THE DUSTON SCHOOL
Knowledge itself is power
4-19

Year 11 Higher Maths Knowledge Organiser Term 2

Name:	Class:

Topics This term:

- Probability – GCSE Statistics
  - Relative risk v Absolute risk
  - Elements of the Venn Diagram
  - Conditional Probability
  - 'Given that' probabilities
- Shape and Geometry
  - Re-cap and Strengthening of your Shape and Geometry skills

RESPECT

In Mathematics, a classroom environment should always be respectful. Students can show respect through:

- **Supporting each other with their learning.** Pupils should recognise that every individual has their own strengths and weaknesses and, as a class, we should 'up-lift' students.
- **Students should not be felt to be rushed by others in the classroom**. Respect that all students have different experiences and therefore will access the knowledge at different rates.
- **Being Polite.** As no different to the rest of school. Students should embrace diversity and treat all others with tolerance and decency.

ASPIRATION

- **Building logical processes.** Understanding that learning mathematical concepts improves our logical reasoning which improves other aspects of our lives: language, culture, games etc. the essence of mathematics is in respect of ideas, structures and relationships by logical reasoning.
- **Everyday needs.** Understanding that being numerate, along with literate, is a strong indicator of long-term success and students' ability to climb the tree of knowledge.

RESILIENCE

- **I don't know it… yet.** Understanding that maths can be abstract and that, as with anything new, it will take time to learn. With time, you will succeed.
- **Mathematical concept won't always come easily.** Understanding that getting things wrong is a frustrating and not pleasant feeling but, to succeed, it is a passage we need to go through.
- **Practice makes permanent.** Mathematics is a logical subject such that, rehearsal and repetition of method is the key to being successful and committing the knowledge to long-term memory. This process takes time and will come with failures along the way which we must persevere through.

Higher Tier Formulae Sheet GCSE Mathematics

Perimeter, area and volume

Where a and b are the lengths of the parallel sides and h is their perpendicular separation:

Area of a trapezium = $\frac{1}{2}(a + b)\,h$

Volume of a prism = area of cross section × length

Where r is the radius and d is the diameter:

Circumference of a circle = $2\pi r = \pi d$

Area of a circle = πr^2

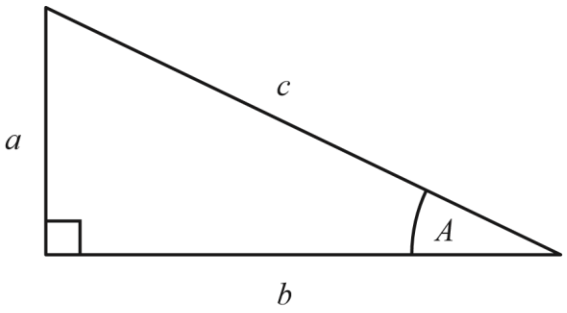
Quadratic formula

The solution of $ax^2 + bx + c = 0$

where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Pythagoras' Theorem and Trigonometry

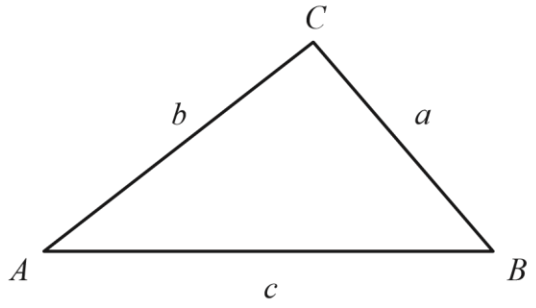


In any right-angled triangle where a, b and c are the length of the sides and c is the hypotenuse:

$a^2 + b^2 = c^2$

In any right-angled triangle ABC where a, b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$



In any triangle ABC where a, b and c are the length of the sides:

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

cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2}\,a\,b \sin C$

Compound Interest

Where P is the principal amount, r is the interest rate over a given period and n is number of times that the interest is compounded:

Total accrued = $P\left(1 + \frac{r}{100}\right)^n$

Probability

Where P (A) is the probability of outcome A and P (B) is the probability of outcome B:

P (A or B) = P (A) + P (B) – P (A and B)

P (A and B) = P (A given B) P(B)

END OF EXAM AID

MathsWatch

Grade 4	
Clip	Topic
131	Index Notation
132	Introduction to Bounds
133	Midpoint of a Line on a Graph
134a	Expanding and Simplifying Brackets - Single
134b	Expanding and Simplifying Brackets - Double
135a	Solving Equations - Balancing
135b	Solving Equations - Float & Ping
136	Rearranging Simple Formulae
137	Forming Formulae and Equations
138	Inequalities on a Number Line
139	Solve Linear Inequalities
140	Simultaneous Equations Graphically
141	Fibonacci Sequences
142	Compound Units
143	Distance-Time Graphs
144	Similar Shapes
145a	Constructing Perpendiculars - Bisecting a Line
145b	Constructing Perpendiculars - From any Point
145c	Bisecting an Angle
146	Loci
147	Draw a Triangle Using Compasses
148	Enlargements
149	Tangents, Arcs, Sectors and Segments
150a	Pythagoras' Theorem - A Simple Approach
150b	Pythagoras' Theorem - An Algebraic Approach
150c	Pythagoras' Theorem - Line on a Graph
151	Simple Tree Diagrams
152	Sampling Populations
153	Time Series

Grade 5	
Clips	Topic
154	Negative Indices
155	Error Intervals
156	Mathematical Reasoning
157	Factorising and Solving Quadratics
158	The Difference of Two Squares
159a	Equation of a Straight Line - y=mx+c
159b	Equation of a Straight Line - Gradient
160	Roots and Turning Points of Quadratics
161	Cubic and Reciprocal Graphs
162	Simultaneous Equations Algebraically
163	Geometric Progressions
164	Compound Interest and Depreciation
165a	Ratio Questions - Standard Questions
165b	Ratio Questions - Questions with Overlap
165c	Ratio Questions - Ratios, Fractions, Equations
166	Congruent triangles
167	Sectors of a Circle
168	Trigonometry
169	Spheres
170	Pyramids
171	Cones
172	Frustums
173	Exact Trigonometric Values
174	Introduction to Vectors
175	Harder Tree Diagrams
176	Stratified sampling

Grade 6	
Clip	Topic
177	Recurring Decimals to Fractions
178	Product of Three Binomials
179	Iteration - Trial and Improvement
180	Iterative Processes
181a	Enlargement - Negative SF - Construction Lines
181b	Enlargement - Negative SF - Column Vectors
182	Combinations of Transformations
183	Circle Theorems
184	Proof of Circle Theorems
185	Probability using Venn Diagrams
186	Cumulative Frequency
187	Boxplots

Grade 7	
Clip	Topic
188	Fractional Indices
189	Recurring Decimals - Proof
190	Rearranging difficult Formulae
191	Solving Quadratics with the Formula
192	Factorising Hard Quadratics
193	Algebraic Proof
194	Exponential Functions
195a	Trigonometric Graphs - Sine and Cosine
195b	Trigonometric Graphs - Tangent
196a	Transformation of Functions - Polynomial
196b	Transformation of Functions - Trigonometric
197	Equation of a Circle
198	Regions
199	Direct and Inverse Proportion
200a	Ratio Questions - Standard Questions
200b	Ratio Questions - Ratios to Equations
200c	Ratio Questions - Equations to Ratios
201	Similarity - Area and Volume
202a	The Sine Rule
202b	The Cosine Rule
203	Area of a Triangle Using Sine
204	And and Or Probability Questions
205	Histograms

Grade 8 and 9	
Clip	Topic
206	Upper and Lower Bounds
207a	Surds - Introduction to Surds
207b	Surds - Surd Expressions
207c	Surds - Rationalising the Denominator
208	Perpendicular Lines
209a	Completing the Square - Basics
209b	Completing the Square - Solving
209c	Completing the Square - Sketching
210a	Algebraic Fractions - Simplifying
210b	Algebraic Fractions - Solving
211	Simultaneous Equations with a Quadratic
212	Solve Quadratic Inequalites
213	Finding the nth Term of a Quadratic
214a	Inverse Functions - Introduction
214b	Inverse Functions - Harder Questions
215	Composite Functions
216a	Interpreting Graphs - Velocity-Time Graphs
216b	Interpreting Graphs - Rate of Change
217	Pythagoras in 3D
218	Trigonometry in 3D
219	Vectors

Higher Tier Formulae

You must not write on this page.

Anything you write on this page will gain NO credit.

Skew = $\frac{3(\text{mean} - \text{median})}{\text{standard deviation}}$

Standard deviation = $\sqrt{\frac{1}{n}\sum(x-\bar{x})^2}$

An alternative formula for standard deviation is

standard deviation $\sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$

Spearman's rank correlation coefficient $r_s = 1 - \frac{6\sum d^2}{n(n^2-1)}$

Rates of change (e.g. Crude birth rate = $\frac{number\ of\ births \times 1000}{total\ population}$)

END OF EXAM AID

UNIT 5 : Time Series

Time Series: a statistical diagram used to represent data over a period of ***time*** where time is always plotted on the x axis

Points are plotted and then joined like a dot-to-dot

Moving averages are an efficient and practical way of finding the trend and mean you make more **ACCURATE** predictions

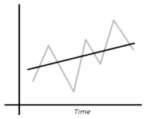
Moving averages tend to reduce the amount of **VARIABILITY** present in a time series

An 'n-point' moving average relies on how many **SEASONS** are repeated

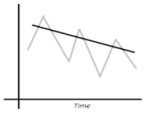
To calculate a moving average, we must work out the **MEAN** of each n points in the data, overlapping values so the averages 'move'

UNIT 5 : Time Series

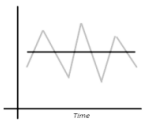
The general trend can be shown on the graph by drawing a trend line. Look at the general trend of the data and draw a line through the middle of the data



- This is an example of a **'rising trend'**
- It can also be called an **'upwards trend'**
- It can also be called an **'increasing trend'**
- We must NEVER use the term **'positive'**



- This is an example of a **'falling trend'**
- It can also be called an **'downwards trend'**
- It can also be called an **'decreasing trend'**
- We must NEVER use the term **'negative'**



- This is an example of a **'level trend'**
- We must NEVER use the term **'no trend'**

UNIT 5 : Time Series

The equation of the trend line

$y = mx + c$ or $y = a + bx$

To find the gradient you need to:

- pick 2 coordinates on your line
- divide the difference in the y coordinates, by the difference in the x coordinates

N.B. It is important to pay close attention to the scale on both the x and the y axis and whether the trend line is going up (positive gradient) or going down (negative gradient)

The gradient tells us how much y increases each time x increases by 1
Think about what this means in context of the question by considering what the scale of the x axis is.

UNIT 5 : Time Series

Seasonal Variation: when data follows the same pattern each season over a series of time frames.
Seasonal variation can help us to make more accurate predictions for future values

Seasonal Effect: the difference between the actual value and the value read from the trend line at a given point (season)

Seasonal Effect can be seen on the graph as the distance between the y value on the time series and the y value on the trend line at the same value for x

Seasonal Effect = Observed Value - Trend Line Value

UNIT 5 : Time Series

The average of each seasonal effects can be calculated for one season over several years to find the

Mean Seasonal Variation (M.S.V)

By simply calculating the mean of the seasonal effect values for one particular season

- A positive M.S.V mean that on average the values in that season are above the trend line
- A negative M.S.V means that on average the values in that season are below the trend line

UNIT 5 : Time Series

We use the Mean Seasonal Variation to help make more accurate predictions from our Time Series Graph. When making a prediction we read off the value from the trend line then ADD our M.S.V to compensate for the average difference between the trend line and observed values

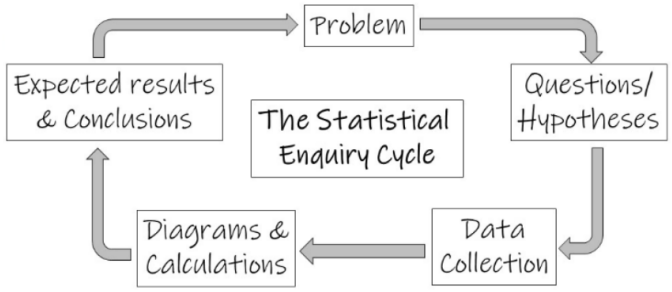
It is always the case with Time Series predictions that the following assumptions are made:

- The seasonal variation will continue in the same pattern
- The trend will continue at the same rate
- There will be no big changes that cause the data to behave differently

This means that our predictions may not always be accurate

UNIT 6 : The SEC

The Statistical Enquiry Cycle



UNIT 6 : The SEC

Hypothesis: a sensible assumption written as a statement that can be tested to see if it is correct or not

Some things we need to remember when writing a hypothesis ...

- A hypothesis is not a question
- A hypothesis should be a statement
- A hypothesis should suggest a testable answer to the question
- A hypothesis should relate to as many aspects of the scenario as possible

How to start a hypothesis ...

- The most popular / most common / most frequent ... is ...
- The average ... is ...
- There is a weak / moderate / strong / very strong

positive / negative relationship between ... and ...

- ... do better on average than ...

UNIT 7 : Probability

Theoretical Probability: the calculated probability that would be expected if everything worked IN THEORY and there was no other possible factor that could cause a change to the outcomes

We find probabilities by writing:

$$\frac{\textit{the number of what we want}}{\textit{the total number of everything}}$$

Relative Frequency:

$$\frac{\textit{number of successful trials}}{\textit{total number of trials}}$$

Expected values:

Relative Frequency X N

UNIT 7 : Probability

Simulation is the use of probabilities and probability experiments to predict the outcome of various situations

1 Find the probability of each outcome

2 Assign a success criteria to each outcome based on its probability
e.g. flip a coin, heads/tails
roll a dice 1/2/3/4/5/6
assign random numbers

3 Carry out the simulation to determine the success of each outcome

UNIT 7 : Probability

Risk and Accidents

relative risk = number of successes ÷ total number of trials

Cost of Risk

cost of risk = relative risk X average cost

Risk of Fault

number of faults = risk of a fault X number of items

UNIT 7 : Probability

Randomised Response: a research method used in structured survey interview.

1. Participants take part in a probability experiment, such as flipping a coin or rolling a dice.
2. Depending on the result, participants answer the question:
a) yes (embarrassing answer)
b) honestly
3. Then we estimate the true proportion of results using theoretical probability eliminating the calculated proportion of participants who will have answered yes through random selection

UNIT 7 : Probability

The Addition Rule

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

This is ALWAYS true for all probabilities

Exhaustive Events

Two events are **exhaustive** if between them they cover every possible outcome

N.B. Outcomes can be repeated

UNIT 7 : Probability

Mutually Exclusive Events

Two events are **mutually exclusive** if they cannot occur at the same time

$$P(A \cup B) = P(A) + P(B)$$

This is sometimes referred to as the 'or' rule (the probability of A ***OR*** B)

If two events are **mutually exclusive** then there is no intersection between the two events hence:

$$P(A \cap B) = 0$$

This is known as the **addition** rule *for mutually exclusive events*

UNIT 7 : Probability

Independent Events

Two events are **independent** if the outcome of one event does not affect the other

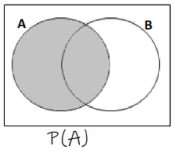
$$P(A \cap B) = P(A) \times P(B)$$

This is sometimes referred to as the 'and' rule (the probability of A ***AND*** B)

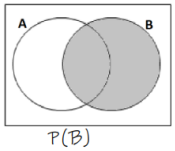
This is known as the **multiplication** rule *for independent events*

UNIT 7 : Probability

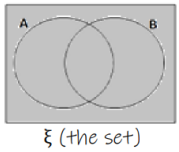
Venn Diagrams: Set Notation



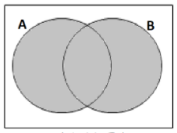
P(A)



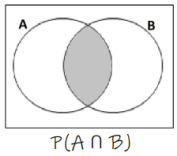
P(B)



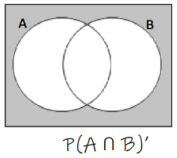
ξ (the set)



P(A ∪ B)
The union



P(A ∩ B)
The intersect



P(A ∩ B)'
The complement

What revision resources can help you revise?

Website	Log-in details	QR Codes
MathsWatch	Username: (firstname)(lastname)@dustonschool Password: berrywood	
methodmaths	Centre ID: duston Username: (firstname)(lastname) Password: berrywood	
Maths Genie	Non-required Contains adverts.	

Homework

Due date:	Set on:	Title