KLA Year 10 Term 2 Maths Knowledge Organisers

Year 10 – Foundation Knowledge Organiser Half Term 3

Key Topics and Vocabulary

Probability

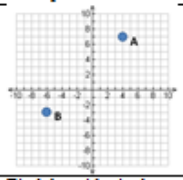
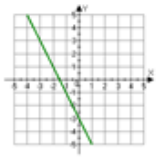
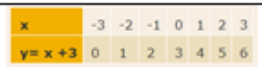
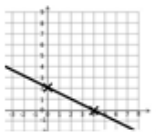
Probability
Relative Frequency
Expected Outcomes
Exhaustive
Mutually Exclusive
Frequency Tree
Sample space diagram

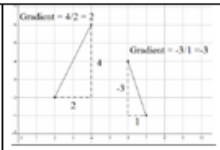
Statistical measures

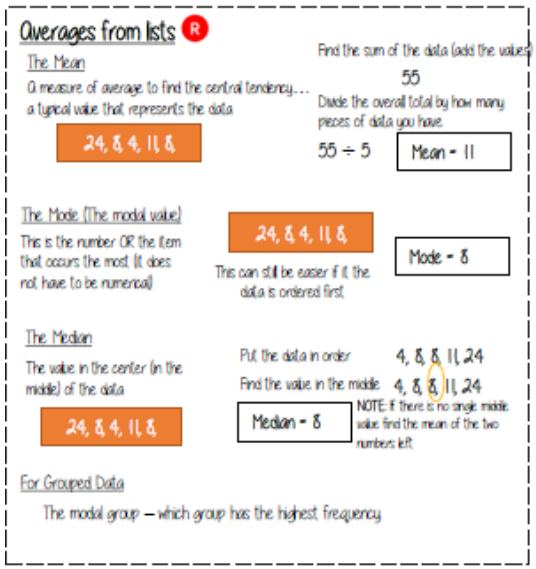
Frequency Table
Bar Chart
Types of Bar Chart
Pie Chart
Pictogram
Line Graph
Two Way Tables

Scatter graphs

Correlation
Causality
Positive Correlation
Negative Correlation
No Correlation
Strong Correlation
Weak Correlation
Scatter Graph
Line of Best Fit
Outlier

Topic/Skill	Definition/Tips	Example
1. Coordinates	Written in **pairs**. The **first** term is the **x-coordinate** (movement **across**). The **second** term is the **y-coordinate** (movement **up or down**)	 A: (4,7) B: (-6,-3)
2. Midpoint of a Line	Method 1: **add the x coordinates and divide by 2, add the y coordinates and divide by 2** Method 2: Sketch the line and find the values half way between the two x and two y values.	Find the midpoint between (2,1) and (6,9) $\frac{2+6}{2}=4$ and $\frac{1+9}{2}=5$ So, the midpoint is (4,5)
3. Linear Graph	**Straight line** graph. The general equation of a linear graph is $y = mx + c$ where m **is the gradient** and c **is the y-intercept**. The **equation** of a linear graph can contain an **x-term**, a **y-term** and a **number**.	Example:  Other examples: $x = y$ $y = 4$ $x = -2$ $y = 2x - 7$ $y + x = 10$ $2y - 4x = 12$
4. Plotting Linear Graphs	Method 1: **Table of Values** Construct a table of values to calculate coordinates. Method 2: **Gradient-Intercept Method** (use when the equation is in the form $y = mx + c$) 1. Plots the y-intercept 2. Using the gradient, plot a second point. 3. Draw a line through the two points plotted. Method 3: **Cover-Up Method** (use when the equation is in the form $ax + by = c$) 1. Cover the x term and solve the resulting equation. Plot this on the $x-axis$. 2. Cover the y term and solve the resulting equation. Plot this on the $y-axis$. 3. Draw a line through the two points plotted.	   $2x + 4y = 8$

5. Gradient	The gradient of a line is how **steep** it is. **Gradient** = $\frac{Change\ in\ y}{Change\ in\ x} = \frac{Rise}{Run}$ The gradient can be positive (sloping upwards) or negative (sloping downwards)	
6. Finding the Equation of a Line given a point and a gradient	**Substitute** in the **gradient (m)** and **point (x,y)** in to the equation $y = mx + c$ and **solve for c**.	Find the equation of the line with gradient 4 passing through (2,7). $y = mx + c$ $7 = 4 \times 2 + c$ $c = -1$ $y = 4x - 1$
7. Finding the Equation of a Line given two points	Use the two points to **calculate the gradient**. Then **repeat the method above** using the gradient and either of the points.	Find the equation of the line passing through (6,11) and (2,3) $m = \frac{11-3}{6-2} = 2$ $y = mx + c$ $11 = 2 \times 6 + c$ $c = -1$ $y = 2x - 1$
8. Parallel Lines	If two lines are **parallel**, they will have the **same gradient**. The value of m will be the same for both lines.	Are the lines $y = 3x - 1$ and $2y - 6x + 10 = 0$ parallel? Answer: Rearrange the second equation in to the form $y = mx + c$ $2y - 6x + 10 = 0 \rightarrow y = 3x - 5$ Since the two gradients are equal (3), the lines are parallel.



Year 10 – Foundation Knowledge Organiser Half Term 4

Key Vocabulary

Inequalities

Inequality

Inequality symbols

Inequalities on a Number Line

Graphical Inequalities

Sketching graphs

Coordinates

Linear Graph

Quadratic Graph

Cubic Graph

Reciprocal Graph

Asymptote

Exponential Graph

Solving quadratic equations

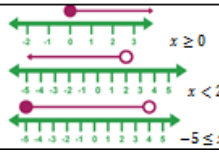
Quadratic

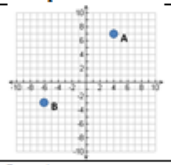
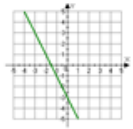
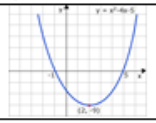
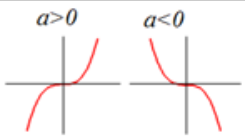
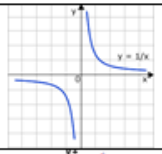
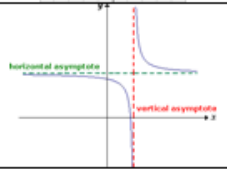
Factorising Quadratics

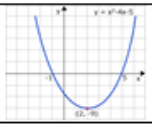
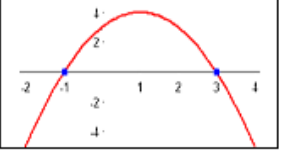
Difference of Two Squares

Quadratic Graph

Roots of a Quadratic

Topic/Skill	Definition/Tips	Example
1. Inequality	An inequality says that two values are **not equal**. $a \neq b$ means that a is not equal to b.	$7 \neq 3$ $x \neq 0$
2. Inequality symbols	$x > 2$ means **x is greater than 2** $x < 3$ means **x is less than 3** $x \geq 1$ means **x is greater than or equal to 1** $x \leq 6$ means **x is less than or equal to 6**	State the integers that satisfy $-2 < x \leq 4$. -1, 0, 1, 2, 3, 4
3. Inequalities on a Number Line	Inequalities can be shown on a number line. **Open circles** are used for numbers that are **less than or greater than** ($<$ *or* $>$) **Closed circles** are used for numbers that are **less than or equal or greater than or equal** ($\leq$ *or* $\geq$)	

Topic/Skill	Definition/Tips	Example
1. Coordinates	Written in **pairs**. The **first** term is the **x-coordinate** (movement **across**). The **second** term is the **y-coordinate** (movement **up or down**)	 A: (4, 7) B: (-6,-3)
2. Linear Graph	**Straight line** graph. The **equation** of a linear graph can contain an **x-term**, a **y-term** and a **number**.	Example:  Other examples: $x = y$ $y = 4$ $x = -2$ $y = 2x - 7$ $y + x = 10$ $2y - 4x = 12$
3. Quadratic Graph	A '**U-shaped**' curve called a **parabola**. The equation is of the form $y = ax^2 + bx + c$, where a, b and c are numbers, $a \neq 0$. If $a < 0$, the parabola is **upside down**.	
4. Cubic Graph	The equation is of the form $y = ax^2 + k$, where k **is an number**. If $a > 0$, the curve is **increasing**. If $a < 0$, the curve is **decreasing**.	
5. Reciprocal Graph	The equation is of the form $y = \frac{A}{x}$, where A **is a number** and $x \neq 0$. The graph has **asymptotes** on the **x-axis and y-axis**.	
6. Asymptote	A **straight line** that a graph **approaches** but **never touches**.	

Topic/Skill	Definition/Tips	Example
1. Quadratic	A quadratic expression is of the form $ax^2 + bx + c$ where a, b and c are numbers, $a \neq 0$	Examples of quadratic expressions: x^2 $8x^2 - 3x + 7$ Examples of non-quadratic expressions: $2x^2 - 5x^2$ $9x - 1$
2. Factorising Quadratics	When a quadratic expression is in the form $x^2 + bx + c$ find the two numbers that **add to give b** and **multiply to give c**.	$x^2 + 7x + 10 = (x + 5)(x + 2)$ (because 5 and 2 add to give 7 and multiply to give 10) $x^2 + 2x - 8 = (x + 4)(x - 2)$ (because +4 and -2 add to give +2 and multiply to give -8)
3. Difference of Two Squares	An expression of the form $a^2 - b^2$ can be factorised to give $(a + b)(a - b)$	$x^2 - 25 = (x + 5)(x - 5)$ $16x^2 - 81 = (4x + 9)(4x - 9)$
4. Solving Quadratics ($ax^2 = b$)	Isolate the x^2 term and square root both sides. Remember there will be a **positive and a negative solution**.	$2x^2 = 98$ $x^2 = 49$ $x = \pm 7$
5. Solving Quadratics ($ax^2 + bx = 0$)	**Factorise** and then **solve = 0**.	$x^2 - 3x = 0$ $x(x - 3) = 0$ $x = 0$ *or* $x = 3$
6. Solving Quadratics by Factorising ($a = 1$)	**Factorise** the quadratic in the usual way. **Solve = 0** Make sure the equation = 0 before factorising.	Solve $x^2 + 3x - 10 = 0$ Factorise: $(x + 5)(x - 2) = 0$ $x = -5$ *or* $x = 2$
7. Quadratic Graph	A '**U-shaped**' curve called a **parabola**. The equation is of the form $y = ax^2 + bx + c$, where a, b and c are numbers, $a \neq 0$. If $a < 0$, the parabola is **upside down**.	
8. Roots of a Quadratic	A root is a **solution**. The roots of a quadratic are the **x-intercepts of the quadratic graph**.	

Year 10 – Higher Knowledge Organiser Half Term 3

Key Topics and Vocabulary

Statistical measures

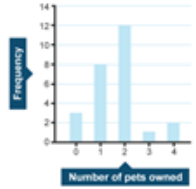
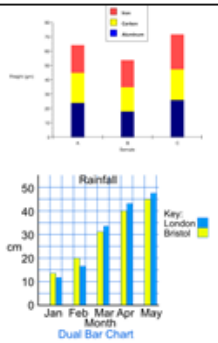
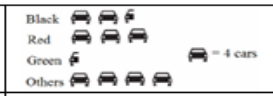
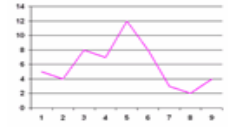
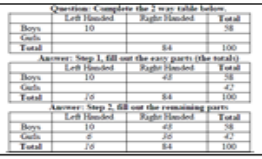
Frequency Table
Bar Chart
Types of Bar Chart
Pie Chart
Pictogram
Line Graph
Two Way Tables

Numerical methods

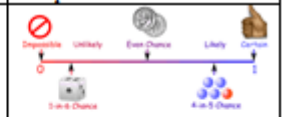
Iteration
Iterative Method

Probability

Probability
Probability Notation
Theoretical Probability
Relative Frequency
Expected Outcomes
Exhaustive
Mutually Exclusive
Frequency Tree
Sample space diagram

Topic/Skill	Definition/Tips	Example
1. Frequency Table	A record of **how often each value** in a set of data **occurs**.	
2. Bar Chart	Represents data as vertical blocks. ***x − axis*** shows the **type** of data ***y − axis*** shows the **frequency** for each type of data Each bar should be the **same width** There should be **gaps** between each bar Remember to **label** each axis.	
3. Types of Bar Chart	**Compound/Composite** Bar Charts show data stacked on top of each other. **Comparative/Dual** Bar Charts show data side by side.	
4. Pie Chart	Used for showing **how data breaks down into** its constituent **parts**. When drawing a pie chart, **divide 360° by the total frequency**. This will tell you how many degrees to use for the frequency of each category. Remember to **label** the category that each sector in the pie chart represents.	 If there are 40 people in a survey, then each person will be worth 360÷40=9° of the pie chart.
5. Pictogram	Uses **pictures** or symbols to **show the value** of the data. A pictogram must have a **key**.	
6. Line Graph	A graph that uses **points connected by straight lines** to show how data changes in values. This can be used for **time series data**, which is a series of data points spaced over uniform time intervals in **time order**.	
7. Two Way Tables	A table that **organises data** around **two categories**. Fill out the information step by step using the information given. Make sure all the totals add up for all columns and rows.	

Topic/Skill	Definition/Tips	Example
1. Iteration	The act of **repeating a process** over and over again, often with the aim of **approximating** a desired result more closely. **Recursive** Notation: $x_{n+1} = \sqrt{3x_n + 6}$	$x_1 = 4$ $x_2 = \sqrt{3 \times 4 + 6} = 4.242640\ldots$ $x_3 = \sqrt{3 \times 4.242640\ldots + 6}$ $= 4.357576\ldots$
2. Iterative Method	To create an iterative formula, **rearrange** an equation with more than one x term to **make one of the x terms the subject**. You will be given the first value to substitute in, often called x_1. **Keep substituting in your previous answer** until your answers are the same to a certain degree of accuracy. This is called converging to a limit. Use the 'ANS' button on your calculator to keep substituting in the previous answer.	Use an iterative formula to find the positive root of $x^2 - 3x - 6 = 0$ to 3 decimal places. $x_1 = 4$ Answer: $x^2 = 3x + 6$ $x = \sqrt{3x + 6}$ So $x_{n+1} = \sqrt{3x_n + 6}$ $x_1 = 4$ $x_2 = \sqrt{3 \times 4 + 6} = 4.242640\ldots$ $x_3 = \sqrt{3 \times 4.242640\ldots + 6}$ $= 4.357576\ldots$ Keep repeating… $x_7 = 4.372068.. = 4.372\ (3dp)$ $x_8 = 4.372208\ldots = 4.372\ (3dp)$ So answer is $x = 4.372\ (3dp)$

Topic/Skill	Definition/Tips	Example
1. Probability	The **likelihood/chance** of something **happening**. Is expressed as a number **between 0 (impossible) and 1 (certain)**. Can be expressed as a fraction, decimal, percentage or in words (likely, unlikely, even chance etc.)	
2. Probability Notation	**P(A)** refers to the **probability that event A will occur**.	P(Red Queen) refers to the probability of picking a Red Queen from a pack of cards.
3. Theoretical Probability	$\frac{Number\ of\ Favourable\ Outcomes}{Total\ Number\ of\ Possible\ Outcomes}$	Probability of rolling a 4 on a fair 6-sided die = $\frac{1}{6}$
4. Relative Frequency	$\frac{Number\ of\ Successful\ Trials}{Total\ Number\ of\ Trials}$	A coin is flipped 50 times and lands on Tails 29 times. The relative frequency of getting Tails = $\frac{29}{50}$

Year 10 – Higher Knowledge Organiser Half Term 4

Key Topics and Vocabulary

Further equations and graphs

Coordinates

Linear Graph

Quadratic Graph

Cubic Graph

Reciprocal Graph

Asymptote

Exponential Graph

$y=sinx$, $y=cosx$, $y=tanx$, $f(x)+a$

$f(x+a)$, $-f(x)$, $f(-x)$

Circle theorems

Angles in a semi-circle have a right angle at the circumference.

Opposite angles in a cyclic quadrilateral add up to 180°.

The angle at the centre is twice the angle at the circumference.

Angles in the same segment are equal.

A tangent is perpendicular to the radius at the point of contact.

Tangents from an external point at equal in length.

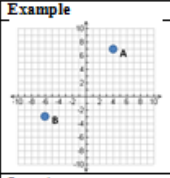
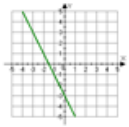
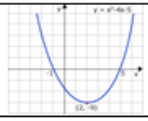
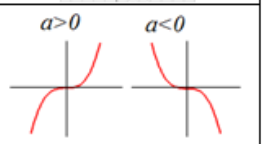
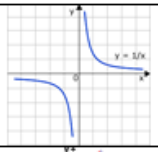
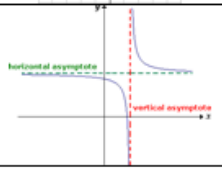
Alternate Segment Theorem

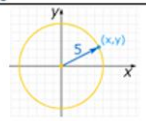
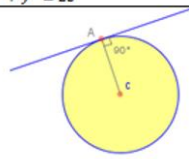
Equation of a circle

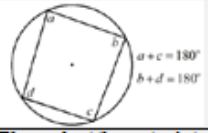
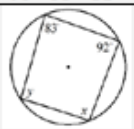
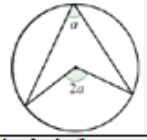
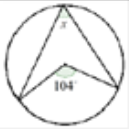
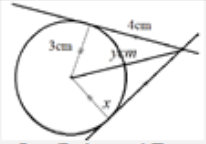
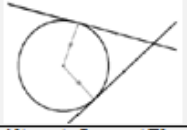
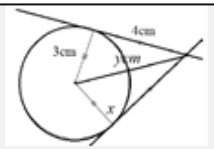
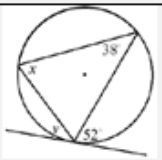
Equation of a Circle

Tangent

Gradient

Topic/Skill	Definition/Tips	Example
1. Coordinates	Written in **pairs**. The **first** term is the **x-coordinate** (movement **across**). The **second** term is the **y-coordinate** (movement **up or down**)	 A: (4,7) B: (-6,-3)
2. Linear Graph	**Straight line** graph. The **equation** of a linear graph can contain an **x-term**, a **y-term** and a **number**.	Example:  Other examples: $x=y$ $y=4$ $x=-2$ $y=2x-7$ $y+x=10$ $2y-4x=12$
3. Quadratic Graph	A '**U-shaped**' curve called a **parabola**. The equation is of the form $y=ax^2+bx+c$, where a, b and c are numbers, $a \neq 0$. If $a<0$, the parabola is **upside down**.	
4. Cubic Graph	The equation is of the form $y=ax^3+k$, where k **is an number**. If $a>0$, the curve is **increasing**. If $a<0$, the curve is **decreasing**.	 $a>0$ $a<0$
5. Reciprocal Graph	The equation is of the form $y=\frac{A}{x}$, where A **is a number** and $x \neq 0$. The graph has **asymptotes** on the **x-axis and y-axis**.	
6. Asymptote	A **straight line** that a graph **approaches** but **never touches**.	

Topic/Skill	Definition/Tips	Example
1. Equation of a Circle	The equation of a **circle**, **centre (0,0)**, **radius r**, is: $x^2+y^2=r^2$	 $x^2+y^2=25$
2. Tangent	A straight **line** that **touches** a circle at **exactly one point**, never entering the circle's interior. A **radius** is **perpendicular** to a **tangent** at the **point of contact**.	

Topic/Skill	Definition/Tips	Example
Circle Theorem 1	**Angles in a semi-circle have a right angle at the circumference.** 	 $y=90°$ $x=180-90-38=52°$
Circle Theorem 2	**Opposite angles in a cyclic quadrilateral add up to 180°.** 	 $x=180-83=97°$ $y=180-92=88°$
Circle Theorem 3	**The angle at the centre is twice the angle at the circumference.** 	 $x=104\div 2=52°$
Circle Theorem 4	**Angles in the same segment are equal.** 	 $x=42°$ $y=31°$
Circle Theorem 5	**A tangent is perpendicular to the radius at the point of contact.** 	 $y=5cm$ (Pythagoras' Theorem)
Circle Theorem 6	**Tangents from an external point at equal in length.** 	 $x=90°$
Circle Theorem 7	**Alternate Segment Theorem** 	 $x=52°$ $y=38°$

Year 10 - Foundation

Maths

Knowledge Questions

Below are a series of questions.

Use these to apply your knowledge and practice.

Scatter graphs

What is the same and what is different about the points with coordinates $(a, 0)$ and $(-a, 0)$?
Why are coordinates $(a, 0)$ and $(0, a)$ different?
Why do the order of the numbers in a coordinate matter?

Statistical Measures

Is it possible (e.g.) to have 3.9 people in family? What would be a better average to use?

Probability

What makes events equally likely to occur?

If it (e.g.) might rain, or might not, are these events equally likely?

Angles

How can you draw a 200° angle using a 180° protractor?

Inequalities

List all of the integer values that satisfy each inequality.

a) $-1 < n < 3$ b) $1 \leq n < 4$ c) $-7 \leq n \leq -3$

Solving quadratic equations

How many roots is it possible for a quadratic equation to have? Can a quadratic equation have more than 2 roots? 0 roots?

Quadratic Graphs

How could I tell if one of my coordinates was incorrect, or if I had plotted it incorrectly?

Year 10 - Foundation

Maths

Knowledge Checklist

	KNOWLEDGE CHECKLIST	KNOWLEDGE PROGRESS R	A	G
1	Scatter graphs			
2	Statistical Measures			
3	Probability			
4	Angles			
5	Inequalities			
6	Solving quadratic equations			
7	Sketching graphs			
8	Quadratic graphs			
9				
10				

High Flyers - Enrichment Task

x^2 $2x^2$ $x^2 - x$

Eva substitutes $x = 3$ into each expression.
Jack substitutes $x = -3$ into each expression.
Jack thinks that he will get the same answers as Eva each time.
Do you agree with Jack? Justify your answer.

Year 10 - Higher

Maths

Knowledge Questions

Below are a series of questions.

Use these to apply your knowledge and practice.

Numerical Methods

An approximate solution for the equation

$$x^2 - 11x - 6 = 0$$

Statistical measures

Is it possible (e.g.) to have 3.9 people in family? What would be a better average to use?

Probability

What makes events equally likely to occur?

If it (e.g.) might rain, or might not, are these events equally likely?

Circle Theorems

Work out the size of the angles marked with letters.

Equation of a circle

What's the same and what's different about solving an equation or an inequality?

How many solutions does an inequality have?

Further equations of graphs

What units are used to measure volume?

What is the difference between a cube and a cuboid?

Year 10 - Higher

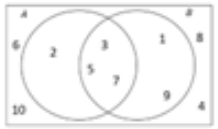
Maths

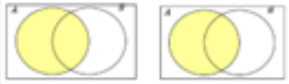
Knowledge Checklist

	KNOWLEDGE CHECKLIST	KNOWLEDGE PROGRESS R	A	G
1	Numerical Methods			
2	Statistical measures			
3	Probability			
4	Circle Theorems			
5	Equation of a circle			
6	Further equations of graphs			
7				
8				
9				
10				

High Flyers - Enrichment Task

The Venn diagram shows:
ξ = {integers from 1 to 10}
A = {prime numbers}
B = {odd numbers}





How do the two Venn diagrams help to show the probability of a number being odd, given it's prime? Calculate this probability

Use a similar approach to show that:
The probability of a number being prime, given that it's odd is $\frac{3}{5}$