

UCC Mathematical Tables

Calculus

$f(x)$	$f'(x)$	$f(x)$	$\int f(x) dx$	$f(x)$	$\int f(x) dx$
x^n	nx^{n-1}	$x^n (n \neq -1)$	$\frac{x^{n+1}}{n+1}$	$\frac{1}{\sqrt{a^2 - x^2}}$	$\sin^{-1} \frac{x}{a}$
$\ln x $	$\frac{1}{x}$	$\frac{1}{x}$	$\ln x $	$\frac{1}{a^2 + x^2}$	$\frac{1}{a} \tan^{-1} \frac{x}{a}$
$\cos x$	$-\sin x$	$\cos x$	$\sin x$	$\frac{1}{\sqrt{x^2 + a^2}}$	$\ln \left \frac{x + \sqrt{x^2 + a^2}}{a} \right $
$\sin x$	$\cos x$	$\sin x$	$-\cos x$	$\frac{1}{a^2 - x^2}$	$\frac{1}{2a} \ln \left \frac{a+x}{a-x} \right $
$\tan x$	$\sec^2 x$	$\tan x$	$\ln \sec x $	$\frac{1}{x\sqrt{x^2 - a^2}}$	$\frac{1}{a} \sec^{-1} \frac{x}{a}$
e^{ax}	ae^{ax}	e^{ax}	$\frac{1}{a} e^{ax}$	$\frac{1}{\sqrt{x^2 - a^2}}$	$\ln \left \frac{x + \sqrt{x^2 - a^2}}{a} \right $
$\cosh x$	$\sinh x$				
$\sinh x$	$\cosh x$				
$\tanh x$	$\operatorname{sech}^2 x$				

Product rule $y = uv \Rightarrow \frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$

Quotient rule $y = \frac{u}{v} \Rightarrow \frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$

Chain rule $f(x) = u(v(x)) \Rightarrow f'(x) = \frac{du}{dv} \frac{dv}{dx} = u'(v(x))v'(x)$

Newton-Raphson $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$

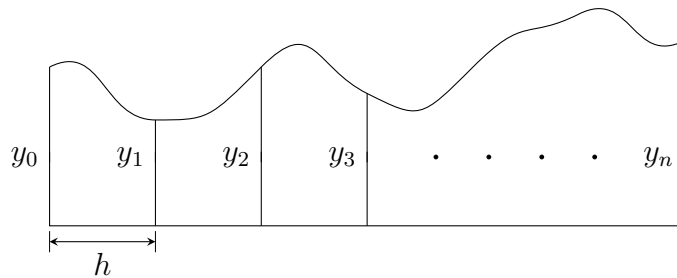
Integration by parts $\int u(x)v'(x) dx = u(x)v(x) - \int u'(x)v(x) dx$

Volume of solid of revolution about x -axis $V = \int_{x=a}^{x=b} \pi y^2 dx$

Taylor series (centre a) $f(a+x) = f(a) + f'(a)x + \frac{f''(a)}{2!}x^2 + \dots + \frac{f^{(r)}(a)}{r!}x^r + \dots$

Trapezoidal rule $A \approx \frac{h}{2} [y_0 + y_n + 2(y_1 + y_2 + \dots + y_{n-1})]$

Simpson's rule (n even) $A \approx \frac{h}{3} [y_0 + y_n + 2(y_2 + y_4 + \dots + y_{n-2}) + 4(y_1 + y_3 + \dots + y_{n-1})]$



Trigonometry

A	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$
$\cos A$	1	0	-1	0	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$
$\sin A$	0	1	0	-1	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$
$\tan A$	0	-	0	-	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$

$$\tan A = \frac{\sin A}{\cos A} \quad \cot A = \frac{\cos A}{\sin A}$$

$$\sec A = \frac{1}{\cos A} \quad \operatorname{cosec} A = \frac{1}{\sin A}$$

$$\cos(-A) = \cos A$$

$$\sin(-A) = -\sin A$$

$$\tan(-A) = -\tan A$$

$$\cos^2 A + \sin^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$e^{in\theta} = (\cos \theta + i \sin \theta)^n$$

$$= \cos n\theta + i \sin n\theta$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

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

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

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

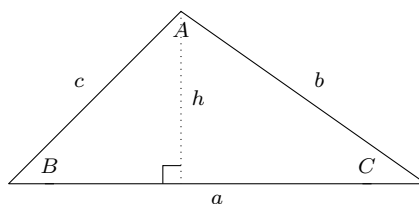
Length/Area/Volume

Triangle

$$\text{Area } A = \frac{1}{2}ab \sin C = \frac{1}{2}ah$$

$$\text{Sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

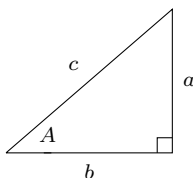
$$\text{Cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A$$



Right-angled triangle

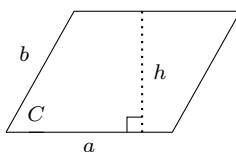
$$\sin A = \frac{a}{c} \quad \tan A = \frac{a}{b}$$

$$\cos A = \frac{b}{c} \quad c^2 = a^2 + b^2$$



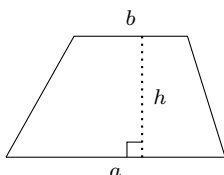
Parallelogram

$$\text{Area } A = ah = ab \sin C$$



Trapezium

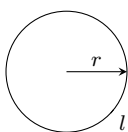
$$\text{Area } A = \left(\frac{a+b}{2} \right) h$$



Circle

$$\text{Circumference } l = 2\pi r$$

$$\text{Area } A = \pi r^2$$

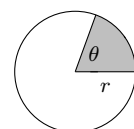


Arc/sector

$$\text{Length } l = r\theta$$

$$\text{Area } A = \frac{1}{2}r^2\theta$$

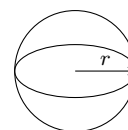
(θ in radians)



Sphere

$$\text{Surface area } A = 4\pi r^2$$

$$\text{Volume } V = \frac{4}{3}\pi r^3$$

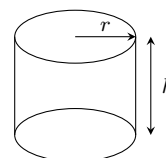


Cylinder

Curved surface

$$\text{area } A = 2\pi r h$$

$$\text{Volume } V = \pi r^2 h$$



Cone

Curved surface

$$\text{area } A = \pi r l$$

$$\text{Volume } V = \frac{1}{3}\pi r^2 h$$

