MISCELLANEOUS FORMULAE

Mensuration

Arc length:	$l = r\theta$	In any triangle:	$a/\sin A = b/\sin B = c/\sin C$
Area of sector:	$\triangle = \frac{1}{2}r^2\theta$	In any triangle:	$a^2 = b^2+c^2-2bc\cos A$
Volume of pyramid:	$V = \frac{1}{3}Ah$	Area of triangle:	$\triangle = \frac{1}{2}bc\sin A$
Volume of cone:	$V = \frac{1}{3}\pi r^2 h$	Area of trapezium:	$\frac{1}{2}(a+b)h$
Volume of sphere:	$V = \frac{4}{3}\pi r^3$		

Circular Functions

$\sin(u\pm v) = \sin u \cos v \pm \cos u \sin v$

$\cos(u\pm v) = \cos u \cos v \mp \sin u \sin v$

$\tan(u\pm v) = (\tan u \pm \tan v)/(1 \mp \tan u \tan v)$

$\sin 2t = 2 \sin t \cos t$

$\cos 2t = \cos^2 t - \sin^2 t = 2\cos^2 t - 1 = 1 - 2\sin^2 t$

$\tan 2t = (2\tan t)/(1-\tan^2 t)$

$2\cos u \cos v = \cos(u+v)+\cos(u-v)$

$2\sin u \sin v = \cos(u-v)-\cos(u+v)$

$2\sin u \cos v = \sin(u+v)+\sin(u-v)$

$\sin w + \sin z = 2\sin\frac{1}{2}(w+z)\cos\frac{1}{2}(w-z)$

$\sin w - \sin z = 2\cos\frac{1}{2}(w+z)\sin\frac{1}{2}(w-z)$

$\cos w + \cos z = 2\cos\frac{1}{2}(w+z)\cos\frac{1}{2}(w-z)$

$\cos w - \cos z = -2\sin\frac{1}{2}(w+z)\sin\frac{1}{2}(w-z)$

Other Functions and Relations

Logarithms: $\log_a x + \log_a y = \log_a xy$ $\quad \log_a x - \log_a y = \log_a(x/y)$

$p\log_a x = \log_a x^p$ $\quad \log_b x = \log_a x/\log_a b$

Arithmetic Series: $a+(a+d)+\ldots+[a+(n-1)d] = \frac{1}{2}n[2a+(n-1)d]$

Geometric Series: $a+ar+\ldots+ar^{n-1} = a(1-r^n)/(1-r),\ (r \neq 1)$

$a^n - x^n = (a-x)(a^{n-1}+a^{n-2}x+a^{n-3}x^2+\ldots+x^{n-1})$

Compound Interest: $A_n = P(1+r/100)^n$

Binomial Series: $a^n + \binom{n}{1}a^{n-1}x+\ldots+\binom{n}{r}a^{n-r}x^r+\ldots+x^n = (a+x)^n$

Coordinate Geometry

Distance: $d(P_1, P_2) = \sqrt{[(x_2-x_1)^2+(y_2-y_1)^2]}$

Division of Interval: $x = (mx_2+nx_1)/(m+n),\ y = (my_2+ny_1)/(m+n)$

Name	Equation of Conic	Foci	Equation of Directrices	Other Relationships
Ellipse	$x^2/a^2+y^2/b^2 = 1$	$(\pm ae, 0)$	$x = \pm a/e$	$b^2 = a^2(1-e^2),\ 0<e<1$
Hyperbola	$x^2/a^2-y^2/b^2 = 1$	$(\pm ae, 0)$	$x = \pm a/e$	$b^2 = a^2(e^2-1),\ e>1$
Parabola	$y^2 = 4ax$	$(a, 0)$	$x = -a$	$e = 1$

Polar equation of conic: $l/r = 1+e\cos\theta$

Calculus

$f(x) = y$	$f'(x) = Df(x) = dy/dx$	$f(x) = y$	$f'(x) = Df(x) = dy/dx$
x^n	nx^{n-1}	$\arcsin(x/a)$	$1/\sqrt{(a^2-x^2)}$
$\log_e x = \ln x$	x^{-1}	$\arccos(x/a)$	$-1/\sqrt{(a^2-x^2)}$
$\log_e(ax+b)$	$a/(ax+b)$	$\arctan(x/a)$	$a/(a^2+x^2)$
e^{kx}	ke^{kx}	$g(x)h(x)$	$g'(x)h(x)+g(x)h'(x)$
$\sin kx$	$k\cos kx$	$g(x)/h(x)$	$\{g'(x)h(x)-g(x)h'(x)\}/\{h(x)\}^2$
$\cos kx$	$-k\sin kx$	$g \circ h(x) = g\{h(x)\}$	$g'\{h(x)\}h'(x)$
$\tan kx$	$k\sec^2 kx$		

Matrices and Determinants

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1} = \frac{1}{a_{11}a_{22}-a_{12}a_{21}} \begin{bmatrix} a_{22} & -a_{12} \\ -a_{21} & a_{11} \end{bmatrix}$$

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then $\det A = |A| = ad-bc$.

Probability and Statistics

Permutations: ${}^nP_r = n(n-1)\ldots(n-r+1)$

Combinations: ${}^nC_r = \binom{n}{r} = \{n(n-1)\ldots(n-r+1)\}/r!$

Probability: $Pr(A) = 1-Pr(A')$

$Pr(A\cup B) = Pr(A)+Pr(B)-Pr(A\cap B)$

$Pr(A\cap B) = Pr(A)\,.\,Pr(B)$ if A, B are independent

$Pr(A|B) = Pr(A\cap B)/Pr(B)$ if $Pr(B) \neq 0$

Sample mean: $\bar{x} = (\Sigma x)/n$

Sample variance: $s^2 = \dfrac{\Sigma(x-\bar{x})^2}{n-1} = \dfrac{\Sigma(x-a)^2-\{\Sigma(x-a)\}^2/n}{n-1}$

Distribution	$Pr(X = x)$	Mean	Variance
Binomial	$\binom{n}{x}\pi^x(1-\pi)^{n-x}$	$n\pi$	$n\pi(1-\pi)$
Hypergeometric	$\binom{D}{x}\binom{N-D}{n-x}/\binom{N}{n}$	$\dfrac{n\,.\,D}{N}$	$n\cdot\dfrac{D}{N}\left(1-\dfrac{D}{N}\right)\dfrac{N-n}{N-1}$
Poisson	$e^{-\lambda}\,.\,\lambda^x/x!$	λ	λ

Normal distribution curve: $y = \dfrac{1}{\sigma\sqrt{(2\pi)}}e^{-\frac{1}{2}(x-\mu)^2/\sigma^2}$