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

[Return to Overview](#HOverview)

**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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| **1a. Calculations, checking and rounding**  (N2, N3, N5, N14, N15) | **Teaching time**  3-5 hours |

**OBJECTIVES**

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

* Add, subtract, multiply and divide decimals, whole numbers including any number between 0 and 1;
* Put digits in the correct place in a decimal calculation and use one calculation to find the answer to another;
* Use 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);
* Round numbers to the nearest 10, 100, 1000, the nearest integer, to a given number of decimal places and to a given number of significant figures;
* Estimate answers to one- or two-step calculations, including use of rounding numbers and formal estimation to 1 significant figure: mainly whole numbers and then decimals.

**POSSIBLE SUCCESS CRITERIA**

Given 5 digits, what is the largest even number, largest odd number, or largest or smallest answers when subtracting a two-digit number from a three-digit number?

Given 2.6 × 15.8 = 41.08 what is 26 × 0.158? What is 4108 ÷ 26?

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Problems that include providing reasons as to whether an answer is an overestimate or underestimate.

Missing digits in calculations involving the four operations.

Questions such as: Phil states 3.44 × 10 = 34.4, and Chris states 3.44 × 10 = 34.40. Who is correct?

Show me another number with 3, 4, 5, 6, 7 digits that includes a 6 with the same value as the “6” in the following number 36 754.

**COMMON MISCONCEPTIONS**

Significant figure and decimal place rounding are often confused.

Some pupils may think 35 934 = 36 to two significant figures.

**NOTES**

The expectation for Higher tier is that much of this work will be reinforced throughout the course.

Particular emphasis should be given to the importance of clear presentation of work.

Formal written methods of addition, subtraction and multiplication work from right to left, whilst formal division works from left to right.

Any correct method of multiplication will still gain full marks, for example, the grid method, the traditional method, Napier’s bones.

Encourage the exploration of different calculation methods.

Amounts of money should always be rounded to the nearest penny.

Make sure students are absolutely clear about the difference between significant figures and decimal places.