

3 Subject content

This syllabus gives you the flexibility to design a course that will interest, challenge and engage your learners. Where appropriate you are responsible for selecting resources and examples to support your learners' study. These should be appropriate for the learners' age, cultural background and learning context as well as complying with your school policies and local legal requirements.

Learners should pursue an integrated course that allows them to fully develop their skills and understanding both with and without the use of a calculator.

A List of formulas is provided on page 2 of the examination papers for candidates to refer to during the examinations. Please note that **not** all required formulas are given; the 'Notes and examples' column of the subject content will indicate when a formula is given in the examination papers and when a formula is not given, i.e. knowledge of a formula is required.

1 Number

1.1 Types of number

Notes and examples

Identify and use:

- natural numbers
- integers (positive, zero and negative)
- prime numbers
- square numbers
- cube numbers
- common factors
- common multiples
- rational and irrational numbers
- reciprocals.

Example tasks include:

- convert between numbers and words, e.g. six billion is 6 000 000 000
10 007 is ten thousand and seven
- express 72 as a product of its prime factors
- find the highest common factor (HCF) of two numbers
- find the lowest common multiple (LCM) of two numbers.

1 Number (continued)

1.2 Sets

Understand and use set language, notation and Venn diagrams to describe sets and represent relationships between sets.

Notes and examples

Venn diagrams are limited to two or three sets.

The following set notation will be used:

- $n(A)$ Number of elements in set A
- \in ‘... is an element of ...’
- \notin ‘... is not an element of ...’
- A' Complement of set A
- \emptyset The empty set
- \mathcal{E} Universal set
- $A \subseteq B$ A is a subset of B
- $A \not\subseteq B$ A is not a subset of B
- $A \cup B$ Union of A and B
- $A \cap B$ Intersection of A and B .

Example definition of sets:

$$A = \{x: x \text{ is a natural number}\}$$

$$B = \{(x, y): y = mx + c\}$$

$$C = \{x: a \leq x \leq b\}$$

$$D = \{a, b, c, \dots\}.$$

1.3 Powers and roots

Calculate with the following:

- squares
- square roots
- cubes
- cube roots
- other powers and roots of numbers.

Notes and examples

Includes recall of squares and their corresponding roots from 1 to 15, and recall of cubes and their corresponding roots of 1, 2, 3, 4, 5, and 10, e.g.:

- Write down the value of $\sqrt{169}$.
- Work out $5^2 \times \sqrt[3]{8}$.

1 Number (continued)

1.4 Fractions, decimals and percentages

Notes and examples

1 Use the language and notation of the following in appropriate contexts:

- proper fractions
- improper fractions
- mixed numbers
- decimals
- percentages.

Candidates are expected to be able to write fractions in their simplest form.

Recurring decimal notation **is** required, e.g.

- $0.1\dot{7} = 0.1777\dots$
- $0.1\dot{2}\dot{3} = 0.1232323\dots$
- $0.\overline{123} = 0.123123\dots$

2 Recognise equivalence and convert between these forms.

Includes converting between recurring decimals and fractions and vice versa, e.g. write $0.1\dot{7}$ as a fraction.

1.5 Ordering

Notes and examples

Order quantities by magnitude and demonstrate familiarity with the symbols $=$, \neq , $>$, $<$, \geq and \leq .

1.6 The four operations

Notes and examples

Use the four operations for calculations with integers, fractions and decimals, including correct ordering of operations and use of brackets.

Includes:

- negative numbers
- improper fractions
- mixed numbers
- practical situations, e.g. temperature changes.

1.7 Indices I

Notes and examples

1 Understand and use indices (positive, zero, negative and fractional).

Examples include:

- $6^{\frac{1}{2}} = \sqrt{6}$
- $16^{\frac{1}{4}} = \sqrt[4]{16}$
- find the value of 7^{-2} , $81^{\frac{1}{2}}$, $8^{-\frac{2}{3}}$.

2 Understand and use the rules of indices.

e.g. find the value of $2^{-3} \times 2^4$, $(2^3)^2$, $2^3 \div 2^4$.

1.8 Standard form

Notes and examples

1 Use the standard form $A \times 10^n$ where n is a positive or negative integer and $1 \leq A < 10$.

2 Convert numbers into and out of standard form.

3 Calculate with values in standard form.

1 Number (continued)

1.9 Estimation

Notes and examples

1 Round values to a specified degree of accuracy.

Includes decimal places and significant figures.
e.g. Write 5764 correct to the nearest thousand.

2 Make estimates for calculations involving numbers, quantities and measurements.

e.g. By writing each number correct to 1 significant

figure, estimate the value of $\frac{41.3}{9.79 \times 0.765}$.

3 Round answers to a reasonable degree of accuracy in the context of a given problem.

1.10 Limits of accuracy

Notes and examples

1 Give upper and lower bounds for data rounded to a specified accuracy.

e.g. write down the upper bound of a length measured correct to the nearest metre.

2 Find upper and lower bounds of the results of calculations which have used data rounded to a specified accuracy.

Example calculations include:

- calculate the upper bound of the perimeter or the area of a rectangle given dimensions measured to the nearest centimetre
- find the lower bound of the speed given rounded values of distance and time.

1.11 Ratio and proportion

Notes and examples

Understand and use ratio and proportion to:

- give ratios in their simplest form
- divide a quantity in a given ratio
- use proportional reasoning and ratios in context.

e.g. 20:30:40 in its simplest form is 2:3:4.

e.g. adapt recipes; use map scales; determine best value.

1 Number (continued)

1.12 Rates

Notes and examples

1 Use common measures of rate.

e.g. calculate with:

- hourly rates of pay
- exchange rates between currencies
- flow rates
- fuel consumption.

2 Apply other measures of rate.

e.g. calculate with:

- pressure
- density
- population density.

3 Solve problems involving average speed.

Required formulas will be given in the question.

Knowledge of speed/distance/time formula is required.

e.g. A cyclist travels 45 km in 3 hours 45 minutes. What is their average speed?

The notation used for rates will be in the form, e.g. m/s (metres per second), g/cm^3 (grams per cubic centimetre).

1.13 Percentages

Notes and examples

1 Calculate a given percentage of a quantity.

2 Express one quantity as a percentage of another.

3 Calculate percentage increase or decrease.

4 Calculate with simple and compound interest.

Problems may include repeated percentage change. Formulas are **not** given.

5 Calculate using reverse percentages.

e.g. find the cost price given the selling price and the percentage profit.

Percentage calculations may include:

- deposit
- discount
- profit and loss (as an amount or a percentage)
- earnings
- percentages over 100%.

1.14 Using a calculator

Notes and examples

1 Use a calculator efficiently.

e.g. know not to round values within a calculation and to only round the final answer.

2 Enter values appropriately on a calculator.

e.g. enter 2 hours 30 minutes as 2.5 hours or $2^\circ 30' 0''$.

3 Interpret the calculator display appropriately.

e.g. in money 4.8 means \$4.80; in time 3.25 means 3 hours 15 minutes.

1 Number (continued)

1.15 Time

Notes and examples

- 1 Calculate with time: seconds (s), minutes (min), hours (h), days, weeks, months, years, including the relationship between units.
- 2 Calculate times in terms of the 24-hour and 12-hour clock.
- 3 Read clocks and timetables.

1 year = 365 days.

In the 24-hour clock, for example, 3.15 a.m. will be denoted by 03 15 and 3.15 p.m. by 15 15.

Includes problems involving time zones, local times and time differences.

1.16 Money

Notes and examples

- 1 Calculate with money.
- 2 Convert from one currency to another.

1.17 Exponential growth and decay

Notes and examples

Use exponential growth and decay.

e.g. depreciation, population change.
Knowledge of e is not required.

1.18 Surds

Notes and examples

- 1 Understand and use surds, including simplifying expressions.
- 2 Rationalise the denominator.

Examples include:

- $\sqrt{20} = 2\sqrt{5}$
- $\sqrt{200} - \sqrt{32} = 6\sqrt{2}$.

Examples include:

- $\frac{10}{\sqrt{5}} = 2\sqrt{5}$
- $\frac{1}{-1 + \sqrt{3}} = \frac{1 + \sqrt{3}}{2}$.