Mathematics Methods Units 1 and 2 Formula Sheet

Measurement

Circumference of circle, radius r
$C = 2\pi r$

Arc length of circle, central angle θ
$l = r\theta$

Area of circle
$A = \pi r^2$

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

Area of segment
$A = \frac{1}{2}r^2(\theta - \sin\theta)$

Trigonometry

$\sin(-\theta) = -\sin\theta$
$\cos(-\theta) = \cos\theta$
$\tan(-\theta) = -\tan\theta$

$\sin\left(\theta + \frac{\pi}{2}\right) = \cos\theta$
$\cos\left(\theta - \frac{\pi}{2}\right) = \sin\theta$

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

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

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

$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A\tan B}$

In any triangle *ABC*

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

Cosine rule

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

Area

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

$A = \sqrt{s(s-a)(s-b)(s-c)}$ where
$s = \frac{a+b+c}{2}$

Function

If $ax^2 + bx + c = 0$, then $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

Probability

$P(\overline{A}) = 1 - P(A)$
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$P(A \cap B) = P(A)P(B|A) = P(B)P(A|B)$

Sequences and series

Arithmetic

$a + (a+d) + (a+2d) + (a+3d) + \cdots$

$T_{n+1} = T_n + d, \qquad T_1 = a$

$T_n = a + (n-1)d$

$S_n = \frac{n}{2}(2a + (n-1)d)$

Geometric

$a + ar + ar^2 + ar^3 + \cdots$

$T_{n+1} = rT_n, \qquad T_1 = a$

$T_n = ar^{n-1}$

$S_n = \frac{a(1-r^n)}{1-r}$

$S_\infty = \frac{a}{1-r}, \qquad |r| < 1$

Differential calculus

If $f(x) = y$ then $f'(x) = \frac{dy}{dx}$

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

If $f(x) = x^n$ then $f'(x) = nx^{n-1}$

$\int x^n dx = \frac{x^{n+1}}{n+1} + c, n \neq -1$

Mathematics Methods Units 1 and 2 Formula Sheet

Index laws

For $a, b > 0$ and m, n real,

$$a^m a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

$$a^m b^m = (ab)^m$$

$$a^0 = 1$$

$$a^{-m} = \frac{1}{a^m}$$

For $a > 0$ and m an integer and n a positive integer,

$$a^{m/n} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$$