Mathematical Analysis

FORMULA SHEET

Short table of derivatives

$f(x)$	$f'(x)$	$f(x)$	$f'(x)$
k	0	x^a	ax^{a-1}
$\cos(ax)$	$-a\sin(ax)$	$\sin(ax)$	$a\cos(ax)$
e^{ax}	ae^{ax}	$\ln(ax)$	$\frac{1}{x}$
$\cos^{-1}\left(\frac{x}{a}\right)$	$-\frac{1}{\sqrt{a^2-x^2}}$	$\sin^{-1}\left(\frac{x}{a}\right)$	$\frac{1}{\sqrt{a^2-x^2}}$
$\tan(ax)$	$a\sec^2(ax)$	$\tan^{-1}\left(\frac{x}{a}\right)$	$\frac{a}{a^2+x^2}$

Trigonometric identities

$$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta \qquad \cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$$
$$\sin\alpha\sin\beta = \tfrac{1}{2}(\cos(\alpha-\beta) - \cos(\alpha+\beta)) \qquad \cos\alpha\cos\beta = \tfrac{1}{2}(\cos(\alpha-\beta) + \cos(\alpha+\beta))$$
$$\sin\alpha\cos\beta = \tfrac{1}{2}(\sin(\alpha+\beta) + \sin(\alpha-\beta))$$

Values of trigonometric functions

$$\sin\left(\tfrac{\pi}{4}\right) = \tfrac{1}{\sqrt{2}} = \tfrac{\sqrt{2}}{2} \qquad \cos\left(\tfrac{\pi}{4}\right) = \tfrac{1}{\sqrt{2}} = \tfrac{\sqrt{2}}{2} \qquad \tan\left(\tfrac{\pi}{4}\right) = 1$$
$$\sin\left(\tfrac{\pi}{3}\right) = \tfrac{\sqrt{3}}{2} \qquad \cos\left(\tfrac{\pi}{3}\right) = \tfrac{1}{2} \qquad \tan\left(\tfrac{\pi}{3}\right) = \sqrt{3}$$
$$\sin\left(\tfrac{\pi}{6}\right) = \tfrac{1}{2} \qquad \cos\left(\tfrac{\pi}{6}\right) = \tfrac{\sqrt{3}}{2} \qquad \tan\left(\tfrac{\pi}{6}\right) = \tfrac{1}{\sqrt{3}} = \tfrac{\sqrt{3}}{3}$$

Integration by parts

$$\int u\frac{dv}{dx}\,dx = uv - \int v\frac{du}{dx}\,dx$$

Taylor series about $x = a$

$$f(x) = f(a) + (x-a)f'(a) + \frac{(x-a)^2}{2!}f''(a) + \frac{(x-a)^3}{3!}f'''(a) + \cdots + \frac{(x-a)^r}{r!}f^{(r)}(a) + \cdots$$

valid for some interval I containing x and a.

(End)