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

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

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

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

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

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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,

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