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| **UNIT 1: Powers, decimals, HCF and LCM, positive and negative, roots, rounding, reciprocals, standard form, indices and surds**  |

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**SPECIFICATION REFERENCES**

N2 apply the four operations, including formal written methods, to integers, decimals … both positive and negative; understand and use place value (e.g. working with very large or very small numbers, and when calculating with decimals)

N3 recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals

N4 use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem

N5 apply systematic listing strategies **including use of the product rule for counting** **(i.e. if there are *m* ways of doing one task and for each of these, there are *n* ways of doing another task, then the total number of ways the two tasks can be done is *m* × *n* ways)**

N6 use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5; **estimate powers and roots of any given positive number**

N7 calculate with roots and with integer **and fractional** indices

N8 calculate exactly with … **surds**; … **simplify surd expressions involving squares
(e.g. √12 = √(4 × 3) = √4 × √3 = 2√3)**

N9 calculate with and interpret standard form *A* x 10*n*, where 1 ≤ *A* < 10 and *n* is an integer.

N14 estimate answers; check calculations using approximation and estimation, including answers obtained using technology

N15 round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures); …

**PRIOR KNOWLEDGE**

It is essential that students have a firm grasp of place value and be able to order integers and decimals and use the four operations.

Students should have knowledge of integer complements to 10 and to 100, multiplication facts to 10 × 10, strategies for multiplying and dividing by 10, 100 and 1000.

Students will have encountered squares, square roots, cubes and cube roots and have knowledge of classifying integers.

**KEYWORDS**

Integer, number, digit, negative, decimal, addition, subtraction, multiplication, division, remainder, operation, estimate, power, roots, factor, multiple, primes, square, cube, even, odd, surd, rational, irrational standard form, simplify

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| **1c. Factors, multiples, primes, standard form and surds**(N3, N4, N8, N9) | **Teaching time**6-8 hours |

**OBJECTIVES**

By the end of the sub-unit, students should be able to:

* Identify factors, multiples and prime numbers;
* Find the prime factor decomposition of positive integers – write as a product using index notation;
* Find common factors and common multiples of two numbers;
* Find the LCM and HCF of two numbers, by listing, Venn diagrams and using prime factors – include finding LCM and HCF given the prime factorisation of two numbers;
* Solve problems using HCF and LCM, and prime numbers;
* Understand that the prime factor decomposition of a positive integer is unique, whichever factor pair you start with, and that every number can be written as a product of prime factors;
* Convert large and small numbers into standard form and vice versa;
* Add, subtract, multiply and divide numbers in standard form;
* Interpret a calculator display using standard form and know how to enter numbers in standard form;
* Understand surd notation, e.g. calculator gives answer to sq rt 8 as 4 rt 2;
* Simplify surd expressions involving squares (e.g. √12 = √(4 × 3) = √4 × √3 = 2√3).

**POSSIBLE SUCCESS CRITERIA**

Know how to test if a number up to 120 is prime.

Understand that every number can be written as a unique product of its prime factors.

Recall prime numbers up to 100.

Understand the meaning of prime factor.

Write a number as a product of its prime factors.

Use a Venn diagram to sort information.

Write 51080 in standard form.

Write 3.74 x 10–6 as an ordinary number.

Simplify √8.

Convert a ‘near miss’, or any number, into standard form; e.g. 23 × 107.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Evaluate statements and justify which answer is correct by providing a counter-argument by way of a correct solution.

Links with other areas of Mathematics can be made by using surds in Pythagoras and when using trigonometric ratios.

**COMMON MISCONCEPTIONS**

1 is a prime number.

Particular emphasis should be made on the definition of “product” as multiplication, as many students get confused and think it relates to addition.

Some students may think that any number multiplied by a power of ten qualifies as a number written in standard form.

When rounding to significant figures some students may think, for example, that 6729 rounded to one significant figure is 7.

**NOTES**

Use a number square to find primes (Eratosthenes sieve).

Using a calculator to check the factors of large numbers can be useful.

Students need to be encouraged to learn squares from 2 × 2 to 15 × 15 and cubes of 2, 3, 4, 5 and 10, and corresponding square and cube roots.

Standard form is used in science and there are lots of cross-curricular opportunities.

Students need to be provided with plenty of practice in using standard form with calculators.

Rationalising the denominator is covered later in unit 17.