THE DUSTON SCHOOL
Knowledge itself is power

Year 10 Maths Foundation Knowledge Booklet Term 1

Name:

Class:

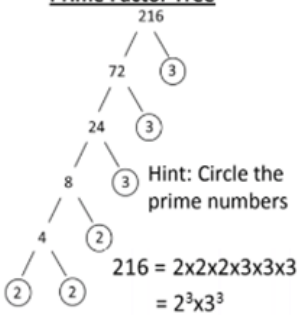
Order	Unit	Links	Pre-requisite skills
1	Integers, powers & roots		
2	Lines, angles & shape		
3	Simplifying & substituting	Unit 1	Using powers, listing factors, understanding product / sum.
4	Area and perimeter	Unit 2	Forming expressions for area/perimeter algebraically through use of brackets, correct notation and simplifying expressions.
5	Calculations & Accuracy	Unit 1	Understanding numbers.
6	Construction and LOCI	Unit 2	Measuring angles for bearings, parallel line angle facts.
7	FDP	Unit 1	Using powers, understanding lowest common multiples.
8	Sequences, functions and graphs	Unit 3/5	Substituting into a function applying BIDMAS to calculate coordinates, factorising for roots of quadratics, understanding powers and all 4 operations with negatives.
9	Ratio & Proportion	Unit 1/7	Decimals/powers as multipliers, calculating/understanding fractions as parts.
10	Transformations	Unit 2/8	Identifying 90/180/270 degrees, plotting mirror lines of basic functions.
11	Pythagoras and Trigonometry	Unit 1/2/3/4/5	Powers/surds, types of triangles, use in area/perimeter problems to find required lengths, rounding answers.
12	Forming and solving	Unit 3/4	Properties of 2d shapes, angle facts including polygons & parallel lines, algebraic notation and simplifying, forming expressions.
13	Measures	Unit 1/7	Calculating, multiplying decimals and powers of 10 for metric conversions.
14	Volume and Surface area	Unit 4/5/13	Area of 2d shapes, rounding/calculating with bounds, conversion of units (length/area/volume), calculating missing sides using pythagoras/ trigonometry.
15	Probability	Unit 1/7	Types of numbers, calculating with fractions & decimals.
16	Inequalities	Unit 12/8/5/7	Solving equations, rounding, plotting graphs for regions, calculating with fractions.
17	Statistics	Unit 1/6/9/16	Using a protractor for pie charts, proportion to calculate angles for a pie chart, use of inequality symbols for recording data.

Homework 1 Due	
Homework 2 Due	
Homework 3 Due	

Overview	**Learning Objective**	
Topic: Integers, Powers and Roots **Big Questions** - Which has the greatest value $(2^3)^4$ or $(2^4)^3$? - List all the factors of m^2n^2p - Who might use standard form in their jobs? - What's the same and what's different about 3×10^6 and 3×10^{-6}?	- Calculate HCF and LCM of pairs of numbers. - Know that anything to the power of 0 is 1. - Know and use the index laws for multiplication and division of positive integer indices.	-Convert from ordinary to standard form. Both positive & negative powers. - Convert from Standard form to ordinary numbers. - Know that $(a^b)^c = a^{bc}$
Topic: Lines, angles and shapes **Big Questions** - A square and a regular hexagon tessellate with another regular shape. How many sides does this shape have? - Why do exterior angles always add up to 360^o? - What is the correct name for an F angle?	- Use angle facts to solve problems involving triangles. - Use angle facts to solve quadrilateral problems. -Circle definitions. - Calculate interior and exterior angles of a regular polygon. - Solve problems involving corresponding, alternate and supplementary angles.	- Recognise tangents, arcs, sectors and segments of circles.
Topic: Simplifying and substituting **Big Questions** - What's the same/different - 6y+3y and 3(2y+y) and 9y - List all the factors of 24 / 13 / 60 - Show that $a^2b^2 - 16x^4$ is the difference of to squares.	- Substitute numbers into an expression. - Substitute numbers into a formula and more complicated formula. - Substitute numbers into more complicated formula. - Expand single brackets.	-Expand and simplify. - Expand quadratics. - Interpret basic functions. (f(5)) - Factorise single brackets.

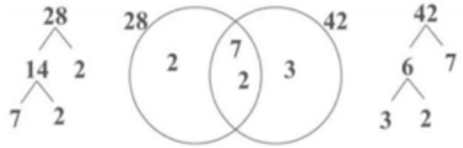
INTEGERS, POWERS & ROOTS KNOWLEDGE ORGANISER

Prime Factor Tree



Lowest Common Multiple and Highest Common Factor

First draw a PFT and then place in the venn diagram.



HCF: Multiply the middle numbers

LCM: Multiply all the numbers

Integers

"Integer" is just a posh word for whole number.

The thing to remember is that integers can be positive or negative.

So: 1, 7, 298, -3, 0 and -49 are all integers, but 2.5 is not and neither is $3\frac{5}{8}$!

Multiples

The Multiples of a number are all the numbers in your number's times table.

Don't forget: you must count the number itself!

e.g. Some multiples of 7 are: 7, 14, 21, 28... but there are loads more, like 700 and 4445

Factors

The Factors of a number are all integers that divide into your number exactly (there must not be a remainder!)

Don't forget: 1 is a factor of all numbers, and so is the number itself!

e.g. The factors of 12 are: 1, 2, 3, 4, 6 and 12

Common

Shared by two or more things.

Prime Number	A positive integer greater than 1 that can only be divided by itself and 1 without leaving a remainder.	7, 23, and 67 are examples. 1 is **not** a prime number.
Base	The big number on the left; the number that will be multiplied by itself.	5 is the base in 5^3
Index	The small number on the top-right; the number of times a value is multiplied by itself.	3 is the index in 5^3
Power of exponent	Another word for index.	3 to the power of 2 = 3^2
Indices	Plural of index	
Reciprocal	The reciprocal of a number is one divided by that number	The reciprocal of 4 is $\frac{1}{4}$ which is equal to 0.25

Remember

$a^2 + a^2 = 2a^2$ **BUT** $a^2 \times a^2 = a^4$

Steps to estimate a square root	1: Identify the **square on either side**. 2: Place the squares and their roots at **either end of a blank line.** 3: Identify the **halfway** point. 4: **Place** your number on the line. 5: **Estimate** its position. 6: **Square** your answer to check.

	Rule	Example
1	$x^1 = x$	$5^1 = 5$
2	$x^0 = 1$	$5^0 = 1$
3	$x^n \times x^m = x^{n+m}$	$x^2 \times x^3 = x^{2+3} = x^5$
4	$x^n \div x^m = x^{n-m}$	$x^5 \div x^2 = x^{5-2} = x^3$
5	$(x^n)^m = x^{n \times m}$	$(x^3)^2 = x^{3 \times 2} = x^6$

Standard Form

A number in standard form must be written in this way.

A number between 1 and 10 × A power of 10

2×10^{15} and 1.5×10^{-12}

Going from standard form to ordinary numbers

5×10^{10} = 50 000 000 000

0.0006 = 6×10^{-4}

7.1×10^6 = 7 100 000

0.00000072 = 7.2×10^{-7}

Look at the power: positive the number will get bigger, if negative the number will be smaller.

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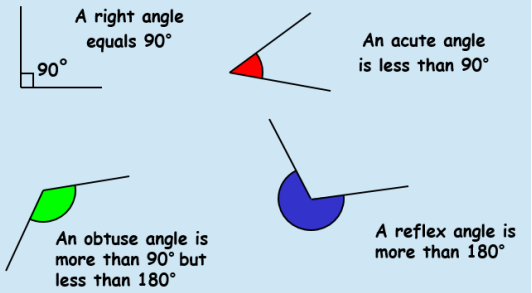
Knowledge Recall **Term 1 HW: 1**

Date Due_____ **Score to beat**_____

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Which is bigger: $\frac{3}{7}$ or $\frac{2}{5}$?		11. Expand: 3(x + 5)		21. Work out the area of a parallelogram of base 6cm and height 8cm.	
2. Which is bigger: 0.45 or $\frac{2}{5}$?		12. Factorise: 3x + 9			
3. Increase £30 by 15%		13. Solve: 2(x – 5) = 7		22. Three of the angles of a quadrilateral are 120°, 48° and 92°. What is the size of the 4th angle?	
4. Decrease £40 by 15%		14. Solve: 3x + 1 = 2x + 10			
5. Write 4 : 8 in form 1: n		15. Find the 10th term 1 3 5 7 9 ...		23. Work out the area of a triangle of base 6cm and height 8cm.	
6. 10 pens cost £2.50 Find the cost of 7pens		16. If T(n) = 3n – 1, what is the 3rd term?			
7. Estimate: 32 x 43		17. If y=3x + 2, find the value of y when x = -2		24. If the probability of rain is 0.87, what is the probability of NO rain?	
8. If 36 x 47 = 1692 What is 3.6 x 47?		18. If y= -3x - 2, find the value of y when x = 2			
9. Add: $\frac{1}{3}$ and $\frac{1}{4}$		***Use π = 3*** 19. Calculate the area of a circle with radius of 5cm		25. Work out the volume of a cuboid 5cm by 3cm by 6cm?	
10. Work out: $\frac{2}{5}$ of 8		***Use π = 3*** 20. Calculate the length of the circumference of a circle with diameter of 6cm			
Total (A)		Total (B)		Total (C)	
Test Total (A+B+C)		R (0-9)	Y (10-19)	G (20-25)	

LINES, ANGLES AND SHAPES KNOWLEDGE ORGANISER

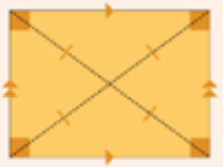
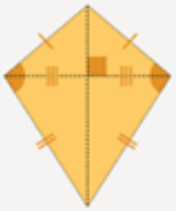
Types of Angles

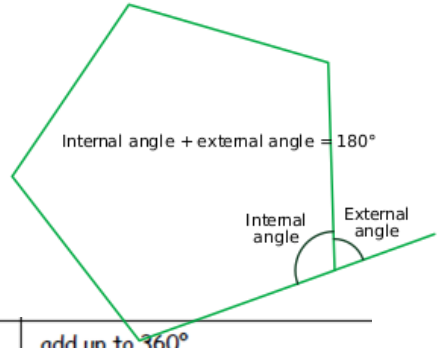


Angle Facts

Angles on a straight line **sum to 180°**	
Opposite angles are **equal**	
Angles round a point **sum to 360°**	
Alternate angles are **equal**	
Corresponding angles are **equal**	
Co-interior angles **sum to 180°**	

Circumference	The distance around the edge of the circle
Radius	The distance from the centre of the circle to the edge of the circle
Diameter	The distance across the circle from edge to edge, going through the centre
Tangent	A straight line that touches the circle

Quadrilateral	Properties
Square 	• A square is a regular quadrilateral. • All angles are equal (90°). • All sides are of equal length. • Opposite sides are parallel. • The diagonals bisect each other at 90°. • The diagonals are equal in length.
Rhombus 	• Diagonally opposite angles are equal. • All sides are of equal lengths. • Opposite sides are parallel. • The diagonals bisect each other at 90°.
Rectangle 	• All angles are equal (90°). • Opposite sides are of equal length. • The diagonals are equal in length.
Parallelogram 	• Diagonally opposite angles are equal. • Opposite sides are of equal length. • Opposite sides are parallel. • The diagonals bisect each other.
Trapezium 	• One pair of opposite sides is parallel.
Kite 	• Two pairs of sides are of equal length. • One pair of diagonally opposite angles is equal. • Only one diagonal is bisected by the other. • The diagonals cross at 90°.



Exterior angles of a polygon	add up to 360°
The interior and exterior angle of any polygon	add up to 180°
The sum of the interior angles of a polygon can be found by using the formula	**(number of sides-2) x 180°**
Regular polygons have all sides the same length and all angles the same size	

Number of Sides	Name of Polygon	Picture of Polygon	Interior angle of a regular polygon	Sum of the interior Angles	Number of Triangles
3	Triangle		60°	180°	1
4	Quadrilateral		90°	360°	2
5	Pentagon		108°	540°	3
6	Hexagon		120°	720°	4
7	Heptagon		128.6°	900°	5
8	Octagon		135°	1080°	6
9	Nonagon		140°	1260°	7
10	Decagon		144°	1440°	8

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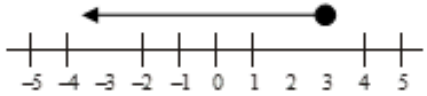
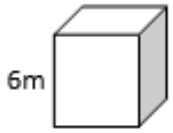
Knowledge Recall **Term 1 HW: 2**

Date Due_____ **Score to beat**_____

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Which is bigger: $\frac{3}{4}$ or $\frac{2}{3}$?		11. Factorise: 5x + 20		21. Work out the area of a parallelogram of base 10cm and height 4cm.	
2. Increase £60 by 15%		12. Solve: 3x + 5 = 14			
3. 10 pens cost £4.00 Find the cost of 7pens		13. If T(n) = 4n – 1, what is the 3rd term?		22. Three of the angles of a quadrilateral are 53°, 127° and 72°. What is the size of the 4th angle?	
4. Estimate: 69 x 33		14. If y=3x + 2, find the value of y when x = -3			
5. Work out: $\frac{2}{3}$ of 8		***Use π on the calculator*** 15. Calculate the area of a circle with radius of 2cm (1dp)		23. A car travels at a steady speed and takes 5 hours to travel 510 miles. Work out the average speed?	
6. To decrease an amount by 3%, what single multiplier would you use?		16. Expand & simplify: 4(x + 5) – 2(x – 3)			
7. Decrease 42kg by 3%		17. Give the inequality 		24. If the relative frequency of getting a 'six' on a dice is 0.3, how many sixes would you expect to get in 400 throws of the dice?	
8. Without a calculator work out: 0.7 x 0.1		18. Work out the value of: 3x + 2y When x = 4 and y = -5			
9. Round off 4252 to one significant figure		19. Write down the next term in this sequence: 3 8 15 24 ...		25. Work out the volume of this cube? 	
10. Use a calculator to work out: $2.7^2 + 3.9^2$		20. If $y = x^3 + 3$, find the value of y when x = -1			
Total (A)		Total (B)		Total (C)	
Test Total (A+B+C)		R (0-9)	Y (10-19)	G (20-25)	

SIMPLIFYING AND SUBSTITUTION KNOWLEDGE ORGANISER

HOW SHOULD WE WRITE THIS?

4 more than p	= p + 4
6 less than g	= g - 6
y x y x y	= y^3
y + y + y + y	= 4y
1 x r	= r
b x a	= ba = ab
p ÷ 3	= $\frac{p}{3}$
p ÷ q	= $\frac{p}{q}$

Expression: A collection of terms. *(Simplified)*

Equation: Expressions that equal one another. *(Solved)* (An inequality is a special ≠ equation)

Identity: An equation that is true for all values *(Show)* of the variables.

Formula: An identity seen as a general rule. *(Subject)*

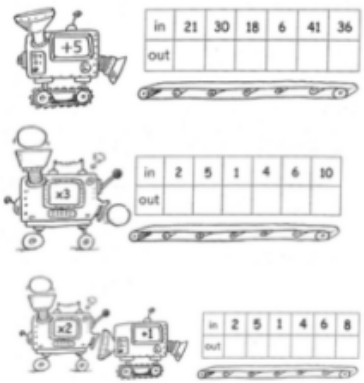
Function: An expression for which inputs *(Substitute)* are used to generate outputs from inputs.

Constants are numbers that stand on their own. They will not have an "x", "y", "z", or any other variable attached to them. They can be small numbers, like "7", or big numbers, like "23 849".

Variables are symbols that stand for numbers that vary. A variable is usually written as a letter, such as "x", "y", or "z".

The difference between constants and variables is that the value of a variable can change, while the value of a constant stays the same.

FUNCTION MACHINES



Key Facts - Adding and Subtracting

Consider the family meal below.

We need to **group the *same items*** together, so when we order through the drive-through its simple.

3b + f + 5c + 3b + s + 2f + m + 2m + mf + c + s + 2b

This would be a **mouthful** to say into the microphone when ordering ... so lets group all the same items together.

3b + 2b + 3b = **8 burgers**
s + s = **2 salads**
5c + c = **6 cokes**
f + 2f = **3 fries**
m + 2m = **3 milkshakes**
1 McFlurry

If the coefficient is 1 we don't write it.

8b +2s +6c +3f + 3m + mf

Key Facts - Multiplying

5  x 2 = 10 

5b x 2c = 10bc ✓

3  x 7  = 21 

3pl x 7c = 21plc ✓

SUBSTITUTION

SUBSTITUTION means putting numbers where the letters are.

$x + \frac{x}{2}$

$x = 5 \rightarrow 5 + \frac{5}{2}$

EXPANDING

EXPANDING means multiplying all terms together and simplifying.

Single brackets

$3(a + 4) = 3$

	a	+4
3	3a	+12

means: "3 times (a + 4)" = 3a + 12

Double brackets

$(a + 2)(a + 3) =$

	a	+2
a	a^2	+2a
+3	+3a	+6

means: "(a + 2) times (a + 3)" = $a^2 + 5a + 6$

Multiple binomials - using a grid.

Example of expanding more than two binomials:

$(x + 3)(x - 5)(x + 4)$

First two brackets expand to $x^2 + 3x - 5x - 15 = x^2 - 2x - 15$

$\rightarrow (x^2 - 2x - 15)(x + 4)$

We now must multiply everything in the left hand bracket by x and then by 4

$\rightarrow x^3 - 2x^2 - 15x + 4x^2 - 8x - 60 = x^3 + 2x^2 - 23x - 60$

If you have three binomials times together, you will end up with a cubic expression, 4 will make a *quartic* expression and so on.

Multiply $(x^2 - 2x - 15)$ by $(x + 4)$

	x^2	-2x	-15
x	x^3	$-2x^2$	-15x
+4	$+4x^2$	-8x	-60

$(x + 3)(x - 5)(x + 4) = x^3 - 2x^2 - 23x - 60$

FACTORISING

FACTORISING means find highest common factors, (numbers, letters or both), in all terms and put back into brackets.

How to Factorise a Single Bracket

$14y^2 + 21y$

- Find the highest common factor of 14 and 21
- 7 is the highest common factor
- y is the common factor letter
- Factorise... $14y^2 \div 7y$ and $21y \div 7y$

$7y(2y + 3)$

How to Factorise a Quadratic Equation

A)
How to factorise when the coefficient of x^2 is = 1

$x^2 + 8x + 15$

- Find the **factors** of 15 which sum to 8.
- Factors of 15 are:
- 1, 15, 3, 5
- Only 3 and 5 **sum** to 8 and multiply to give 15

3 + 5 = 8
3 x 5 = 15

$(x + 3)(x + 5)$

Difference of Squares

$4a^4 - 9b^4$

$\sqrt{4(a^4)} - \sqrt{9(b^4)}$

$2a^{\frac{4}{2}} - 3b^{\frac{4}{2}}$

$(2a^2 + 3b^2)(2a^2 - 3b^2)$

$25v^4 - 16u^4$

$\sqrt{25(v^4)} - \sqrt{16(u^4)}$

$5v^{\frac{4}{2}} - 4u^{\frac{4}{2}}$

$(5v^2 + 4u^2)(5v^2 - 4u^2)$

FUNCTION

Function $f(x)$ or $x \rightarrow$ or $y =$	A function is a special relationship where each input has a single output.
$f(x) = x^2$ (function name; input; what to output)	It is often written as "f(x)" where x is the input value.

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Knowledge Recall **Term 1 HW: 3**

Date Due_____ **Score to beat**_____

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Which is bigger: $\frac{3}{4}$ or $\frac{4}{5}$?		11. Expand: x(x - 1)		21. Work out the area of a parallelogram of base 7cm and height 3cm.	
2. Which is bigger: 0.3 or $\frac{1}{3}$?		12. Factorise: 8x + 12			
3. Increase £60 by 10%		13. Solve: 2(x – 1) = 10		22. Three of the angles of a quadrilateral are 148^0, 104^0 and 36^0. What is the size of the 4^{th} angle?	
4. Decrease £40 by 10%		14. Solve: 3x + 17 = 2x + 14			
5. Write 4 : 2 in form 1: n		15. Find the 10th term 3 7 11 15 19 ...		23. Work out the area of a triangle of base 9cm and height 4cm.	
6. 10 pens cost £6.50 Find the cost of 4pens		16. If T(n) = 2n + 3, what is the 3^{rd} term?			
7. Estimate: 355 x 21		17. If y=2x - 3, find the value of y when x = 2		24. If the probability of rain is 0.03, what is the probability of NO rain?	
8. If 62 x 38 = 2356 What is 6.2 x 3.8		18. If y=2x - 3, find the value of y when x = -2			
9. Work out: $\frac{4}{5} - \frac{1}{2}$		***Use π = 3*** 19. Calculate the area of a circle with radius of 4cm		25. Work out the volume of a cuboid 6cm by 4cm by 2.5cm?	
10. Work out: $\frac{3}{5}$ of 7		***Use π = 3*** 20. Calculate the length of the circumference of a circle with diameter of 7cm			
Total (A)		Total (B)		Total (C)	
Test Total (A+B+C)		R (0-9)	Y (10-19)	G (20-25)	