

# Knowledge Organisers

**5. Knowledge Organisers – Create a one-page document that outlines the most important knowledge a student needs to engage in a unit of learning.**

## REPRESENTATIONS OF DATA

### KEY WORDS & DEFINITIONS

**1. Outlier**  
A data value that lies beyond expected extremes. These are usually calculated as a multiple of the interquartile range above the upper quartile or below the lower quartile (i.e. either greater than  $Q_3 + k(Q_3 - Q_1)$  or less than  $Q_1 - k(Q_3 - Q_1)$ )

**2. Cleaning**  
The process of removing anomalies from the data set.

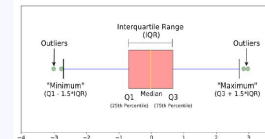
### WHAT DO I NEED TO KNOW?

Comparing 2 sets of data:  
Calculate & compare the measures of location  
Calculate & compare the measures of spread  
Compare outliers if applicable  
Mean & sd go together  
Median & IQR go together  
Ensure all comparisons are done IN CONTEXT

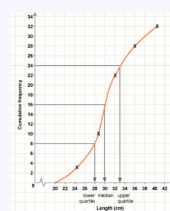
**Histograms**  
Area of bar  $\propto$  Frequency so  
Area of bar =  $k \times$  Frequency  
Area does NOT always = Frequency

### BOX PLOTS

Box plots are rarely symmetrical  
25% of the data lies within each section  
Always use the same scale when comparing box plots

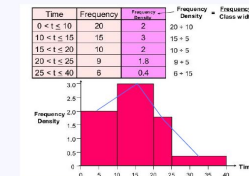


### CUMULATIVE FREQUENCY



Plot points at the upper limits of group boundaries  
Ensure it makes sense to extrapolate the curve at the beginning  
Be careful of questions that ask "how many are more than..."

### HISTOGRAMS



Histograms are used to represent grouped continuous data  
Area of bar =  $k \times$  Frequency  
If  $k = 1$ , then  $\text{frequency density} = \frac{\text{frequency}}{\text{class width}}$   
You may need to find the areas of parts of bars if questions don't use the class boundaries  
Joining the middle of the tops of each bar in a histogram forms a frequency polygon

## NUMBER SKILLS

**Key Words**

- Commutative:** changing the order of operations does not change the result
- Associative:** when you add or multiply you can do so regardless of how the numbers are grouped
- Inverse:** the operation that undoes what was done by the previous operation
- Subtract:** taking away one number from another
- Negative:** a value less than zero
- Debit:** money that leaves a bank account
- Credit:** money that goes into a bank account
- Integer:** a whole number
- Product:** multiply terms
- Operation:** a mathematical process

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**What do I need to be able to do?**  
You should be able to:

- Understand properties of addition and subtraction
- Understand properties of multiplication and division
- Use formal methods of addition and subtraction for integers
- Use formal methods of multiplication and division for integers
- Add and subtract directed numbers
- Multiply and divide directed numbers
- Understand and use order of operations with positive and negative integers

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**Addition**

Addition is commutative:  $2 + 4 = 4 + 2$

Addition is associative:  $6 + (3 + 4) = (6 + 3) + 4$

**Subtraction**

Subtraction is NOT commutative or associative:  $12 - 8 \neq 8 - 12$

When you subtract, the order must stay the same.

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**Written Methods for Multiplication**

LONG MULTIPLICATION

GRID METHOD

GELOSLA

REPEATED ADDITION

**Calculations with Directed Numbers**

**Addition**  
 $2 + 3 = 5$

**Subtraction**  
 $2 - 3 = -1$

**Generalisation**  
 $2 + 3 = -1$

**Multiplication**  
 $2 \times 3 = 6$

**Division**  
 $2 \times -3 = -6$

**Generalisation**  
Eg  $6 + -3 = -3$   
 $-6 + 2 = -4$

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**Written Methods for Division**

SHORT DIVISION

SHORT DIVISION with remainder

LONG DIVISION

**Order of Operations**

**Example 1**  
 $(4 \times 7) \div 3$   
So we need to evaluate the brackets first:  $4 \times 7 = 28$   
This is now  $28 \div 3 = 9 \frac{2}{3}$

**Example 2**  
 $4 - 8 \times 2 \div 12 = 4$   
So we need to evaluate the brackets first and we work left to right:  $6 \div 4 = 3 \cdot 7$   
This is now  $7 \times 4 = 49 \times 4 = 196$

**Example 3**  
 $4 - 8 \times 2 \div 12 = 4$   
So first we do the multiplication/division left to right:  $4 - 16 \div 3 = 7$   
Now we do the addition/subtraction from left to right:  $-12 \div 3 = -4$

## Factorising

**Key Ideas**

**Main Notes**

The inverse of expanding brackets. You take an expression and you 'factor' (divide) out common terms. This creates a set of brackets containing your simplified expression with your factored terms outside. Use of the Ladder method is very effective at removing common factors in a 'step by step' fashion.

**Ladder Method**

- Start by factoring numbers out first if all letters in one big step or little steps!
- Then factor out the letters (paying particular attention to  $^2$  and  $^3$  etc.)
- The expression at the bottom of the ladder goes into brackets. Simplify the factored terms on the left side to create the term that sits outside of the brackets.

**Ladder Method**

$\begin{array}{r} 2 \quad   \quad 16y - 32 \\ 2 \quad   \quad 8y - 16 \\ 2 \quad   \quad 4y - 8 \\ 2 \quad   \quad 2y - 4 \\ \hline y - 2 \end{array}$	$\begin{array}{r} 4 \quad   \quad 16y - 32 \\ 4 \quad   \quad 4y - 8 \\ \hline y - 2 \end{array}$	$\begin{array}{r} 16 \quad   \quad 16y - 32 \\ \hline y - 2 \end{array}$
$= 2^4(y - 2)$	$= 4(y - 2)$	$= 16(y - 2)$

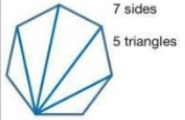
Little steps or larger steps will get you the same result! Do what you feel comfortable with.

**What would a Knowledge Organiser look like for your class this term? Work with a partner and develop an Organiser.**

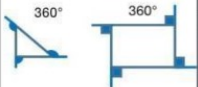
# Geometry Knowledge Organizer

## 5H Angles and Trigonometry 5a Polygons, angles and parallel lines

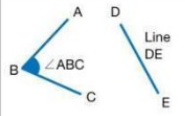
### Important ideas

 7 sides  
5 triangles

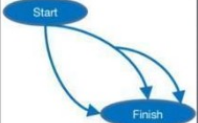
The **sum of the interior angles** in a **polygon** can be calculated by thinking about the **number of triangles** that can fit inside the polygon. This is always **2 less than the number of sides**

 360°

It doesn't matter how many sides a polygon has, the **exterior angles always add up to 360°**. If you cut them out, they would form a whole turn

 A D  
B C Line DE  
E

When solving angle fact problems you must use **three-letter angle notation**, **two-letter line notation** and **state every angle fact** you use to tell the 'logical story' of how you solved the problem

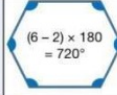
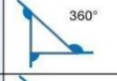
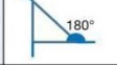
 Start → Finish

Sometimes there is **more than one way** to solve an angle fact problem. It doesn't matter which approach you use so long as it is **mathematically correct** and you **state all the angle facts** you use

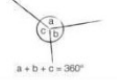
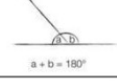
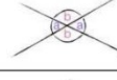
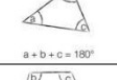

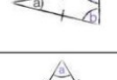
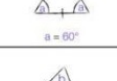
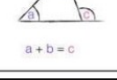
### Important vocabulary

<b>Polygon</b>	A <b>2D shape</b> made from <b>3 straight sides</b> or more
<b>Regular polygon</b>	A <b>polygon</b> with <b>all sides equal</b> in length and <b>all interior angles equal</b> in size
<b>Isosceles triangle</b>	A triangle with <b>two equal length sides</b> . The two <b>base angles</b> are equal in size
<b>Equilateral triangle</b>	A triangle with <b>three equal length sides</b> . The <b>three interior angles</b> are equal in size
<b>Interior angle</b>	An angle between <b>two adjacent sides</b> inside a <b>polygon</b>
<b>Exterior angle</b>	An angle between a <b>side of a polygon</b> and an <b>adjacent side extended outward</b>
<b>Parallel</b>	<b>Lines</b> that have the <b>same distance continuously</b> between them. They <b>never intersect</b>

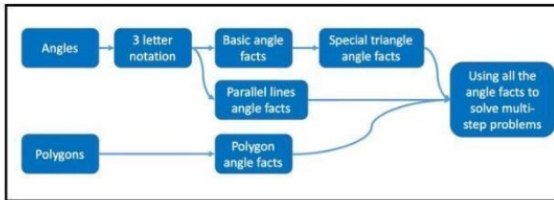
### Key facts to memorise- polygon angle facts

Polygon names		Polygon angle facts	
3 sides	Triangle	Sum of interior angles in a polygon with n sides = $(n - 2) \times 180$	
4 sides	Quadrilateral	Sum of exterior angles in a polygon = 360°	
5 sides	Pentagon	Interior angle + exterior angle = 180°	
6 sides	Hexagon		
7 sides	Heptagon		
8 sides	Octagon		
9 sides	Nonagon		
10 sides	Decagon		

### Key facts to memorise- basic angle facts

Basic angle facts	
Angles around a point add up to 360°	 $a + b + c = 360^\circ$
Angles on a straight line add up to 180°	 $a + b = 180^\circ$
Vertically opposite angles are equal	
Angles in a triangle add up to 180°	 $a + b + c = 180^\circ$
Angles in a quadrilateral add up to 360°	 $a + b + c + d = 360^\circ$
Base angles in an isosceles triangle are equal	
Angles in an equilateral triangle are all 60°	 $a = 60^\circ$
The exterior angle of a triangle is equal to the sum of the two opposite interior angles	 $a + b = c$

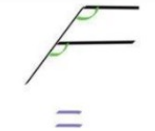
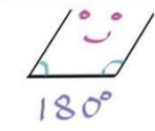

### Learning objectives knowledge structure



### Historical importance

300 BC	Greek mathematician <b>Euclid</b> writes a collection of 13 books called <b>The Elements</b> . These introduce and <b>prove angle facts</b> and important ideas in <b>number theory</b> . Starting from just <b>7 basic assumptions (axioms)</b> , Euclid proved all the angle facts we still use today. Most mathematicians say <b>The Elements</b> is the <b>most important</b> maths book ever written. It introduced the idea of using <b>logic to prove theorems</b> in maths.
250 BC	<b>Archimedes</b> used <b>Pythagoras' Theorem</b> in polygons to find <b>upper</b> and <b>lower bounds</b> for the value of Pi. He first imagined a circle <b>inscribed</b> by a <b>regular polygon</b> (vertices touching the circumference of the circle). He then imagined the same circle <b>circumscribed</b> by a <b>regular polygon</b> (midpoints of sides touching the circumference of the circle). By calculating the <b>areas</b> of the <b>polygons</b> and knowing the <b>area</b> of the <b>circle</b> was between these values he could find <b>upper</b> and <b>lower bounds</b> for the value of Pi.

### Key facts to memorise- angles in parallel facts

Angles in parallel lines facts		
		
Corresponding angles are equal	Co-interior angles add up to 180°	Alternate angles are equal