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| **U****NIT 18: More fractions, reciprocals, standard form, zero and negative indices** |

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**SPECIFICATION REFERENCES**

N2 apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative; understand and use place value (e.g. when 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

N7 calculate with roots, and with integer indices

N8 calculate exactly with fractions …

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

**PRIOR KNOWLEDGE**

Students should know how to do the four operations with fractions.

Students should be able to write powers of 10 in index form and recognise and recall powers of 10, i.e. 102 = 100.

Students should recall the index laws.

**KEYWORDS**

Add, subtract, multiply, divide, mixed, improper, fraction, decimal, indices, standard form, power, reciprocal, index

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| **18b. Indices and standard form**  (N7, N9) | **Teaching time**  4-6 hours |

**OBJECTIVES**

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

* Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, fractions and powers of a power;
* Use numbers raised to the power zero, including the zero power of 10;
* 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.

**POSSIBLE SUCCESS CRITERIA**

Write 51 080 in standard form.

Write 3.74 × 10–6 as an ordinary number.

What is 90?

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Link with other areas of mathematics, such as compound measures, by using speed of light in standard form.

**COMMON MISCONCEPTIONS**

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**

Negative fractional indices are not included at Foundation tier, but you may wish to extend the work to include these.

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.