(x)}=\lim\frac{f'(x)}{g'(x)}$$

RATIONAL FUNCTION AT ∞

$$\lim_{x\to\infty}\frac{a_0x^m+\cdots}{b_0x^n+\cdots}=\begin{cases}0, & m<n\\ a_0/b_0, & m=n\\ \pm\infty, & m>n\end{cases}$$

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