TRIGONOMETRY

* $\frac{D}{90} = \frac{2C}{\pi}$ * $\sin x = \frac{1}{\operatorname{cosec} x}$ * $\cos x = \frac{1}{\sec x}$ * $\tan x = \frac{1}{\cot x}$

* $1 + \tan^2 x = \sec^2 x$ * $1 + \cot^2 x = \operatorname{cosec}^2 x$
* $\sin^2 x + \cos^2 x = 1$

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

* $\tan(x+y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}$

* $\tan(x-y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$

* $\cot(x+y) = \frac{\cot x \cot y - 1}{\cot x + \cot y}$

* $\cot(x-y) = \frac{\cot x \cot y + 1}{\cot x - \cot y}$

* $\sin 2x = 2 \sin x \cos x = \frac{2 \tan x}{1 + \tan^2 x}$

* $\cos 2x = \cos^2 x - \sin^2 x = 1 - 2\sin^2 x = 2\cos^2 x - 1 = \frac{1 - \tan^2 x}{1 + \tan^2 x}$

* $\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$

* $\sin 3x = 3 \sin x - 4 \sin^3 x$
* $\cos 3x = 4\cos^3 x - 3 \cos x$
* $\tan 3x = \frac{3 \tan x - \tan^3 x}{1 - 3\tan^2 x}$ * $\cot 3x = \frac{\cot^3 x - 3 \cot x}{3\cot^2 x - 1}$

* $\cos x + \cos y = 2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$
* $\cos x - \cos y = -2\sin\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)$
* $\sin x + \sin y = 2\sin\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$
* $\sin x - \sin y = 2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$

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

→ $\sin x = 0$, $x = n\pi$, $n \in Z$

→ $\cos x = 0$, $x = 2(n+1)\frac{\pi}{2}$, $n \in Z$

→ $\tan x = 0$, $x = n\pi$, $n \in Z$

→ if $\sin x = \sin y$, $x = n\pi + (-1)^n y$, $n \in Z$

→ if $\cos x = \cos y$, $x = 2\pi n \pm y$, $n \in Z$

→ if $\tan x = \tan y$, $x = n\pi + y$, $n \in Z$

* $1 + \sin\theta = \cos^2\frac{\theta}{2} + \sin^2\frac{\theta}{2} + 2\cos\frac{\theta}{2}\sin\frac{\theta}{2}$

☆ eqⁿ of circle -

$$(x-h)^2 + (y-K)^2 = r^2 ; \quad (h,K) - \text{centre}, \quad r - \text{radius}$$

☆ ellipse eqⁿ -

$$\frac{(x-h)^2}{a^2} + \frac{(y-K)^2}{b^2} = 1$$

☆ hyperbola eqⁿ -

$$\frac{(x-h)^2}{a^2} - \frac{(y-K)^2}{b^2} = 1$$

☆ parabola eqⁿ -

$$y = a(x-h)^2 + K$$

INTEGRATION

* $\int x^n dx = \frac{x^{n+1}}{n+1} + c$

* $\int e^x dx = e^x + c$

* $\int \frac{1}{x} dx = \log|x| + c$

* $\int a^x dx = \frac{a^x}{\log_e a} + c$

* $\int \sin x \, dx = -\cos x + c$

* $\int \cos x \, dx = \sin x + c$

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

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

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

* $\int \operatorname{cosec} dx = \log|\operatorname{cosec} x - \cot x| + c$

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

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

* $\int \sec x \tan x \, dx = \sec x + c$

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

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

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

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

* $\int \frac{-1}{1+x^2} dx = \cot^{-1} x + c$

* $$\int \frac{1}{x\sqrt{x^2-1}}\,dx = \sec^{-1}x + c$$

* $$\int \frac{-1}{x\sqrt{x^2-1}}\,dx = \mathrm{cosec}^{-1}x + c$$

* $$\int (ax+b)^n\,dx = \left[\frac{1}{a} \times \frac{(ax+b)^{n+1}}{n+1}\right] + c$$

* $$\int \frac{dx}{(x^2-a^2)} = \frac{1}{2a}\log\left|\frac{x-a}{x+a}\right| + c$$

* $$\int \frac{dx}{(a^2-x^2)} = \frac{1}{2a}\log\left|\frac{a+x}{a-x}\right| + c$$

* $$\int \frac{dx}{(a^2+x^2)} = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + c$$

* $$\int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}\left(\frac{x}{a}\right) + c$$

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

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

* $$\int \sqrt{a^2-x^2}\,dx = \frac{x}{2}\sqrt{a^2-x^2} + \frac{a^2}{2}\sin^{-1}\left(\frac{x}{a}\right) + c$$

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

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

Integration by parts -

$$\Rightarrow \int (uv)\,dx = u\int v\,dx - \int\left[\frac{d}{dx}(u)\cdot\int v\,dx\right]dx$$

Definite Integrals -

* $\int_a^b f(x)\,dx = -\int_b^a f(x)\,dx$

* $\int_a^b f(x)\,dx = \int_a^b f(a+b-x)\,dx$

* $\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$

* $\int_0^{2a} f(x)\,dx = \int_0^a f(x)\,dx + \int_0^a f(2a-x)\,dx$

* $\int_a^a f(x)\,dx = 0$

* $\int_0^{2a} f(x)\,dx \begin{cases} 2\cdot\int_0^a f(x)\,dx, & \text{when } f(2a-x) = f(x) \\ 0, & \text{when } f(2a-x) = -f(x) \end{cases}$

* $\int_{-a}^{a} f(x)\,dx \begin{cases} 2\cdot\int_0^a f(x)\,dx, & \text{when } f(x) \text{ is even} \\ 0, & \text{when } f(x) \text{ is odd.} \end{cases}$