KLA Year 10 Term 3 Maths Knowledge Organisers

Year 10 – Foundation Knowledge Organiser Half Term 5

Key Topics and Vocabulary

Simultaneous equations

Simultaneous Equations
Variable
Coefficient
Solving Simultaneous Equations (by Elimination)
Solving Simultaneous Equations (by Substitution)
Solving Simultaneous Equations (Graphically)
Solving Linear and Quadratic Simultaneous Equations

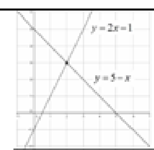
Algebra and graphs

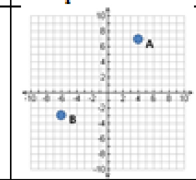
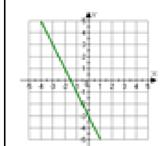
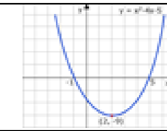
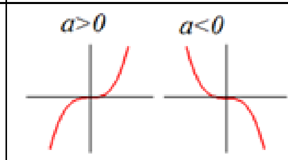
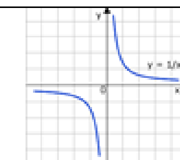
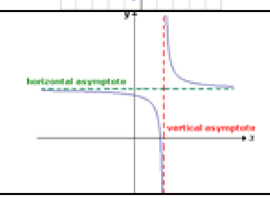
Coordinates
Linear Graph
Quadratic Graph
Cubic Graph
Reciprocal Graph
Asymptote

Calculating with percentages

Increase or Decrease by a Percentage
Percentage Multiplier
Reverse Percentage
Simple Interest

Topic/Skill	Definition/Tips	Example
1. Simultaneous Equations	A set of **two or more equations**, each involving **two or more variables** (letters). The **solutions** to simultaneous equations **satisfy both**/all of the **equations**.	$2x + y = 7$ $3x - y = 8$ $x = 3$ $y = 1$
2. Variable	A **symbol**, usually a **letter**, which **represents a number** which is usually unknown.	In the equation $x + 2 = 5$, x is the variable.
3. Coefficient	**A number** used to **multiply a variable**. It is the number that comes before/in front of a letter.	6z 6 is the coefficient z is the variable
4. Solving Simultaneous Equations (by Elimination)	1. **Balance** the **coefficients** of one of the variables. 2. **Eliminate** this variable by adding or subtracting the equations (**Same Sign Subtract, Different Sign Add**) 3. **Solve** the linear equation you get using the other variable. 4. **Substitute** the value you found back into one of the previous equations. 5. **Solve** the equation you get. 6. **Check** that the two values you get satisfy both of the original equations.	$5x + 2y = 9$ $10x + 3y = 16$ Multiply the first equation by 2. $10x + 4y = 18$ $10x + 3y = 16$ Same Sign Subtract (+10x on both) $y = 2$ Substitute $y = 2$ in to equation $5x + 2 \times 2 = 9$ $5x + 4 = 9$ $5x = 5$ $x = 1$ Solution: $x = 1, y = 2$
5. Solving Simultaneous Equations (by Substitution)	1. **Rearrange** one of the equations into the form $y = ...$ or $x = ...$ 2. **Substitute** the right-hand side of the rearranged equation into the other equation. 3. Expand and **solve** this equation. 4. **Substitute** the value into the $y = ...$ or $x = ...$ equation. 5. **Check** that the two values you get satisfy both of the original equations.	$y - 2x = 3$ $3x + 4y = 1$ Rearrange: $y - 2x = 3 \rightarrow y = 2x + 3$ Substitute: $3x + 4(2x + 3) = 1$ Solve: $3x + 8x + 12 = 1$ $11x = -11$ $x = -1$ Substitute: $y = 2 \times -1 + 3$ $y = 1$ Solution: $x = -1, y = 1$

6. Solving Simultaneous Equations (Graphically)	**Draw the graphs** of the two equations. The **solutions** will be **where the lines meet**. The solution can be written as a **coordinate**.	 $y = 5 - x$ and $y = 2x - 1$. They meet at the point with coordinates (2,3) so the answer is $x = 2$ and $y = 3$

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**.	
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. Increase or Decrease by a Percentage	Non-calculator: **Find the percentage** and **add or subtract** it from the **original** amount. Calculator: Find the **percentage multiplier** and multiply.	<u>Increase 500 by 20% (Non Calc):</u> 10% of 500 = 50 so 20% of 500 = 100 500 + 100 = 600 <u>Decrease 800 by 17% (Calc):</u> 100%-17%=83% 83% ÷ 100 = 0.83 0.83 x 800 = 664
2. Percentage Multiplier	The **number** you **multiply** a quantity by to **increase or decrease** it by **a percentage**.	The multiplier for increasing by 12% is 1.12 The multiplier for decreasing by 12% is 0.88 The multiplier for increasing by 100% is 2.

Year 10 – Foundation Knowledge Organiser Half Term 6

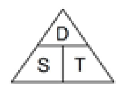
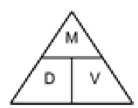
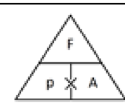
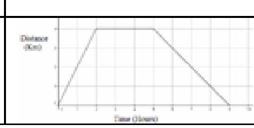
Key Vocabulary

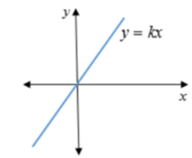
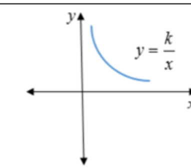
Measures

Metric System
Imperial System
Metric and Imperial Units
Speed, Distance, Time
Density, Mass, Volume
Pressure, Force, Area

Direct and inverse proportion

Direct Proportion
Inverse Proportion
Using proportionality formulae
Direct Proportion with powers
Inverse Proportion with powers

Topic/Skill	Definition/Tips	Example
1. Metric System	A system of measures based on: - the metre for length - the kilogram for mass - the second for time **Length: mm, cm, m, km** **Mass: mg, g, kg** **Volume: ml, cl, l**	$1\,kilometres = 1000\,metres$ $1\,metre = 100\,centimetres$ $1\,centimetre = 10\,millimetres$ $1\,kilogram = 1000\,grams$
2. Imperial System	A system of weights and measures originally developed in England, usually based on human quantities **Length: inch, foot, yard, miles** **Mass: lb, ounce, stone** **Volume: pint, gallon**	$1\,lb = 16\,ounces$ $1\,foot = 12\,inches$ $1\,gallon = 8\,pints$
3. Metric and Imperial Units	Use the **unitary method** to convert between metric and imperial units.	$5\,miles \approx 8\,kilometres$ $1\,gallon \approx 4.5\,litres$ $2.2\,pounds \approx 1\,kilogram$ $1\,inch = 2.5\,centimetres$
4. Speed, Distance, Time	**Speed = Distance ÷ Time** **Distance = Speed x Time** **Time = Distance ÷ Speed**  Remember the correct units.	Speed = 4mph Time = 2 hours Find the Distance. $D = S \times T = 4 \times 2 = 8\,miles$
5. Density, Mass, Volume	**Density = Mass ÷ Volume** **Mass = Density x Volume** **Volume = Mass ÷ Density**  Remember the correct units.	Density = $8kg/m^3$ Mass = 2000g Find the Volume. $V = M \div D = 2 \div 8 = 0.25m^3$
6. Pressure, Force, Area	**Pressure = Force ÷ Area** **Force = Pressure x Area** **Area = Force ÷ Pressure**  Remember the correct units.	Pressure = 10 Pascals Area = $6cm^2$ Find the Force $F = P \times A = 10 \times 6 = 60\,N$
7. Distance-Time Graphs	You can find the **speed** from the **gradient** of the line (Distance ÷ Time) The steeper the line, the quicker the speed. A **horizontal** line means the object is not moving (**stationary**).	

Topic/Skill	Definition/Tips	Example
1. Direct Proportion	If two quantities are in direct proportion, **as one increases**, the **other increases** by the **same percentage**. If y is directly proportional to x, this can be written as $y \propto x$ An equation of the form $y = kx$ represents direct proportion, where k **is the constant of proportionality**.	
2. Inverse Proportion	If two quantities are inversely proportional, **as one increases**, the **other decreases** by the **same percentage**. If y is inversely proportional to x, this can be written as $y \propto \frac{1}{x}$ An equation of the form $y = \frac{k}{x}$ represents inverse proportion.	

Year 10 – Higher Knowledge Organiser Half Term 5

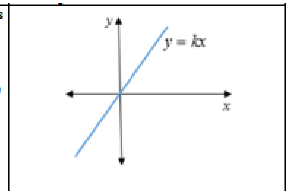
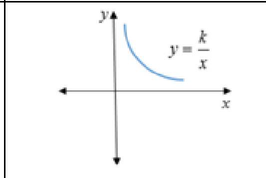
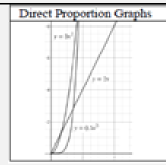
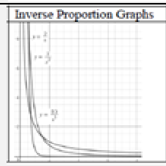
Key Topics and Vocabulary

Direct and inverse proportion
Direct Proportion
Inverse Proportion
Using proportionality formulae
Direct Proportion with powers
Inverse Proportion with powers

Calculating with percentages
Increase or Decrease by a Percentage
Percentage Multiplier
Reverse Percentage
Simple Interest

Simultaneous equations
Simultaneous Equations
Variable
Coefficient
Solving Simultaneous Equations (by Elimination)
Solving Simultaneous Equations (by Substitution)
Solving Simultaneous Equations (Graphically)
Solving Linear and Quadratic Simultaneous Equations

Inequalites
Inequality
Inequality symbols
Inequalities on a Number Line
Graphical Inequalities
Quadratic Inequalities
Set Notation

1. Direct Proportion	If two quantities are in direct proportion, as **one increases**, the **other increases** by the **same percentage**. If y is directly proportional to x, this can be written as $y \propto x$ An equation of the form $y = kx$ represents direct proportion, where k is **the constant of proportionality**.	
2. Inverse Proportion	If two quantities are inversely proportional, **as one increases**, the **other decreases** by the **same percentage**. If y is inversely proportional to x, this can be written as $y \propto \frac{1}{x}$ An equation of the form $y = \frac{k}{x}$ represents inverse proportion.	
3. Using proportionality formulae	**Direct**: **y = kx** or $y \propto x$ **Inverse**: $y = \frac{k}{x}$ or $y \propto \frac{1}{x}$ 1. **Solve to find k** using the pair of values in the question. 2. **Rewrite the equation** using the k you have just found. 3. **Substitute the other given value** from the question in to the equation to **find the missing value**.	p is directly proportional to q. When p = 12, q = 4. Find p when q = 20. 1. p = kq 12 = k x 4 so k = 3 2. p = 3q 3. p = 3 x 20 = 60, so p = 60
4. Direct Proportion with powers	Graphs showing **direct proportion** can be written in the form $y = kx^n$ Direct proportion graphs will always start at the origin.	Direct Proportion Graphs 
5. Inverse Proportion with powers	Graphs showing **inverse proportion** can be written in the form $y = \frac{k}{x^n}$ Inverse proportion graphs will never start at the origin.	Inverse Proportion Graphs 

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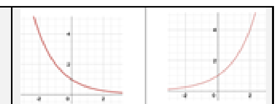
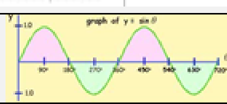
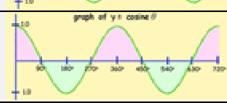
1. Simultaneous Equations	A set of **two or more equations**, each involving **two or more variables** (letters). The **solutions** to simultaneous equations **satisfy both**/all of the **equations**.	$2x + y = 7$ $3x - y = 8$ $x = 3$ $y = 1$
2. Variable	**A symbol**, usually a **letter**, which **represents a number** which is usually unknown.	In the equation $x + 2 = 5$, x is the variable.
3. Coefficient	**A number** used to **multiply a variable**. It is the number that comes before/in front of a letter.	6z 6 is the coefficient z is the variable
4. Solving Simultaneous Equations (by Elimination)	1. **Balance the coefficients** of one of the variables. 2. **Eliminate** this variable by adding or subtracting the equations (**Same Sign Subtract, Different Sign Add**) 3. **Solve** the linear equation you get using the other variable. 4. **Substitute** the value you found back into one of the previous equations. 5. **Solve** the equation you get. 6. **Check** that the two values you get satisfy both of the original equations.	$5x + 2y = 9$ $10x + 3y = 16$ Multiply the first equation by 2. $10x + 4y = 18$ $10x + 3y = 16$ Same Sign Subtract (+10x on both) $y = 2$ Substitute $y = 2$ in to equation $5x + 2 \times 2 = 9$ $5x + 4 = 9$ $5x = 5$ $x = 1$ Solution: $x = 1, y = 2$
5. Solving Simultaneous Equations (by Substitution)	1. **Rearrange** one of the equations into the form $y = \ldots$ or $x = \ldots$ 2. **Substitute** the right-hand side of the rearranged equation into the other equation. 3. Expand and **solve** this equation. 4. **Substitute** the value into the $y = \ldots$ or $x = \ldots$ equation. 5. **Check** that the two values you get satisfy both of the original equations.	$y - 2x = 3$ $3x + 4y = 1$ Rearrange: $y - 2x = 3 \rightarrow y = 2x + 3$ Substitute: $3x + 4(2x + 3) = 1$ Solve: $3x + 8x + 12 = 1$ $11x = -11$ $x = -1$ Substitute: $y = 2 \times -1 + 3$ $y = 1$ Solution: $x = -1, y = 1$

7. Exponential Graph	The equation is of the form $y = a^x$, where a is a number called the **base**. If $a > 1$ the graph **increases**. If $0 < a < 1$, the graph **decreases**. The graph has an **asymptote** which is the **x-axis**.	
8. $y = \sin x$	Key Coordinates: $(0,0), (90,1), (180,0), (270,-1), (360,0$ y is never more than 1 or less than -1. Pattern repeats every 360°.	
9. $y = \cos x$	Key Coordinates: $(0,1), (90,0), (180,-1), (270,0), (360,1$ y is never more than 1 or less than -1. Pattern repeats every 360°.	
10. $y = \tan x$	Key Coordinates: $(0,0), (45,1), (135,-1), (180,0), (225,1), (315,-1), (360,0)$ **Asymptotes** at $x = 90$ and $x = 270$ Pattern repeats every 360°.	

Year 10 – Higher Knowledge Organiser Half Term 6

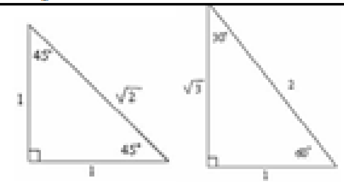
Key Topics and Vocabulary

Sine and Cosine rules

Exact Values for Angles in Trigonometry

Sine Rule

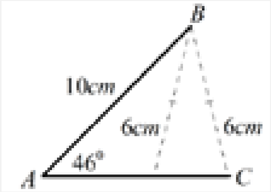
Cosine Rule

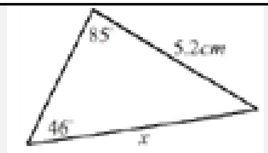
<table>
<tr><th>Topic/Skill</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Exact Values for Angles in Trigonometry</td><td>
<table>
<tr><th></th><th>0°</th><th>30°</th><th>45°</th><th>60°</th><th>90°</th></tr>
<tr><td>sin</td><td>0</td><td>$\frac{1}{2}$</td><td>$\frac{\sqrt{2}}{2}$</td><td>$\frac{\sqrt{3}}{2}$</td><td>1</td></tr>
<tr><td>cos</td><td>1</td><td>$\frac{\sqrt{3}}{2}$</td><td>$\frac{\sqrt{2}}{2}$</td><td>$\frac{1}{2}$</td><td>0</td></tr>
<tr><td>tan</td><td>0</td><td>$\frac{1}{\sqrt{3}}$</td><td>1</td><td>$\sqrt{3}$</td><td>—</td></tr>
</table>
</td><td>


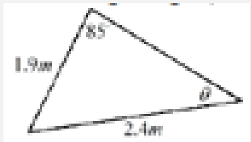
</td></tr>
<tr><td>2. Sine Rule</td><td>
Use with non right angle triangles.
Use when the question involves 2 sides and 2 angles.

For missing side:
$\frac{a}{\sin A} = \frac{b}{\sin B}$

For missing angle:
$\frac{\sin A}{a} = \frac{\sin B}{b}$

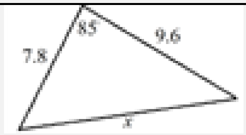
There is an ambiguous case (where there are two potential answers)


To find the two angles, use sine to find one, and then subtract your answer from 180 to find the other answer.
</td><td>


$\frac{x}{\sin 85} = \frac{5.2}{\sin 46}$
$x = \frac{5.2 \times \sin 85}{\sin 46} = 3.75cm$


$\frac{\sin\theta}{1.9} = \frac{\sin 85}{2.4}$
$\sin\theta = \frac{1.9 \times \sin 85}{2.4} = 0.789$
$\theta = sin^{-1}(0.789) = 52.1°$
</td></tr>
<tr><td>3. Cosine Rule</td><td>
Use with non right angle triangles.
Use when the question involves 3 sides and 1 angle.

For missing side:
$a^2 = b^2 + c^2 - 2bc\cos A$

For missing angle:
$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$
</td><td>


$x^2 = 9.6^2 + 7.8^2 - (2 \times 9.6 \times 7.8 \times \cos 85)$
$x = 11.8$
</td></tr>
</table>

Year 10 Foundation

Your Future starts here

KING'S LYNN ACADEMY

Welcome to KLA your … rts here

Term 1

- Trigonometry & Pythagoras (recap)
- Circumference and area
- Ratio and proportion, factors and multiples, Indices, Sequences
- Algebra quadratics, rearranging formula and identities
- Basic algebra

Term 2

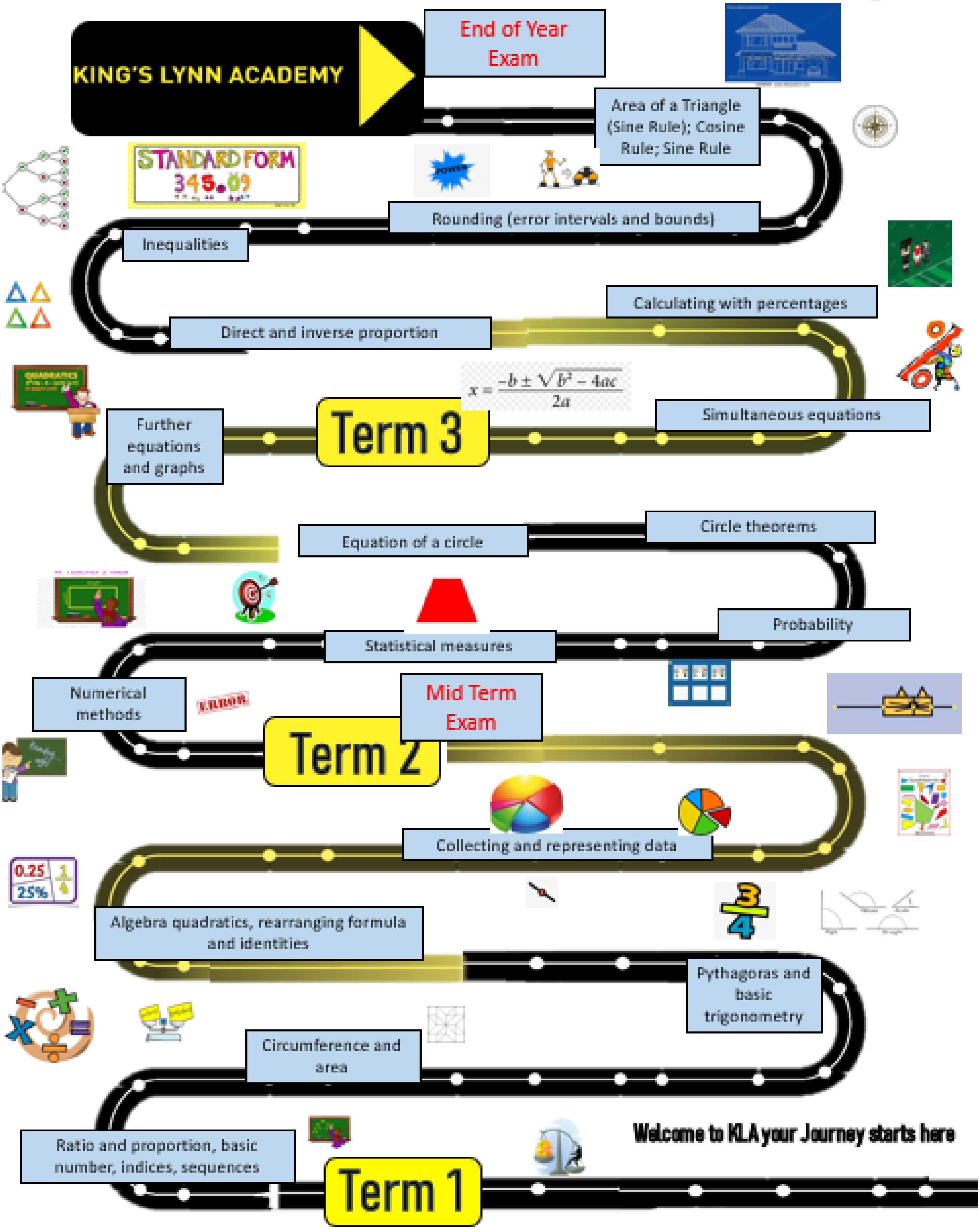
- Collecting and representing data
- Scatter graphs
- Mid Term Exam
- Probability
- Angles
- Statistical measures
- Solving quadratic equations
- Inequalities
- Sketching graphs

Term 3

- Quadratic graphs
- Simultaneous equations
- Algebra and graphs
- Vectors
- Calculating with percentages
- Direct and inverse proportion
- Measures
- End of Year Exam

Year 10 Higher

Your Future starts here



Year 10 - Foundation

Maths

Knowledge Questions

Below are a series of questions.

Use these to apply your knowledge and practice.

Simultaneous Equations

Could I substitute for x? How could I do this?

Could I substitute for y? Do I need to rearrange the linear equation first. How could I do this?

Algebra and graphs

What features of a graph help us to identify its equation? Which types of graphs do you find easier to identify? Why?

Vectors

What do the numbers in the column vector represent?
How do you know which direction they represent?

Calculating with percentages

Which are the most commonly used percentages? What fractions are they equivalent to?

How can you convert any decimal to a fraction?

Direct and indirect proportion

What is the difference between direct and inverse proportion?
If two variables are inversely proportional, what happens to the value of one variable if the other is multiplied by a?

Measures

What is the difference between mass and volume?
Why is the density of a metal likely to be different from the density of a gas?
Why do we measure density in g/cm^3 (or kg/m^3)?

Year 10 - Foundation

Maths

Knowledge Checklist

KNOWLEDGE PROGRESS

	KNOWLEDGE CHECKLIST	R	A	G
1	Simultaneous Equations			
2	Algebra and graphs			
3	Vectors			
4	Calculating with percentages			
5	Direct and indirect proportion			
6	Measures			
7				
8				
9				
10				

High Flyers - Enrichment Task

r is inversely proportional to the cube of s.
When $r = 8$, $s = 5$

- Show that when $r = 64$, $s = 2.5$

Give as exact answers in simplest form.

- Work out r when $s = 8$
- Work out the value of s when $r = 10$

Year 10 - Higher
Maths
Knowledge Questions

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Could I substitute for y? Do I need to rearrange the linear equation first. How could I do this?

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Which are the most commonly used percentages? What fractions are they equivalent to?

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Direct and Indirect Proportion

What is the difference between direct and inverse proportion?
If two variables are inversely proportional, what happens to the value of one variable if the other is multiplied by a?

Rounding

Why do we round numbers?

When talking about the population of the UK, would you round to the nearest hundred, thousand or million? What about the population of Leeds?

Inequalities

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

How many solutions does an inequality have?

Sine and Cosine Rules

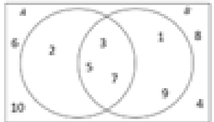
How do we know when to use the sine rule?
How do we know when to use the cosine rule?

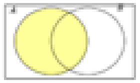
Year 10 - Higher
Maths
Knowledge Checklist

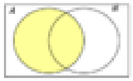
	KNOWLEDGE CHECKLIST	KNOWLEDGE PROGRESS R	A	G
1	Simultaneous Equations			
2	Calculating with percentages			
3	Direct and Indirect Proportion			
4	Rounding			
5	Inequalities			
6	Sine and Cosine Rules			
7				
8				
9				
10				

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 $\frac{3}{5}$