



Knowledge Organiser

MATHS - HIGHER



Maths (Higher)

Non-Calculator Arithmetic	
What is a recurring decimal?	A decimal number that has digits that repeat forever . The part that repeats is usually shown by placing a dot above the digit that repeats, or dots over the first and last digit of the repeating pattern.
What is a rational number?	A number of the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$. A number that cannot be written in this form is called an 'irrational' number
What is a surd?	The irrational number that is a root of a positive integer , whose value cannot be determined exactly.
What does it mean to rationalise a denominator?	The process of rewriting a fraction so that the denominator contains only rational numbers .
What is a quadratic?	A quadratic expression is of the form $ax^2 + bx + c$ where a, b and c are numbers, $a \neq 0$

Sequences	
What is a Geometric Sequence?	A sequence of numbers where each term is found by multiplying the previous one by a number called the common ratio, r .
What is a quadratic sequence?	A sequence of numbers where the second difference is constant . A quadratic sequence will have a n^2 term.
What are triangular numbers?	The sequence which comes from a pattern of dots that form a triangle. $1, 3, 6, 10, 15, 21 \dots$

Proportion	
What is the formula for direct proportion?	Direct: $y = kx$ or $y \propto x$
What is the formula for inverse proportion?	Inverse: $y = \frac{k}{x}$ or $y \propto \frac{1}{x}$

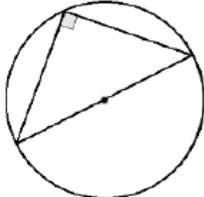
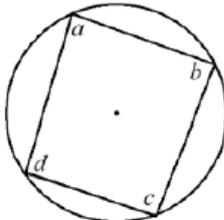
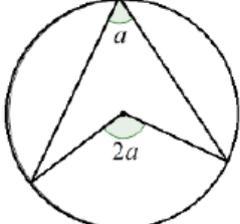
Summarising Data	
What is the lower quartile?	Divides the bottom half of the data into two halves . $LQ = Q_1 = \frac{(n+1)}{4} \text{th value}$
What is the upper quartile?	Divides the top half of the data into two halves . $UQ = Q_3 = \frac{3(n+1)}{4} \text{th value}$
What is the interquartile range?	The difference between the upper quartile and lower quartile . $IQR = Q_3 - Q_1$ The smaller the interquartile range , the more consistent the data.
What information is labelled on a box plot?	The minimum, lower quartile, median, upper quartile and maximum are shown on a box plot. A box plot can be drawn independently or from a cumulative frequency diagram.

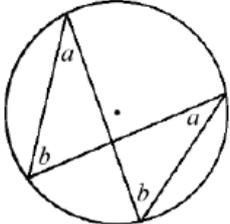
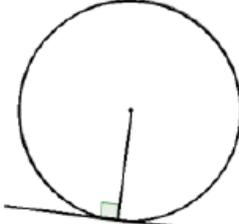
Indices	
What are negative powers?	A negative power performs the reciprocal. $a^{-m} = \frac{1}{a^m}$
What are fractional powers?	The denominator of a fractional power acts as a 'root'. The numerator of a fractional power acts as a normal power. $a^{\frac{m}{n}} = (\sqrt[n]{a})^m$



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Further Quadratics	
What are the roots of a quadratic?	A root is a solution. The roots of a quadratic are the x -intercepts of the quadratic graph.
What is the turning point of a quadratic?	A turning point is the point where a quadratic turns . On a positive parabola , the turning point is called a minimum . On a negative parabola , the turning point is called a maximum .
What is completing the square?	A quadratic in the form $x^2 + bx + c$ can be written in the form $(x + p)^2 + q$ You can use the completing the square form to help find the maximum or minimum of quadratic graph.

Circle Theorems	
What is the first circle theorem?	Angles in a semi-circle have a right angle at the circumference 
What is a cyclic quadrilateral?	A 4 sided shape which sits inside a circle but all four corners of the quadrilateral must touch the edge of the circle
What is the second circle theorem?	Opposite angles in a cyclic quadrilateral add up to 180°.  $a + c = 180^\circ$ $b + d = 180^\circ$
What is the third circle theorem?	The angle at the centre is twice the angle at the circumference. 

What is the fourth circle theorem?	Angles in the same segment are equal. 
What is fifth circle theorem?	A tangent is perpendicular to the radius at the point of contact. 
What is the sixth circle theorem?	Tangents from an external point are equal in length.



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What is the alternate segment theorem?	Alternate Segment Theorem

Inequalities	
How can inequalities be represented on a coordinate grid?	If the inequality is strict ($x > 2$) then use a dotted line . If the inequality is not strict ($x \leq 6$) then use a solid line .

Trigonometry	
When is the Sine Rule used?	Use with non right angle triangles . Use when the question involves 2 sides and 2 angles . For missing side: $\frac{a}{\sin A} = \frac{b}{\sin B}$ For missing angle: $\frac{\sin A}{a} = \frac{\sin B}{b}$

When is the Cosine Rule used?	Use with non right angle triangles . Use when the question involves 3 sides and 1 angle . For missing side: $a^2 = b^2 + c^2 - 2bccosA$ For missing angle: $cos A = \frac{b^2 + c^2 - a^2}{2bc}$
How can you find the area of a triangle?	Use when given the length of two sides and the included angle . $Area \text{ of a Triangle} = \frac{1}{2}ab \sin C$

Probability	
What are independent events?	The outcome of a previous event does not influence/affect the outcome of a second event .
What are dependent events?	The outcome of a previous event does influence/affect the outcome of a second event .
What is conditional probability	The probability of an event A happening, given that event B has already happened. With conditional probability, check if the numbers on the second branches of a tree diagram changes.

Functions	
What is a function?	A relationship between two sets of values.
What is the function notation?	$f(x)$ x is the input value



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	$f(x)$ is the output value.
What is an inverse function?	$f^{-1}(x)$ A function that performs the opposite process of the original function.
What is a composite function?	A combination of two or more functions to create a new function. $fg(x)$ is the composite function that substitutes the function $g(x)$ into the function $f(x)$.

Gradient of curves	
What is the tangent to a curve?	A straight line that touches a curve at exactly one point .
What is the gradient of a curve?	The gradient of a curve at a point is the same as the gradient of the tangent at that point.
What is the rate of change?	The rate of change at a particular instant in time is represented by the gradient of the tangent to the curve at that point.
What can be found from a distance – time graph?	You can find the speed from the gradient of the line (Distance \div Time) The steeper the line, the quicker the speed. A horizontal line means the object is not moving (stationary).
What can be found from a velocity – time graph?	You can find the acceleration from the gradient of the line (Change in Velocity \div Time) The steeper the line, the quicker the acceleration. A horizontal line represents no acceleration, meaning a constant velocity . The area under the graph is the distance .

Iteration	
What is iteration?	The act of repeating a process over and over again, often with the aim of approximating a desired result more closely.

Histograms and Cumulative Frequency	
What is a Histogram?	A visual way to display frequency data using bars. Bars can be unequal in width . Histograms show frequency density on the y-axis , not frequency.
How is a histogram interpreted?	The area of the bar is proportional to the frequency of that class interval.
What is cumulative frequency?	Cumulative Frequency is a running total .

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Proofs	
What is an expression?	A mathematical statement written using symbols, numbers or letters ,
What is an equation?	A statement showing that two expressions are equal
What is an identity?	An equation that is true for all values of the variables An identity uses the symbol: \equiv
What is a formula?	Shows the relationship between two or more variables
What is a coefficient?	A number used to multiply a variable . It is the number that comes before/in front of a letter.
How are odds and evens represented?	An even number is a multiple of 2 An odd number is an integer which is not a multiple of 2 .
What are consecutive integers?	Whole numbers that follow each other in order.
What is a square term?	A term that is produced by multiply another term by itself.
What is the product?	The product of two or more numbers is the value you get when you multiply them together.
How can a multiple be shown in proofs?	To show that an expression is a multiple of a number, you need to show that you can factor out the number .

Vectors	
What is a Vector?	A vector is a quantity represented by an arrow with both direction and magnitude .
What is Magnitude?	Magnitude is defined as the length of a vector.
When are vectors equal?	If two vectors have the same magnitude and direction , they are equal .
What are parallel vectors?	Parallel vectors are multiples of each other.
What are Collinear vectors?	Collinear vectors are vectors that are on the same line . To show that two vectors are collinear , show that one vector is a multiple of the other (parallel) AND that both vectors share a point .
What is a resultant vector?	The resultant vector is the vector that results from adding two or more vectors together.
What is the scalar of a vector?	A scalar is the number we multiply a vector by.

Growth and Decay	
What is Exponential Growth?	When we multiply a number repeatedly by the same number ($\neq 1$), resulting in the number increasing by the same proportion each time.
What is Exponential Decay?	When we multiply a number repeatedly by the same number ($0 < x < 1$), resulting in the number decreasing by the same proportion each time.
What is Compound Interest?	Interest paid on the original amount and the accumulated interest .
What is the equation of an Exponential Graph	The equation is of the form $y = a^x$, where a is a number called the base .