

INFORMATION BOOKLET

Algebra

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

$$\sum_{i=1}^n 1 = n$$

$$\sum_{i=1}^n i = \frac{n(n+1)}{2} = \frac{n^2}{2} + \frac{n}{2}$$

$$\sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6} = \frac{n^3}{3} + \frac{n^2}{2} + \frac{n}{6}$$

$$\sum_{i=1}^n i^3 = \frac{n^2(n+1)^2}{4} = \frac{n^4}{4} + \frac{n^3}{2} + \frac{n^2}{4}$$

$$z = a + bi$$

$$z^* = a - bi$$

$$\ln A + \ln B = \ln(AB)$$

$$\ln A - \ln B = \ln\left(\frac{A}{B}\right)$$

$$\ln A^n = n \ln A$$

$$\log_a x = \frac{\log_b x}{\log_b a}$$

Calculus

$$\text{Area} = \lim_{n \rightarrow \infty} \left(\frac{b-a}{n} \right) \sum_{i=1}^n f(x_i)$$

$$\int_a^b x^n dx = \left[\frac{x^{n+1}}{n+1} \right]_a^b$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$$

$$\int f'(g(x)) \cdot g'(x) dx = f(g(x)) + C$$

$$\int f(x) \cdot g'(x) dx = f(x) \cdot g(x) - \int g(x) \cdot f'(x) dx + C$$

$$x_{r+1} = x_r - \frac{f(x_r)}{f'(x_r)}$$

$$V = \pi \int_a^b y^2 dx$$

Function	Derivative
x^n	nx^{n-1}
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\sec x$	$\sec x \cdot \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cdot \cot x$
$f(g(x))$	$f'(g(x)) \cdot g'(x)$
$f(x) \cdot g(x)$	$g(x) \cdot f'(x) + f(x) \cdot g'(x)$
$\frac{f(x)}{g(x)}$	$\frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{[g(x)]^2}$

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

$$s = r\theta$$

In $\triangle ABC$:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

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

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

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

$$1 + \cot^2 A = \operatorname{cosec}^2 A$$

$$\sin(A \pm B) = \sin A \cdot \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \begin{cases} \cos^2 A - \sin^2 A \\ 2 \cos^2 A - 1 \\ 1 - 2 \sin^2 A \end{cases}$$

$$\sin A \cdot \cos B = \frac{1}{2} [\sin(A+B) + \sin(A-B)]$$

$$\sin A \cdot \sin B = \frac{1}{2} [\cos(A-B) - \cos(A+B)]$$

$$\cos A \cdot \cos B = \frac{1}{2} [\cos(A-B) + \cos(A+B)]$$

Matrix Transformations

$$\begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \quad \begin{pmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{pmatrix}$$

Finance & Modelling

$$F = P(1+in) \quad F = P(1-in) \quad F = P(1+i)^n \quad F = P(1-i)^n$$

$$F = x \left[\frac{(1+i)^n - 1}{i} \right] \quad P = x \left[\frac{1 - (1+i)^{-n}}{i} \right] \quad r_{\text{eff}} = \left(1 + \frac{r}{k} \right)^k - 1$$

$$P_{n+1} = P_n + rP_n \left(1 - \frac{P_n}{K} \right)$$

$$R_{n+1} = R_n + aR_n \left(1 - \frac{R_n}{K} \right) - bR_n F_n \quad F_{n+1} = F_n + f bR_n F_n - cF_n$$

Statistics

$$P(A) = \frac{n(A)}{n(S)} \quad P(B|A) = \frac{P(B \cap A)}{P(A)} \quad P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$${}^n P_r = \frac{n!}{(n-r)!} \quad {}^n C_r = \binom{n}{r} = \frac{n!}{(n-r)!r!} \quad P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$$

$$P(R = r) = \frac{\binom{p}{r} \binom{N-p}{n-r}}{\binom{N}{n}} \quad z = \frac{X - \mu}{\sigma} \quad z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$z = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{\sigma_x^2}{n_x} + \frac{\sigma_y^2}{n_y}}} \quad b = \frac{n \sum(xy) - \sum x \sum y}{n(\sum x^2) - (\sum x)^2} \quad b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n(\bar{x})^2} \quad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$