Mathematics Knowledge Organiser

Year 10 – Autumn T1

'Recurring decimals'

The Knowledge for Progression:

- To know that a recurring decimal does not terminate.
- To know that recurring decimals can be written as a fraction.
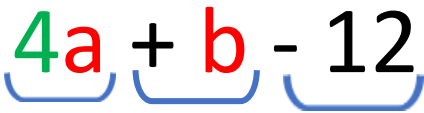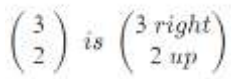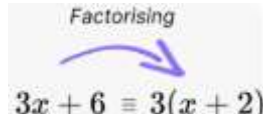
Speak Like a Mathematician

Key Word	Dual Coding			Definition
Terminating decimal	6.1	3.653	-0.332	Decimals that have a finite number of digits after the decimal point. All terminating decimals are rational numbers.
Recurring decimal	7.$\dot{2}$	8.1$\dot{4}$	0.1$\dot{4}\dot{8}$	A recurring decimal exists when decimal numbers repeat forever.

'Algebraic manipulation'

The Knowledge for Progression:

- o To know that terms are a constant, variable or combination of both and can be positive or negative. The 4 operations can be applied in the same way as numerical operations.
- o To know that an expression is made up of constants, variables and mathematical operations, but does not include an = sign.
- o To know that a formula describes a mathematical relationship between variables.
- o To know that a column vector describes movement.
- o To know that expanding means the removal of brackets by multiplication.
- o To know that factorising is a way of writing an expression as the product of its factors using brackets.
- o To know that a quadratic expression is in the form of $ax^2 + bx + c$.
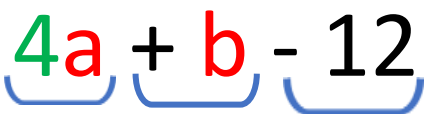
Speak Like a Mathematician

Key Word	Dual Coding	Definition
Variable	$4a + b - 12$	A letter or a symbol representing a numerical value
Coefficient		A numerical value that comes before a variable
Term		A constant, variable or combination of both
Expression	4a + b - 12	Made up of constants, variables, and mathematical operations
Linear Expression	2y + 3	A first order expression, it has no variable with an exponent higher than one
Quadratic Expression	$2y^2 + 3y + 8$	A second order expression, which is in the form $ax^2 + bx + c$
Equation	$4a + b - 12 = 32$	Two expressions connected by an equal symbol
Formula	$S = \dfrac{D}{T}$	Describes a mathematical relationship between variables
Column Vector	$\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ is $\begin{pmatrix} 3\ right \\ 2\ up \end{pmatrix}$	Describes movement
Expand	$2(3a + 5)$	The removal of brackets by multiplying
Factorise	Factorising $3x + 6 \equiv 3(x + 2)$	A way of writing an expression as the product of its factors using brackets

'Rearranging formulae'

The Knowledge for Progression:

- To know that terms are a constant, variable or combination of both and can be positive or negative. The 4 operations can be applied in exactly the same way as numerical operations.
- To know that a formula describes a mathematical relationship between variables.
- To know that "make the subject" means to rearrange a formula so that the required variable on one side of the equation on its own.

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Key Word	Dual Coding	Definition
Variable	$4a + b - 12$	A letter or a symbol representing a numerical value
Coefficient		A numerical value that comes before a variable
Term		A constant, variable or combination of both
Formula	$S = \dfrac{D}{T}$	Describes a mathematical relationship between variables

'Algebraic fraction manipulation'

The Knowledge for Progression:

- To know how to simplify an algebraic fraction.
- To know how to create equivalent algebraic fractions.
- To know how to multiply algebraic fractions.
- To know how to divide algebraic fractions.
- To know how to add and subtract algebraic fractions.
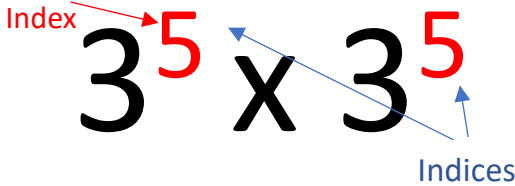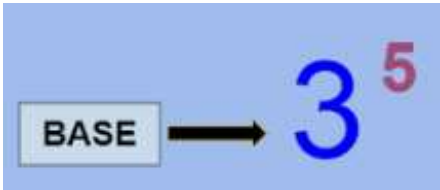
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Key Word	Dual Coding	Definition
Simplify	Simplify: $\frac{18}{27}$ Step 1 Factors of 18: 1, 2, 3, 6, 9, 18 Step 2 Factors of 27: 1, 3, 9, 27 Step 3 $\frac{18 \div 9}{27 \div 9} = \frac{2}{3}$	Reduce to lowest form by dividing by the HCF.
Equivalent	$\frac{2}{6}$ $\frac{1}{3}$ $\frac{4}{12}$	Equal in value.

'Laws of indices'

The Knowledge for Progression:

- To know that anything to the power of zero equals 1.
- To know that anything to the power of 1 is itself.
- To know that to simplify is to reduce to lowest form.
- To know that the base value is the value that is being raised to a power.
- To know that an index (indices plural) is the value that tells you how many times to multiply the base by itself.

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Key Word	Dual Coding	Definition
Simplify		Reduce to lowest simplest form
Indices	Index 3^5 x 3^5 Indices	Indices is plural for index. The number that tells you how many times to multiply the base by itself
Base	BASE ⟶ 3^5	The value that is being raised to a power

'Standard Form'

The Knowledge for Progression:

- To know how to multiply and divide numbers given in standard form.

- To know how to add and subtract numbers given in standard form.

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Key Word	Dual Coding	Definition
Standard from	$a \times 10^n$ Where a is a number $1 \leq a < 10$ and n is an **integer**.	An alternate number system to express large and small numbers.

'Surds'

The Knowledge for Progression:

- To know that a rational number can be written as a fraction.
- To know that an irrational number cannot be written as a fraction.
- To know that a surd is a root of a number that cannot be simplified into a rational number.
- To know that rationalising creates an equivalent fraction with a rational denominator.

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Key Word	Dual Coding	Definition
Rational number	$6 \qquad 3.65 \qquad \dfrac{2}{5} \qquad -0.\dot{4}$	An integer or a decimal that recurs or terminates
Irrational number	$\pi \qquad \sqrt{11} \qquad -\sqrt{5}$	A number that has an infinite number of digits and does not recur or terminate
Surd	✅ $\sqrt{11} \equiv 3.31662\ldots$ ❌ $\sqrt{9} \equiv 3$	A root that cannot be simplified into a rational number
Rationalise	$\dfrac{1}{\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{\sqrt{2}}{2}$	The process of removing surds from the denominator of a fraction

Mathematics Knowledge Organiser

Year 10 – Autumn T2

The Knowledge for Progression:

- ○ To know that an equation contains an equals symbol, variable and constant.
- ○ To know that an inequality contains an inequality symbol, variable and constant.
- ○ To know that equation/inequality are formed from expressions.
- ○ To know that solve means to find the value of the variable.
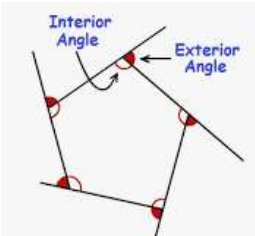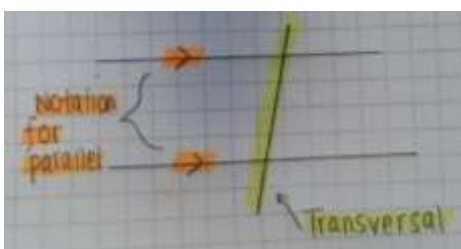- ○ To know that solving always requires performing the inverse operations.
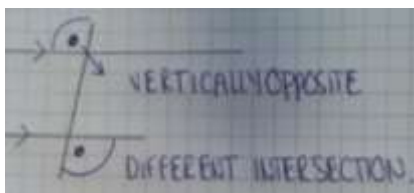
Speak Like a Mathematician
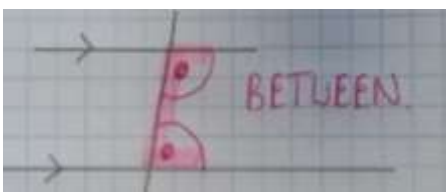
Key Word	Dual Coding	Definition
Equation	$4a + b - 12 = 32$	Two expressions connected by an equal symbol
Inequality	$4a + b - 12 > 32$	Two expressions connected by an inequality symbol
Solve	$\dfrac{x}{5} = 6$ $x = 30$	Find the value of the variable
Inverse	$a^2 \longleftrightarrow \sqrt{a}$	Opposite operations that reverse the effect of the other operation

'Angle geometry'

The Knowledge for Progression:

- To know that the sum of interior angles is calculated by (n-2) x 180° , where n is the number of sides of the polygon.
- To know that sum of the interior angle and the exterior angle equal 180°.
- To know that parallel lines are continuous lines that are always the same distance apart.
- To know that the transversal is a line that cuts through two lines.
- To know that corresponding angles are equal.
- To know that alternate angles are equal.
- To know that co-interior angles sum to 180°.
- To know that vertically opposite angles are equal.
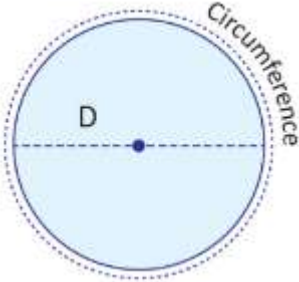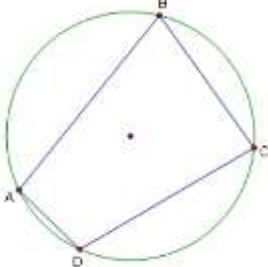
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Key Word	Dual Coding	Definition
Interior		Situated in the inside of a polygon.
Exterior		Situated on the outside of a polygon.
Parallel		Lines that have the same distance between them and never touch.
Transversal		A straight line that intersects two or more parallel lines.
Corresponding		Angles that are at **different intersections** but have the **same position** on the transversal line.
Alternate		Angles that are **vertically opposite** from the initial angle and on a **different intersection**.
Co-interior		Angles occur **between** two parallel lines when intersected by a transversal line.

'Circle geometry'

The Knowledge for Progression:

- To know that angles in triangles sum to 180 degrees.
- To know that angles in quadrilaterals sum to 360 degrees.
- To know that the angle created at the circumference given the diameter is always 90 degrees.
- To know that the angle at the centre is twice the angle at the circumference.
- To know that a quadrilateral with all 4 vertices touching the circumference of a circle is called a *cyclic quadrilateral*.
- To know that opposite angles in a cyclic quadrilateral sum to 180 degrees.

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Key Word	Dual Coding	Definition
Quadrilateral		A 2D shape with 4 vertices and side lengths.
Circumference		The length of a circle.
Diameter		A straight line with both ends touching the circumference and passing through the centre.
Cyclic quadrilateral		A quadrilateral with all 4 vertices toughing the circumference of a circle.

<h1>'Quadratic formula'</h1>

<h2>The Knowledge for Progression:</h2>

- To know that the quadratic formula is $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
- To know that a is the coefficient of the x^2 term.
- To know that b is the coefficient of the x term.
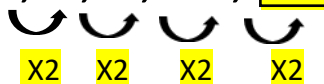- To know the c is the number term.

<h2>Speak Like a Mathematician</h2>
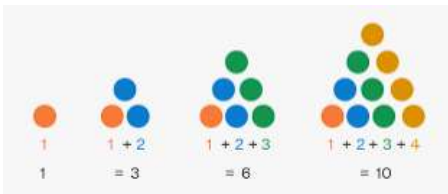
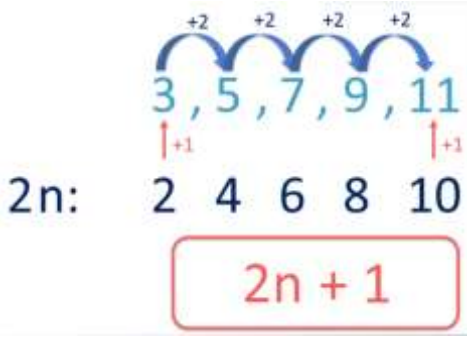| Key Word	Dual Coding	Definition
Variable	4a + b - 12	A letter or a symbol representing a numerical value.
Coefficient		A numerical value that comes before a variable.
Quadratic	$2y^2 + 3y + 8$	Involving a second order power, which is in the form $ax^2 + bx + c$

'Further nth sequences'

The Knowledge for Progression:

- o To know that an arithmetic sequence is where the terms increase or decrease by the same number each time.
- o To know that "n" is the position of a value in the sequence.
- o To know that "n" is always a positive integer.
- o To know that a quadratic sequence is linked to square numbers.
- o To know that a geometric sequence is where each term is generated by multiplying by a constant amount.
- o To know that terms in a triangular sequence are generated by adding consecutive numbers, starting from 1.
- o To know that the terms in a Fibonacci sequence are generated by adding the two previous terms.

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Key Word	Dual Coding	Definition
Sequence	2, 4, 8, 16 … Term: 1 2 3 4	A set of values or diagrams that follow a pattern
Term	Term: 1 2 3 4 5	The position of a value or diagram in a sequence
Term-to-term rule	2, 4, 8, 16, 32 X2 X2 X2 X2	The way that you obtain the next term of a sequence using the previous term
Arithmetic sequence	3, 7, 11, 15 +4 +4 +4	Terms are generated by adding or subtracting a constant amount. This can also be called an arithmetic progression.
Geometric sequence	3, 12, 48, 194 X4 X4 X4	Terms are generated by multiplying by a constant amount. This can also be called a geometric progression.
Triangular sequence	1 1+2 1+2+3 1+2+3+4 1 =3 =6 =10	Terms are generated by adding consecutive numbers, starting from 1
Fibonacci sequence	1, 1, 2, 3, 5, 8, 13 + + + + + +	Terms are generated by adding the two previous terms

Nth term		Relates to the rule of a sequence where 'n' represents the position of the term, starting the count of terms from the first term.
	$+2$ $+2$ $+2$ $+2$ $3, 5, 7, 9, 11$ $\uparrow_{+1}$ $\uparrow_{+1}$ $2n:$ 2 4 6 8 10 $\boxed{2n + 1}$	