Oasis Academy Arena Curriculum Term Plan: Mathematics

Reviewed/Updated 25.06.2018 by Alice Cairns and T. Phuntsok

Title of Scheme of Learning: Prime numbers, factorisation and calculating with fractions

Subject: MATHS
Term: Autumn 1
Year: 8
Length of Unit: 6 weeks

Big Learning Question: What is so special about prime numbers?

Big Assessment outcome? Use prime factor decomposition to find the HCF and LCM; find squares, square roots, cubes and cube roots; add and subtract fractions; multiply and divide fractions

Success Criteria for Big Assessment Outcome:

Unit 1: Prime numbers and factorisation

- Find the factors and multiples of a number
- Find prime numbers
- Find the prime factors of a number
- Determine HCF by prime factorisation
- Determine LCM by prime factorisation
- Find squares, square roots, cubes and cube roots using prime factorisation
- Use indices to record repeated multiplication
- Calculate, with the use of a calculator, including squares, cubes, roots and cube roots

Unit 2 and 3: Calculating with fractions

- Use equivalent fractions
- Add and subtract fractions with like denominators
- Add and subtract fractions with unlike denominators
- Add and subtract fractions, mixed numbers and improper fractions
- Convert between improper fractions and mixed numbers
- Add and subtract fractions, mixed numbers and improper fractions
- Multiply and divide fractions
- Calculate with decimals

Use and apply

Develop fluency

- select and use appropriate calculation strategies to solve increasingly complex problems
- move freely between different numerical and diagrammatic representations
- use language and properties precisely to analyse numbers

Reason mathematically

- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in number
- interpret when the structure of a numerical problem requires additive reasoning

Solve problems

- develop mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems

select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

Lesson	Learning Objective	Learning Outcomes	Planned Questions	Do Now	Main	Plenary	Differentiation	Mastery Skill (exit ticket)	Homework
Unit 1 – prime numbers **Framed work: Weekly review check- up (week 1 – peer assessed and week 2 teacher assessed – followed by mad time student responses)**									
1.1	**Find** the factors of a number	• Find the factors of a number • Find common factors	• What is a factor? • What are common factors? • How many factors does one have? • What type of number always has two as a factor? • What type of number has an odd number of factors? • How can you disprove the statement?	Find the factors of…	Talk task: roll the die and find the factors of the number Independent task: "every multiple of six has more factors than the two numbers either side of it" – how can you prove/disprove this theory?	Find a number with only 3 factors	Use factor bugs to ensure pupils find all factors and see them as pairs Find an example greater than 100 when the statement is true and when it is false Find common factors	1.1 I can find all the factors of numbers up to 144	
1.2	**Identify** prime numbers and recognise the properties of prime numbers	• Identify prime numbers • Know the properties of prime numbers • Find multiples of a number	• What is a factor? • What is a multiple? • How many factors do the unshaded numbers have? • Which numbers greater than 100 have the same number properties? • What kinds of numbers are these? • Which prime numbers other than two are even? Why? • Why is one not a prime number? • Can you make a square without using any blank tiles? • Does it change when you use eight tiles rather than six tiles? • Why is 135 not a prime number?	Find the factors of…	Talk task: http://nrich.maths.org/1200 Using 6 dominos, make a square where the sum of the dots is always a prime number Independent task: make 3 digit numbers using 1, 3 and 5. Every integer > 2 can be written as the sum of two primes.		Use less dominos. Identify the prime numbers first up to 20 and ask pupils to select dominos that sum to those primes Make a domino square using 8 tiles	1.2 I can identify prime numbers and their properties	
1.3	**Investigate** the multiples of a number	• Find the multiples of a number • Know the properties of numbers • Categorise numbers according to their properties	• What is a multiple? • What is the difference between a factor and a multiple? • Can you fill the grid without repeating any numbers? • Can a number be odd and even? • Which are the easiest headings to place?	Complete the sentences with "factor" or "multiple"	Talk task: http://nrich.maths.org/5448 - place headings and numbers into the grid according to their properties	Create own "who am I" using mathematical language	Only use 3 x 3 grid and give example headings. Can use any numbers	1.3 I can find the first 20 multiples of numbers up to 25	

		• Know what odd and even numbers are	• Which will make “impossible” intersections? • What could the headings be here? • Is there more than one solution? • Are multiples of 6 always also multiples of 3? • What other numbers could you substitute in and the puzzle still be correct? • Why are the solutions not unique? • What are the possible solutions?		Independent task: “who am I”?		Restrict numbers to 1-25, use 5 x 5 grid and more headings (include square numbers, triangular numbers) Create own grid – how can you prove it works? What is the most difficult part?		
1.4	**Identify** the prime factors of a number	Find the prime factors of a number	• What do you notice about the factor trees? • Which method do you prefer? • Is there a link between how many digits a number has and how many factor trees can be made?	Fill in a number pattern grid and identify the prime numbers	Model prime factor decomposition. Students complete prime factor decomposition of given numbers	How many different factor trees can you draw for the number 66?	Highlight the misconception that you do not need to always divide the number by two. Consistently recap which numbers are prime. Introduce questions such as find the prime factors of 132^2.	1.4 I can identify the prime factors of a number	
1.5	**Express** a number as a product of prime factorisation	Write the prime factors of a number as a product of prime factorisation	• What is a square number? • What is a cube number? • Why are they called square and cube numbers? • What is the square root? • What is the cube root? • How do we simplify tis expression?	Prime number Sudoku	Students sort diagrams of square cube and square roots numbers into relevant columns to reinforce this concept. Students are then given prime factors of some numbers and asked to calculate the number.	Manga high quiz. https://www.mangahigh.com/en-gb/maths_games/number/factors_multiples_and_primes/product_of_prime_factors	Scaffold by providing factor tree diagrams to fill in. Allow students to create their own method and success criteria for correct prime factor decomposition.	1.5 I can use prime factor decomposition to find the prime factors of any number up to 250	
1.6	**Apply** prime factor decomposition to finding the HCF of two integers	• Find the prime fcators of a integer by using a prime factor tree and venn diagram	• What is meant by common? • What is a factor? • How do we use a Venn diagram? • What is a prime number? • How can finding the HCF be useful? • How is it different from LCM?	Simplifying expressions using indices.	Model prime factor decomposition using a factor trees and a Venn diagram. Present students with pairs of	HCF catch phrase.	Restrict numbers to below 60.	1.6 I can find the HCF of two integers	

		• Determine the HCF of two numbers using factor tree and venn diagram			numbers to find the HCF.		Present students with a triad of numbers to calculate HCF. Challenge students to explain how the method works.		
1.7	**Apply** prime factor decomposition to finding the LCM of two integers	Determine the LCM of two integers using factor tree and venn diagram	• What is a multiple? • How is a multiple different from a factor? • Is a multiple always larger than a factor? • Can factors and multiples be the same? • What is meant by common? • How can finding the LCM e useful?	Put numbers in a two-way table with given constraints e.g. 'even', 'prime', 'factor'.	Model calculating LCM using prime factor decomposition and a Venn Diagram. Students complete a matching grid where they need to find the HCF and LCM.	Worded problems using the LCM.	Restrict to only find LCM. Give students LCM they must find the two numbers.	1.7 I can find the LCM of two integers	
1.8	**Apply** prime factor decomposition to find squares, square roots, cubes and cube roots	Find squares, square roots, cubes and cube roots using prime factorisation	• What is a square number? • What is a cube number? • What is a square root? • What is a cube root? • What notation do we use?	Addition and subtraction of square and cube numbers.	Present students with the prime factors of square numbers and ask them to find a pattern. Then present students with a grid of number some square/cube/not and ask them to use the rule to calculate whether the number is square/cube/not.	Circle the square numbers and cube numbers.	Restrict numbers to below 144 and square numbers. http://nrich.maths.org/871 Extension- Proof using algebra	1.8a I can find squares and square roots 1.8b I can find cube and cube roots	
1.9	**Compare** size of numbers written as indices	Use indices to record repeated multiplication	• Which number is greater? • Which number is smaller? • What is a square number? • How can you write f) using 100 x 100 etc… What would its power be? • Which number is equivalent to 100?	Simplify expressions using indices.	Students arrange indices cards in ascending order citing their justification for their decisions.	True/False, which number is bigger? The integers a,	Reinforce multiplication using bar models and basic number facts. Recap written multiplication for higher numbers e.g. 5 x 5 x 5.	1.9 I can use indices to record repeated multiplication	

			• Which is equivalent to 125? • Is there a quick way of working out 2^7? How many square numbers are there?			b and c are all different and $a^2 + b^2 + c^2 = 121$. What is the value of a + b + c?	How many positive integers n exist for which n^2 has the same number of digits as n^3		
Unit 2 – adding and subtracting fractions									
2.1	**Recognise** and **identify** equivalent fractions	• Know what equivalent fractions are • Recognise equivalent fractions • Find equivalent fractions	• What does equivalent mean? • What is the same about these fractions? What is different? • Can you find an equivalent fraction? • How many halves in a whole? • How many quarters in a whole?	Write two things that are the same and two things that are different about these fractions. Can you represent these in a different way?	American notes- How can you make a whole note using these notes? What notes could you add to these bars to ensure that each bar sums to $\frac{15}{16}$?	Write 3 equivalent fractions.	Support students by giving either the denominator or numerator of the equivalent fraction. Is there more than one possible combination? How many combinations can you find?	2.1 I can find equivalent fractions	
2.2	**Compare** and **convert** improper fractions to mixed numbers	• Know the difference between improper and mixed fractions • Convert improper fractions to mixed numbers • Convert mixed numbers to improper fractions	• How do you know it is an improper fraction? • What makes it improper? • What is the numerator? • How many quarters/fifths, etc. do you have? • How many wholes is this? How do you know? •	Find as many improper fractions as you can with these digits…	Present students with decimal numbers and improper fractions. Find the difference between the smallest and biggest number. Find the sum of the three smallest numbers. Leave your answers in fractional form.	What mixed number am I?	Restrict task to positive integers rather than decimals. What mixed number am I? My numerator is one more than my denominator. My numerator is a multiple of 3 and my denominator is a multiple of 4. How many examples are there?	2.2 I can convert improper fractions to mixed numbers	

2.3	**Explain** how to add and subtract fractions with like denominators	• Understand why you can add and subtract fractions with like denominators • Add and subtract fractions with like denominators	• How do you know that this is false? • How can you show that this is false? • Why does the denominator stay the same? • How can you show this is correct?	Adding like denominators using diagrams	Using the musical beats and bar models, investigate which of the following are true. (give a set of fractions) You must be able to give a reason for your answer.	Egyptian fractions- writing given fractions as the sum of unit fractions.	**Using bar models**, compare the pairs of fractions stating which is bigger with an inequality. Use fill in the gaps to support students.	2.3 I can add/subtract fractions (like denominators)	
							Adding and converting improper to mixed numbers.		
2.4	**Investigate** adding fractions with unlike denominators	Add fractions with unlike denominators by finding the LCM	• Why is this different to the do now? • What do you need to do first? • How do you find the LCM? • Why do the denominators need to be the same? • What is the pattern? • Will it carry on forever? • What do you have to change the denominator to?	Addition pyramid- fractions with like denominators.	$\frac{1}{2}+\frac{2}{1}$ $\frac{2}{3}+\frac{3}{2}$ $\frac{3}{4}+\frac{4}{3}$ **Investigate** this sequence of fraction sums. What is the pattern? What would happen if this carried on forever?	Plenary addition and subtraction of fractions.	How many ways can you make 1 whole by adding or subtracting given fractions? Support students by using a fraction wall.	2.4 I can add fractions (unlike denominators)	
							What do you think will happen if you add the squares of these fractions? $\left(\frac{1}{2}\right)^2+\left(\frac{2}{1}\right)^2$ $\left(\frac{2}{3}\right)^2+\left(\frac{3}{2}\right)^2$ $\left(\frac{3}{4}\right)^2+\left(\frac{4}{3}\right)^2$		
2.5	**Investigate** subtracting fractions with unlike denominators	Subtract fractions with unlike denominators by finding the LCM	• Why do you have to put the bigger number first when subtracting? • If the denominators are different, what do you have to do first?	Addition of fractions matching grid.	Yellow cards 1-4 Blue Cards 2-9 Player 1: Pick two cards from the yellow cards and	Spot the mistake	Model examples. Use step-by-step method of finding the LCM and creating equivalent fractions.	2.5 I can subtract fractions (unlike	

					two from the purple cards. Player 2: Put the numerators and denominators in any order. Choose to add or subtract. Work out the answer to the equation. Player 1: Work out how Player 2 got their answer.		Main -Put the numerators and denominators in any of the 3 possible places in the equation. Player 1 must determine the missing numbers.	denominators)	
2.6	**Apply** to adding and subtracting improper fractions	Add and subtract improper fractions	• What is a mixed number? • What is an improper fraction? • How do you convert to an improper fraction? • How do you convert to a mixed number? • Why should we convert mixed numbers to improper fractions for addition and subtraction?	Convert diagrams into improper fractions	Magic square activity where each column/row/diagonal must sum to 5/2	Addition and subtraction of improper fractions.	Create sums for the magic square Do not give students the magic fraction- they must calculate this for themselves.	2.6 I can add and subtract improper fractions	
2.7	**Apply** to adding and subtracting mixed numbers	Add and subtract mixed number fractions	• What is a mixed number? • What is an improper fraction? • How do you convert to an improper fraction? • How do you convert to a mixed number? • Why should we convert mixed numbers to improper fractions for addition and subtraction?	Write fraction diagrams as mixed and improper fractions.	Fraction addition pyramids.	Compare mixed and improper fractions additions- which is the largest?	Use bar models to support students and give them a step-by-step method. Use fraction pyramids with the base bricks missing.	2.7 I can add and subtract mixed numbers	

2.8	**Solve** problems adding and subtracting mixed numbers and improper fractions **Combine** understanding of fractions to solve multi-step problems in context	Solve problems involving adding and subtraction mixed numbers and improper fractions	• What is the key information in this question? • What fractions do we need to use? • Do we need to convert to mixed/improper? • What units do we need to use?	Fill in the missing numbers in fraction addition and subtraction calculations .	Worded fraction problems from MEP.	Students find the perimeters of rectangles with lengths using mixed numbers.	Missing fractions wheel diagram from MEP. Harmonic Triangle problem from enrich.	2.8 I can solve problems with fractions	
Unit 3 – multiplying fractions									
3.1	**Multiply** a fraction by an integer	Be able to multiply a fraction by an integer	• How does the diagram help to explain what has happened here? • How can these all be equivalent to 2/3? • How do you know? • What happens if the numerator is not 1? • What do you do when you multiply a fraction by an integer? • Does this always work? • How do we multiply fractions by integers?	Fill in the boxes to make the expression true.	Give students fractions multiplied by integers. Some of the digits in the multiplications are in the wrong place. The answer is correct. Change the digits in the question to make the correct answer.	Who is correct? Why?	Derive a method from the diagram to help students. Encourage students to find all the different combinations of correct answers.	3.1 I can multiply a fraction by an integer	
3.2	**Know** how to multiply two fractions	Understand the concept of multiplying two fractions	• What is a fraction? • What fraction of the grid is shaded? • What fraction of the shaded part is crossed? • How do you find a fraction of an amount? • What is the same/different about the grids? • What amount is left unshaded? • What is the relationship between the shaded/unshaded parts?	For each grid write, what fraction is shaded and what fraction is crosshatched.	Fraction multiplication grid- Which fractions are equal to a quarter? 	3 fraction multiplications- How are they the same? How are they different?	Use multiplications as examples for students to come up with the abstract rule rather than diagrams.	3.2 I can multiply two fractions	

			• What does 'of' mean in maths? • How do we multiply two fractions? • Does your method work for all fractions? • How can you show this?				Encourage students to derive a rule for multiplication of fractions.		
3.3	**Multiply** mixed numbers by an integer.	Be able to multiply mixed number fractions by an integer	• How do we multiply fractions? • What does the line mean in fractions? • Is the order of multiplication important? • Where would the answers be on a number line? • How could you use estimation? • How can you express an integer in fraction form? • What does a single bar represent? • How does the model represent the answer? • What is an improper fraction? • How can we convert to mixed numbers? • Why would we convert to mixed numbers? • Where are the mistakes? • How can you tell if this is correct or not? • Can you multiply fractions in more than one way? Why?	Using the digits 1-6, how many fraction multiplications, can you create with an answer between 1 and 2?	Present students with one side length is regular shapes as a mixed fraction and as them to find the perimeter.	Spot the mistake	Use bar models to multiply mixed numbers by integers. If monkey B had half as many bananas as monkey C, what fraction of the original 12 bananas would he have? What about if he had half as many as monkey D?	3.3 I can multiply mixed numbers by an integer.	
3.4	**Multiply** mixed numbers.	Be able to multiply mixed number fractions	• What is area? • Why is multiplication relevant to area? • How do you find the area of a rectangle? • How do you know the lengths of the other sides? • How are these shapes the same/different? • How can you find the side length given the area? • How does this grid represent the area? • What does each square represent? • How do we determine the value of the length of each square? • How is the length different to the area? • What is fraction simplification? • How/why do we simplify fractions?	Calculate area of rectangles with side lengths given as mixed numbers	Find five different rectangles that have an area greater than $6m^2$ and less than $7m^2$. Try to get as close to $7m^2$ as possible.	Put the rectangles in order of size.	Use multilink cubes to build an area model showing the multiplication of fractions. How would the measurements change if you wanted to get the same area, but have a triangular platform?	3.4 I can multiply mixed numbers.	

3.5	**Divide** an integer by a fraction	Be able to divide an integer by a fraction	• How do we multiply a fraction by an integer? • What does multiplication mean? • What is the inverse of multiplication? • How could I write this multiplication differently (order/division)? • What does division mean? • How could I write this division as a multiplication? • What does this bar model represent? • How can we compare the size of fractions? • Is the answer to a division always smaller than the number being divided? • When is it smaller? When is it bigger?	Multiplication of fraction by integer.	Draw bar models to represent the following divisions. Use these models to determine the answers and put them in **descending** order.	True or False? Ally says: "dividing one number by another always gives a smaller answer than the original number"	Model how to draw bar models for each division. Which is the odd one out? Why?	3.5 I can divide a fraction by an integer	
3.6	**Divide** two unit fractions	• Understand the concept of dividing fractions • Be able to divide two unit fractions	• What fractions could you represent with this model? Why? • What is the lowest common multiple? • What is a common denominator? • What do you notice about the divisions? • Is this true for all fractions? • How can we prove this?	Spot the mistakes- divisions of fractions by an integer.	Using your models, investigate what happens when you divide the following fractions. (All unit fractions).	Mixture of questions with unit fractions and integer divisions.	KFC KEEP-FLIP-CHANGE Is there another way that this division could be represented? Which is the most efficient way? Why?	3.6 I can divide unit fractions	
3.7	**Divide** any fraction by another.	Be able to divide any fractions by another fraction	• What does this model represent? • What does each square represent? • How does the value of each square change as the division changes? • Is there a more efficient model to use? Why? • How are these the same/different?	Which of the following could this division model represent?	Group these divisions in any way you like. Your reason <u>must</u> be mathematical.	True/ false using algebraic models of multiplication and		3.7 I can divide two fractions	

			• What processes are being applied here? • How could you explain fraction division to someone? • How could you model fraction division for someone? • What is an improper fraction? • What is a mixed number? • Where would these be placed on a number line? How do you know?	What is the value of each square?		division of fractions.	By putting numbers into the following, how close to zero can you get? a/b ÷ c/d		

Curriculum Links to Oasis 9 habits Values:

Students are encouraged to interact with **patience** towards one another' s contributions in class and support and help each other where appropriate. They are encouraged to be **compassionate** towards other student' s efforts and contributions; supporting and celebrating where appropriate exercising **consideration** where others may find something more challenging than they do. Students are encouraged to see the **joy** that can be taken in mathematics and that it can be studied for the pleasure of it. Students are encouraged to understand that resilience is developed through **self-control** of ones reaction to challenging situations (including work one finds difficult. Students are encouraged to demonstrate **self-control** in terms of their interactions within the classroom. Students are encouraged to be **humble** in terms of understanding their achievements on the journey towards their GCSEs and the roll they can play in supporting others along this journey. Students are encouraged to be **honest** when reflecting on their progress to accurately identify the best areas to focus on for development. This **honesty** is also encouraged in terms of owning one' s own mistakes or poor choices within the classroom setting.

Resources to support teaching and learning

www.mathematicsmastery.org (toolkit),
www.vle.mathswatch.co.uk,
www.mymaths.co.uk,
www.mathsgenie.co.uk,
www.corbettmaths.co.uk,
http://www.counton.org/resources/ks3framework/pdfs/vocabulary.pdf (vocabulary list)