

Maths AS Level Knowledge Organiser
Autumn 1

Pure 01 Algebraic Expressions

Define the term "Indices"

Define the term "Surd"

State (in equation form) the Laws of Indices

By using the mathematical definition of surds and Indices, show that $a^{\frac{n}{m}} = \sqrt[m]{a^n}$

Using the Laws of Indices, show how $a^0 = 1$

Pure 01 Algebraic Expressions

Define what is meant by a "Rational Number"

How are the operations of Factorisation and Expansion linked? Give an example

Given a fractional expression in the following forms, show how you would begin to rationalise the expression (and state the reason why):

$$\frac{1}{\sqrt{a}}$$

$$\frac{1}{b-\sqrt{a}}$$

$$\frac{1}{b+\sqrt{a}}$$

Pure 12 Differentiation

Explain how the gradient of a curve can be defined for any given point on a curve.

Describe how the limit formula for calculating the gradient function works

Describe the rule for finding the derivative of a function of the form $f(x) = ax^n$

How could you find the derivative for a function $f(x)$, when $f(x) = h(x) + g(x)$

Describe how you could find the equation of the tangent to a curve at point $(a, f(a))$

Pure 12 Differentiation

Using the gradient function, explain how you could find if the function is increasing or decreasing over an interval $[a, b]$.

Explain how you can find a Stationary Point. What are the three main types of Stationary Point, and how can you tell them apart?

What is a second order derivative? State a formula for finding the second order derivative,

Pure 02 Quadratics

Describe the process for solving a quadratic by factorisation:

State the general forms for completing the square:

$$x^2 + bx =$$

$$ax^2 + bx + c =$$

Describe the discriminant. What does it mean when discriminant is less than, greater than, or equal to zero?

State the Quadratic formula and define each term:

Pure 02 Quadratics

Define the Domain of a quadratic:

Define the Range of a quadratic:

Define the Roots of a quadratic:

Explain how you could use Completing the Square to find the turning point of a quadratic function:

Pure 03 Equations and Inequalities

Explain the differences and similarities of the Elimination and Substitution methods for solving simultaneous equations.

Describe the process for solving an Quadratic Inequality:

How do the solutions for quadratic simultaneous equations differ from linear simultaneous equations?

When drawing regions of inequalities on a graph, what does a dotted line represent? What about a solid line?

Pure 04 Graphs and Transformations

Define what is meant by a Repeated Root. How does this look on a graph, and how can you recognise it in a function?

A reciprocal function has two sets of asymptotes. Where are they located? Define an asymptote.

What reflective effects does the term negative sign have on these functions?

$$y = -f(x)$$

$$y = f(-x)$$

What translational effects does the term a have on these functions?

$$y = f(x) + a$$

$$y = f(x + a)$$

What stretching effects does the term a have on these functions?

$$y = af(x)$$

$$y = f(ax)$$

Applied 01 Data Collection

Define a Population. How does a Census differ from a Sample when collecting data from a population?

Define a Sampling Unit and a Sampling Frame.

Describe each of the main forms of sampling (Simple Random, Systematic, Stratified, Quota, Opportunity) and their similarities and differences.

Define the terms of Continuous, Discrete, Qualitative, and Quantitative data:

Describe what is meant by a Class, and what the boundaries and midpoints of the class are.

Applied 02 Measures of Location and Spread

Define the three types of average, and describe how these can be found.

Explain what is meant by the concept of quartiles. How does this relate to the Range and the Interquartile Range?

State the formulae for calculating Variance and Standard Deviation. How are these two concepts related, and what do they measure?

Describe how the formulae for Variance and Standard Deviation change when dealing with grouped data from a frequency table.

What is Coded Data? If data is coded in the form $y = \frac{x-a}{b}$, state how you can find the mean and standard deviation.

Applied 08 Modelling in Mechanics

Explain how assumptions can assist in modelling calculations.

How does a Vector quantity differ from a Scalar quantity? Give three examples of each.

State the SI units for each of these measurements, including the symbols.

Mass:

Length/Displacement:

Time:

Explain what a mathematical model is, and what it is used for.

Define the Normal Reaction force, and how it relates to the Weight force.

Applied 09 Constant Acceleration

Velocity and Acceleration can be defined as rates of change of other quantities. What are these quantities? Draw and annotate a Displacement-Time and a Velocity-Time graph to show this.

State the five core Kinematics equations for constant acceleration.

What do the areas beneath a Displacement-Time and a Velocity-Time graph represent?

State the value of the vertical acceleration that models gravity. What conditions and assumptions are required for this modelled value?