UCC Mathematical Tables

Calculus

$f(x)$	$f'(x)$
x^n	nx^{n-1}
$\ln \lvert x \rvert$	$\dfrac{1}{x}$
$\cos x$	$-\sin x$
$\sin x$	$\cos x$
$\tan x$	$\sec^2 x$
e^{ax}	ae^{ax}
$\cosh x$	$\sinh x$
$\sinh x$	$\cosh x$
$\tanh x$	$\operatorname{sech}^2 x$

$f(x)$	$\int f(x)\,dx$
$x^n\ (n \neq -1)$	$\dfrac{x^{n+1}}{n+1}$
$\dfrac{1}{x}$	$\ln \lvert x \rvert$
$\cos x$	$\sin x$
$\sin x$	$-\cos x$
$\tan x$	$\ln \lvert \sec x \rvert$
e^{ax}	$\dfrac{1}{a}e^{ax}$

$f(x)$	$\int f(x)\,dx$
$\dfrac{1}{\sqrt{a^2-x^2}}$	$\sin^{-1}\dfrac{x}{a}$
$\dfrac{1}{a^2+x^2}$	$\dfrac{1}{a}\tan^{-1}\dfrac{x}{a}$
$\dfrac{1}{\sqrt{x^2+a^2}}$	$\ln\left\lvert\dfrac{x+\sqrt{x^2+a^2}}{a}\right\rvert$
$\dfrac{1}{a^2-x^2}$	$\dfrac{1}{2a}\ln\left\lvert\dfrac{a+x}{a-x}\right\rvert$
$\dfrac{1}{x\sqrt{x^2-a^2}}$	$\dfrac{1}{a}\sec^{-1}\dfrac{x}{a}$
$\dfrac{1}{\sqrt{x^2-a^2}}$	$\ln\left\lvert\dfrac{x+\sqrt{x^2-a^2}}{a}\right\rvert$

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

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

Chain rule $\quad f(x) = u\big(v(x)\big) \;\Rightarrow\; f'(x) = \dfrac{du}{dv}\dfrac{dv}{dx} = u'\big(v(x)\big)v'(x)$

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

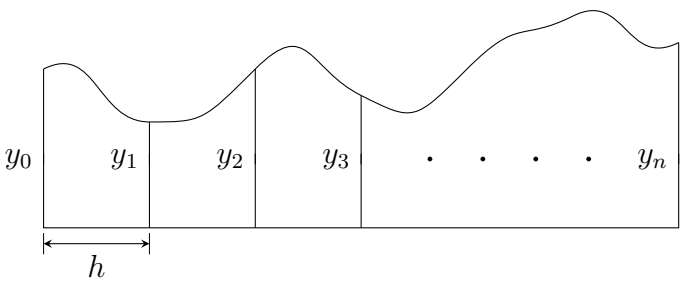
Integration by parts $\quad \displaystyle\int u(x)v'(x)\,dx = u(x)v(x) - \int u'(x)v(x)\,dx$

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

Taylor series (centre a) $\quad f(a+x) = f(a) + f'(a)x + \dfrac{f''(a)}{2!}x^2 + \cdots + \dfrac{f^{(r)}(a)}{r!}x^r + \cdots$

Trapezoidal rule $\quad A \approx \dfrac{h}{2}\Big[y_0 + y_n + 2(y_1 + y_2 + \cdots + y_{n-1})\Big]$

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



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	$\sqrt{3}$

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

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

$$\cos(-A) = \cos A$$
$$\sin(-A) = -\sin A$$
$$\tan(-A) = -\tan A$$
$$\cos^2 A + \sin^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$e^{in\theta} = (\cos\theta + i\sin\theta)^n = \cos n\theta + i\sin n\theta$$

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

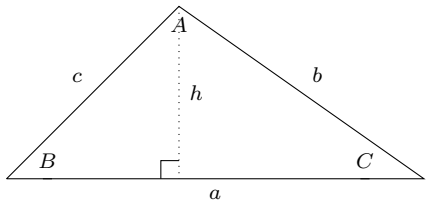
Length/Area/Volume

Triangle

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

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

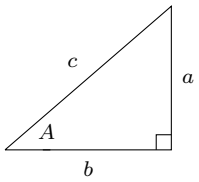
Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$



Right-angled triangle

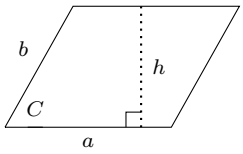
$\sin A = \dfrac{a}{c} \quad \tan A = \dfrac{a}{b}$

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



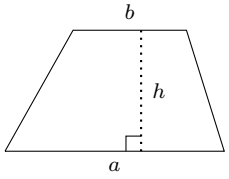
Parallelogram

Area $A = ah = ab\sin C$



Trapezium

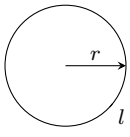
Area $A = \left(\dfrac{a+b}{2}\right)h$



Circle

Circumference $l = 2\pi r$

Area $A = \pi r^2$

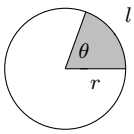


Arc/sector

Length $l = r\theta$

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

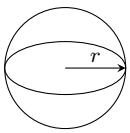
(θ in radians)



Sphere

Surface area $A = 4\pi r^2$

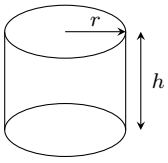
Volume $V = \frac{4}{3}\pi r^3$



Cylinder

Curved surface area $A = 2\pi rh$

Volume $V = \pi r^2 h$



Cone

Curved surface area $A = \pi rl$

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