

Algebraic Laws

Index Laws

$$a^n \times a^m =$$

$$a^n \div a^m =$$

$$(a^n)^m =$$

$$a^{-n} =$$

$$a^{1/n} =$$

$$a^0 =$$

Log Laws

$$\log_a n = x \Leftrightarrow$$

$$\ln xy =$$

$$\ln \frac{x}{y} =$$

$$\ln x^k =$$

$$\ln \frac{1}{x} =$$

$$\ln e =$$

$$\ln 1 =$$

Factor Theorem

$$\text{If } f(a) = 0,$$

Functions

Definition

Terminology

domain: , range:

Composite Functions

$\rightarrow g \text{ then } f$

Inverse Functions

- \leftrightarrow

- reflect

-

Graphs + Coordinates

Midpoint

Gradient

Perpendicular Gradients

If m_1 and m_2 are perp

Equation of a Line

The Discriminant

> 0

$= 0$

< 0

Reciprocal Graphs

$$y = \frac{k}{x}$$

$$y = \frac{k}{x^2}$$

Circles

$$y = -\frac{k}{x}$$

$$y = -\frac{k}{x^2}$$

Sine Rule

Area of a triangle

GCSE Circle Theorems

Arc Length

Sector Area

Segment Area

Transformations, $f(x)$

$$f(x)+a$$

$$af(x)$$

$$-f(x)$$

$$|f(x)|$$

Key: F in the formula booklet

F in the formula booklet but recommended learning by heart

Vectors

Position Vectors

$$\vec{AB} =$$

Parallel Condition

a and b are parallel

if

Magnitude

$$\text{if } a = xi + yj + zk$$

then $|a| =$

Unit Vector

$$\hat{a} =$$

Angles with Axes

$$\cos \theta_x =$$

$$\cos \theta_y =$$

$$\cos \theta_z =$$

Binomial Expansion

Binomial Coefficient

$$\text{F } {}^n C_r = \binom{n}{r} =$$

Formula

$$\text{F } (1+x)^n =$$

for $|x| < 1$

Other form

$$(a+bx)^n =$$

Series

Arithmetic n^{th} term

$$u_n =$$

Arithmetic sum

$$\text{F } S_n =$$

$$\text{F } \bar{s}_n =$$

Geometric n^{th} term

$$u_n =$$

Geometric sums

$$\text{F } S_n =$$

, $S_\infty =$

Increasing Sequence

... if $u_{n+1} > u_n$

Decreasing Sequence

... if $u_{n+1} < u_n$

Periodic Sequence

... if $u_{n+k} = u_n$

... and

Trigonometry

Radians

$$2\pi =$$

$$\pi =$$

$$\frac{\pi}{2} =$$

$$\frac{\pi}{3} =$$

$$\frac{\pi}{4} =$$

$$\frac{\pi}{6} =$$

Small Angle Approximations

$$\sin \theta \approx \theta, \cos \theta \approx 1, \tan \theta \approx \theta$$

Exact Trig Values

$$\sin 30^\circ =$$

$$\cos 30^\circ =$$

$$\tan 30^\circ =$$

$$\sin 60^\circ =$$

$$\cos 60^\circ =$$

$$\tan 60^\circ =$$

$$\sin 45^\circ =$$

$$\cos 45^\circ =$$

$$\tan 45^\circ =$$

Tangent Definition

$$\tan \theta =$$

Solving Equations

$$\sin \theta =$$

$$\cos \theta =$$

$$\tan \theta =$$

Reciprocal Trig Functions

$$\csc \theta =$$

$$\sec \theta =$$

$$\cot \theta =$$

Co-function

$$\sin \theta =$$

$$\cos \theta =$$

Pythagorean Identities

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

$$\frac{du}{dv} =$$

$$\frac{du}{dt} =$$

$$\frac{d^2y}{dx^2} =$$

Addition Formulae

$$\text{F } \sin(A \pm B) =$$

$$\text{F } \cos(A \pm B) =$$

$$\text{F } \tan(A \pm B) =$$

Double Angle Formulae

$$\sin 2\theta =$$

$$\cos 2\theta =$$

$$=$$

$$=$$

$$\tan 2\theta =$$

Rearranged Double Angle

$$\sin^2 \theta =$$

$$\cos^2 \theta =$$

} used in integration

Harmonic Identity ($R \cos(\theta + \alpha)$)

$$\text{F } R \cos \alpha = a, R \sin \alpha = b$$

$$R =$$

$$\tan \alpha =$$

Differentiation

First Principles

$$\text{F } f'(x) =$$

First Derivatives

$$f'(x) < 0$$

$$f'(x) = 0$$

$$f'(x) > 0$$

Second Derivatives

$$f''(x) < 0$$

$$f''(x) = 0$$

$$f''(x) > 0$$

Functions \rightarrow derivatives

$$ax^n \rightarrow$$

$$a^x \rightarrow$$

$$e^x \rightarrow$$

$$\ln x \rightarrow$$

$$\sin x \rightarrow$$

$$\cos x \rightarrow$$

$$\tan x \rightarrow$$

$$\sec x \rightarrow$$

$$\csc x \rightarrow$$

$$\cot x \rightarrow$$

$$\operatorname{cosec} x \rightarrow$$

$$\operatorname{secc} x \rightarrow$$

$$\operatorname{versc} x \rightarrow</$$