TRIGONOMETRY FUNCTIONS...

① $\cos(x+y) = \cos x \cos y - \sin x \sin y$

② $\cos(x-y) = \cos x \cos y + \sin x \sin y$

③ $\sin(x+y) = \sin x \cos y + \cos x \sin y$

④ $\sin(x-y) = \sin x \cos y - \cos x \sin y$

⑤ $\tan(x+y) = \dfrac{\tan x + \tan y}{1 - \tan x \tan y}$

⑥ $\tan(x-y) = \dfrac{\tan x - \tan y}{1 + \tan x \tan y}$

⑦ $\cot(x+y) = \dfrac{\cot x \cot y - 1}{\cot y + \cot x}$

⑧ $\cot(x-y) = \dfrac{\cot x \cot y + 1}{\cot y - \cot x}$

⑨ $\cos 2x = \cos^2 x - \sin^2 x = 2\cos^2 x - 1 = 1 - 2\sin^2 x = \dfrac{1 - \tan^2 x}{1 + \tan^2 x}$

⑩ $\sin 2x = 2 \sin x \cos x = \dfrac{2 \tan x}{1 + \tan^2 x}$

⑪ $\tan 2x = \dfrac{2 \tan x}{1 - \tan^2 x}$

⑫ $\sin 3x = 3 \sin x - 4 \sin^3 x$

⑬ $\cos 3x = 4\cos^3 x - 3\cos x$

⑭ $\tan 3x = \dfrac{3 \tan x - \tan^3 x}{1 - 3\tan^2 x}$

15. $\cos x + \cos y = 2\cos\frac{x+y}{2} \cdot \cos\frac{x-y}{2}$

16. $\cos x - \cos y = -2\sin\frac{x+y}{2} \sin\frac{x-y}{2}$

17. $\sin x + \sin y = 2\sin\frac{x+y}{2} \cos\frac{x-y}{2}$

18. $\sin x - \sin y = 2\sin\frac{x-y}{2} \cos\frac{x+y}{2}$

19. $2\cos x \cos y = \cos(x+y) + \cos(x-y)$

20. $-2\sin x \sin y = \cos(x+y) - \cos(x-y)$

21. $2\sin x \cos y = \sin(x+y) + \sin(x-y)$

22. $2\cos x \sin y = \sin(x+y) - \sin(x-y)$

23. $\sin x = \sin y \rightarrow; \ x = n\pi \pm (-1)^n y$

24. $\cos x = \cos y \ ; \ x = 2n\pi \pm y$

25. $\tan x = \tan y \ ; \ x = n\pi + y$

26. $\sin^2 x + \cos^2 x = 1$

27. $1 + \tan^2 x = \sec^2 x$

28. $1 + \cot^2 x = \operatorname{cosec}^2 x$

INVERSE TRIGONOMETRIC FUNCTION

1. $\sin^{-1}(x) = \operatorname{cosec}^{-1}\left(\frac{1}{x}\right)$
2. $\operatorname{cosec}^{-1}(x) = \sin^{-1}\left(\frac{1}{x}\right)$
3. $\tan^{-1}(x) = \cot^{-1}\left(\frac{1}{x}\right)$
4. $\cot^{-1}(x) = \tan^{-1}\left(\frac{1}{x}\right)$
5. $\cos^{-1}(x) = \sec^{-1}\left(\frac{1}{x}\right)$
6. $\sec^{-1}(x) = \cos^{-1}\left(\frac{1}{x}\right)$
7. $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$
8. $\tan^{-1}(x) + \cot^{-1}(x) = \frac{\pi}{2}$
9. $\sec^{-1}x + \operatorname{cosec}^{-1}x = \frac{\pi}{2}$
10. $\sin^{-1}(-x) = -\sin^{-1}(x)$
11. $\tan^{-1}(-x) = -\tan^{-1}(x)$
12. $\operatorname{cosec}^{-1}(-x) = -\operatorname{cosec}^{-1}(x)$
13. $\cos^{-1}(-x) = \pi - \cos^{-1}x$
14. $\sec^{-1}(-x) = \pi - \sec^{-1}(x)$
15. $\cot^{-1}(-x) = \pi - \cot^{-1}(x)$
16. $\sin^{-1}x + \sin^{-1}y = \sin^{-1}(x\sqrt{1-y^2} + y\sqrt{1-x^2})$
17. $\sin^{-1}x - \sin^{-1}y = \sin^{-1}(x\sqrt{1-y^2} - y\sqrt{1-x^2})$
18. $\cos^{-1}x + \cos^{-1}y = \cos^{-1}(xy - \sqrt{1-x^2}\cdot\sqrt{1-y^2})$
19. $\cos^{-1}x - \cos^{-1}y = \cos^{-1}(xy + \sqrt{1-x^2}\sqrt{1-y^2})$
20. $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ [When, $xy < 1$]
21. $\tan^{-1}x - \tan^{-1}y = \tan^{-1}\left(\frac{x-y}{1+xy}\right)$
22. $\tan^{-1}x - \tan^{-1}y = \pi + \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ [When, $xy > 1$]

(23) $2\tan^{-1}x = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$

(24) $2\tan^{-1}x = \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$

(25) $2\tan^{-1}x = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$

(26) $2\sin^{-1}x = \sin^{-1}2x\sqrt{1-x^2}$

(27) $2\cos^{-1}x = \cos^{-1}(2x^2-1)$

(28) $2\cos^{-1}x = \sin^{-1}2x\sqrt{1-x^2}$

① $\lim_{x \to a} \frac{x^n - a^n}{x - a} = na^{n-1}$

② $\lim_{x \to 0} \frac{\sin x}{x} = 1$

③ $\lim_{x \to 0} \frac{\tan x}{x} = 1$

④ $\lim_{x \to 0} \frac{\log(1+x)}{x} = 1$

⑤ $\lim_{x \to 0} \frac{e^x - 1}{x} = 1$

⑥ $\lim_{x \to 0} \frac{a^x - 1}{x} = \log_e a$

⑦ $\lim_{x \to 0} (1+x)^{\frac{1}{x}} = e$

⑧ $\lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^x = e$

FIRST TYPE

$$f(x) = \begin{cases} 3x & , \text{for } x \neq a \\ 2x & , \text{for } x = a \end{cases}$$

$$\lim_{x \to a} f(x) = f(a)$$

SECOND TYPE

$$f(x) = \begin{cases} 3x & , \text{for } x < a \\ 2x & , \text{for } x = a \\ x & , \text{for } x > a \end{cases}$$

$$LHL = f(a) = RHL$$

1. $\frac{d}{dx}(x^n) = nx^{n-1}$
2. $\frac{d}{dx}(x) = 1$
3. $\frac{d}{dx}(\text{const}) = 0$
4. $\frac{d}{dx}(\sin x) = \cos x$
5. $\frac{d}{dx}(\cos x) = -\sin x$
6. $\frac{d}{dx}(\tan x) = \sec^2 x$
7. $\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$
8. $\frac{d}{dx}(\sec x) = \sec x \tan x$
9. $\frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \cot x$
10. $\frac{d}{dx}(e^x) = e^x$
11. $\frac{d}{dx}(a^x) = a^x \log_e a$
12. $\frac{d}{dx}(\log x) = \frac{1}{x}$
13. $\frac{d}{dx}\left(\frac{1}{x}\right) = \frac{-1}{x^2}$
14. $\frac{d}{dx}(\sqrt{x}) = \frac{1}{2\sqrt{x}}$
15. $\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$
16. $\frac{d}{dx}(\cos^{-1} x) = \frac{-1}{\sqrt{1-x^2}}$
17. $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$
18. $\frac{d}{dx}(\cot^{-1} x) = \frac{-1}{1+x^2}$
19. $\frac{d}{dx}(\sec^{-1} x) = \frac{1}{x\sqrt{x^2-1}}$
20. $\frac{d}{dx}(\operatorname{cosec}^{-1} x) = \frac{-1}{x\sqrt{x^2-1}}$
21. $e^{\log_e x} = x$
22. $\log ab = \log a + \log b$
23. $\log\left(\frac{a}{b}\right) = \log a - \log b$
24. $\log b^a = a \log b$
25. $\log_b a = \frac{\log a}{\log b}$

Scanned by CamScanner

	0°	$\frac{\pi}{6} = 30^\circ$	$\frac{\pi}{4} = 45^\circ$	$\frac{\pi}{3} = 60^\circ$	$\frac{\pi}{2} = 90^\circ$	$\pi = 180^\circ$	$\frac{3\pi}{2} = 270^\circ$	$2\pi = 360^\circ$
sin	0	$1/2$	$1/\sqrt{2}$	$\sqrt{3}/2$	1	0	-1	0
Cos	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$1/2$	0	-1	0	1
tan	0	$1/\sqrt{3}$	1	$\sqrt{3}$	N.D	0	N.D	0
cot	N.D	$\sqrt{3}$	1	$1/\sqrt{3}$	0	~~-1~~ N.D	0	N.D
cosec	N.D	2	$\sqrt{2}$	$2/\sqrt{3}$	1	N.D	-1	N.D
sec	1	$2/\sqrt{3}$	$\sqrt{2}$	2	N.D	-1	N.D	1

Maxima And Minima

$f(x)$

$\downarrow$

$f'(x) \longrightarrow F'(x) = 0$

$\downarrow \qquad\qquad \downarrow$

$F''(x)$ — Get Critical Points

$f''(C.P)$

- +ve — Minima
- −ve — Maxima

Minimum Value $= f(C.P)$

INTEGRATION....

$$\int x^n dx = \begin{cases} \frac{x^{n+1}}{n+1} + C, & n \neq -1 \\ \log|x| + C, & n = -1 \end{cases}$$

$$\int (ax+b)^n dx = \begin{cases} \frac{(ax+b)^{n+1}}{(n+1)a} + C, & n \neq -1 \\ \frac{1}{a}\log|ax+b| + C, & n = -1 \end{cases}$$

$\int \sin x \, dx = -\cos x + C$

$\int \cot x \, dx = \log|\sin x| + C$

$\int \cos x \, dx = \sin x + C$

$\int \sec^2 x \, dx = \tan x + C$

$\int \tan x \cdot dx = -\log|\cos x| + C = \log|\sec x| + C$

$\int \operatorname{cosec}^2 x \, dx = -\cot x + C$

$\int \sec x \tan x \, dx = \sec x + C$

$\int \operatorname{cosec} x \cot x \, dx = -\operatorname{cosec} x + C$

$\int \sec x \, dx = \log|\sec x + \tan x| + C$

$\int \operatorname{cosec} x \, dx = \log|\operatorname{cosec} x - \cot x| + C$

$\int e^x dx = e^x + C$

$\int a^x dx = \frac{a^x}{\log a} + C$

$\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + C$

$\int \frac{1}{1+x^2} dx = \tan^{-1} x + C$

$\int \frac{1}{x\sqrt{x^2-1}} dx = \sec^{-1} x + C, \ |x| > 1$

$$\int \frac{1}{a^2 - x^2} dx = \frac{1}{2a} \log\left|\frac{a+x}{a-x}\right| + C$$

$$\int \frac{1}{x^2 - a^2} dx = \frac{1}{2a} \log\left|\frac{x-a}{x+a}\right| + C$$

$$\int \frac{1}{a^2 + x^2} dx = \frac{1}{a} \tan^{-1}\frac{x}{a} + C$$

$$\int \frac{1}{\sqrt{a^2-x^2}}\,dx = \sin^{-1}\frac{x}{a} + C$$

$$\int \frac{1}{\sqrt{a^2+x^2}}\,dx = \log\left|x+\sqrt{a^2+x^2}\right| + C$$

$$\int \frac{1}{\sqrt{x^2-a^2}}\,dx = \log\left|x+\sqrt{x^2-a^2}\right| + C$$

$$\int \sqrt{a^2-x^2}\,dx = \frac{x}{2}\sqrt{a^2-x^2} + \frac{a^2}{2}\sin^{-1}\frac{x}{a} + C$$

$$\int \sqrt{a^2+x^2}\,dx = \frac{x}{2}\sqrt{a^2+x^2} + \frac{a^2}{2}\log\left|x+\sqrt{a^2+x^2}\right| + C$$

$$\int \sqrt{x^2-a^2}\,dx = \frac{x}{2}\sqrt{x^2-a^2} - \frac{a^2}{2}\log\left|x+\sqrt{x^2-a^2}\right| + C$$

$$\int k\cdot f(x)\,dx = k\int f(x)\,dx$$

$$\int \ln x\,dx = x\ln x - x + C$$

$$\int k\{f(x) \pm g(x)\}\,dx = k\int f(x)\,dx \pm k\int g(x)\,dx$$

$$\int \frac{f'(x)}{f(x)}\,dx = \log|f(x)| + C$$

$$\int [f(x)]^n f'(x)\,dx = \frac{[f(x)]^{n+1}}{n+1} + C$$

$$\int \frac{f'(x)}{[f(x)]^n}\,dx = \frac{(f(x))^{-n+1}}{-n+1} + C$$

$$\int f(x)\cdot g(x)\,dx = f(x)\cdot\left[\int g(x)\,dx\right] - \int f'(x)\cdot\left[\int g(x)\,dx\right]dx$$

$\int 1\,dx = x + C$

$\int \frac{1}{x}\,dx = \log x + C$

$\int \sec x \tan x\,dx = \sec x + C$

$a^{\log_a x} = x$ *

$\int \frac{-1}{\sqrt{1-x^2}}\,dx = \cos^{-1}x + C$

$\int \frac{-1}{1+x^2}\,dx = \cot^{-1}x + C$

$\int \frac{-1}{x\sqrt{x^2-1}}\,dx = \operatorname{cosec}^{-1}x + C$

$\int \frac{1}{2\sqrt{x}}\,dx = \sqrt{x} + C$

$\int \sec x\,dx = \log\left|\tan\left(\frac{x}{2} + \frac{\pi}{4}\right)\right| + C$

$\int \operatorname{cosec} x\,dx = \log\left|\tan \frac{x}{2}\right| + C$

$\int \frac{-1}{\sqrt{1-x^2}} = -\cot^{-1}x + C$

$\int \frac{1}{\sqrt{a^2-x^2}} = \cos^{-1}\left(\frac{x}{a}\right) + C$

$\int \frac{1}{a^2+x^2}\,dx = \frac{-1}{a}\cot^{-1}\left(\frac{x}{a}\right) + C$

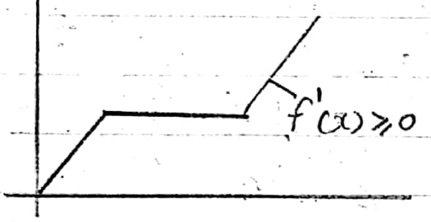
$\int \frac{1}{x\sqrt{x^2-1}}\,dx = \operatorname{cosec}^{-1}x + C$

$\int \frac{1}{x\sqrt{x^2-a^2}} = \frac{1}{a}\sec^{-1}\left(\frac{x}{a}\right) + C = \frac{-1}{a}\operatorname{cosec}^{-1}\left(\frac{x}{a}\right) + C$

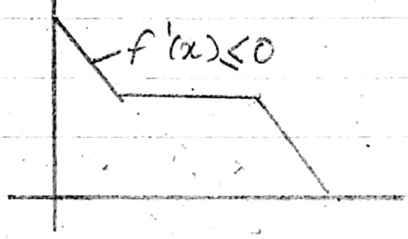
$\int e^{ax}\sin bx\,dx = \frac{e^{ax}}{a^2+b^2}\left[a\sin bx \mp b\, bx\right] + C$

$\int e^{ax}\cos bx\,dx = \frac{e^{ax}}{a^2+b^2}\left[a\cos bx + b\sin bx\right] + C$

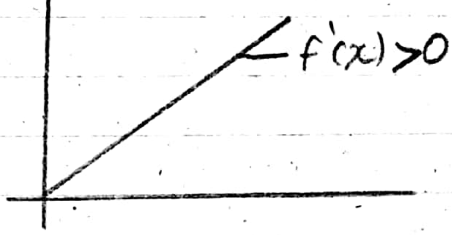
Increasing Function



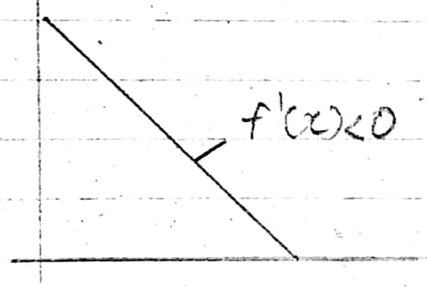
Decreasing Function



Strictly Increasing Function



Strictly Decreasing Function



Approximation

$y = f(x)$ -①

$y + \Delta y = f(x+\Delta x)$ -②

② -①

$\Delta y = f(x+\Delta x) - f(x)$

$\Delta y = \frac{dy}{\cancel{dx}} = \frac{dy}{dx} \Delta x$

$f(a+h) = f(a) + h f'(a)$

Rolle's Theorem

Let $f(x)$ be any function $[a, b]$

① $f(x)$ is defined and continuous $[a,b]$

② $f(x)$ is derivative (a,b)

③ $f(a) = f(b)$, then there exist a point $c \in (a,b)$ such that $f'(c) = 0$

Mean Value Theorem

$f(x)$ = any function $[a,b]$

① $f(x)$ is defined and continuous $[a,b]$

② $f(x)$ is derivable at (a,b) then there exist a point c such that

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$