

Chapter 1 Number

Specification

FS coverage and range	Understand and use whole numbers Understand negative numbers in practical contexts Add, subtract, multiply and divide whole numbers using a range of strategies
FS exemplification	Understand place value Write a number in words and in figures Put whole numbers in order Use of the terms odd, even, multiple, factor Recognise but not calculate, e.g. identify the warmest and coldest from a set of temperatures Use temperatures Add, subtract, multiply and divide positive and negative whole numbers

GCSE

GCSE specification	N a Add, subtract, multiply and divide any number N b Order rational numbers N c Use the concepts and vocabulary of factor (divisor), multiple, common factor, Highest Common Factor (HCF), Least Common Multiple (LCM), prime number and prime factor decomposition
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Edexcel GCSE course	Specification A: Foundation Chapter 1, 5.2, 8.3 Higher Chapter 1, 4.1, 25.2 Specification B: Foundation Unit 1: 1.1, 3.1; Unit 2: 1.2–1.9, 2.1, 2.2, 3.2–3.4, 3.6, 4.3, 4.5–4.7; Unit 3: 1.2–1.4, 2.1 Higher Unit 1: 2.1, 5.1; Unit 2: Chapter 1, Chapter 2, 3.1–3.2, 5.2; Unit 3: 1.1–1.2, 1.4
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Resources

General resources	Dice Large sheets of paper with +, −, × or ÷ on each Fairground ticket price information Posters or events listings Job adverts
Resource sheets	1.1, 1.2, 1.3
Links	http://www.hss.com http://en.wikipedia.org/wiki/List_of_association_football (Search for Stadia by capacity)
ActiveTeach resources	Video ResultsPlus Knowledge Check ResultsPlus Problem Solving Question Audio Animations

Lesson 1

Objectives

- Write numbers using words and figures
- Use place value to order numbers
- Multiply or divide by 10 or 100

Starter

- Ask students to write all the different 3-digit numbers that can be written using the digits 2, 5 and 8. They should then order them from largest to smallest by comparing digits in columns from left to right. Extend this activity by introducing a zero digit.

Main teaching and learning

- Check that students can say all the numbers written during the Starter activity. Then ask which of the numbers found: are odd; are even; have a factor of 5; are closest to a multiple of 10. Ask: *Which number is closest to 700?*
- Relate the Starter activity to *Take a look: Writing a cheque* and *Take a look: Ordering cheque numbers* (p12).
- Write out a 6-digit 'telephone number'. Consider how it would be said as a telephone number, and correctly as a large number using place value. Discuss place value headings up to and including millions.
- Give pairs of students a page from the property section of a local newspaper and ask them to devise a short radio item about local house prices. They should identify the highest and lowest prices for the various types of property listed.
- Ask students to write a straightforward product such as $3 \times 4 = 12$ in the centre of a sheet of paper and then surround this with other products involving 3 and/or 4 multiplied by powers of 10, e.g. $30 \times 4000 = 120\,000$. Discuss how the results involving simple products with an answer which is already a multiple of 10 (e.g. $5 \times 6 = 30$) would vary.
- Ask students to complete *Have a go* Q1–4.

Issues and misconceptions

- Ensure students take care when a zero place-holder appears.

Support

- The place value grids and digit cards on Resource sheet 1.1 may be helpful during the Starter activity.
- Have the correct spellings for numbers on display for reference and highlight trickier spellings such as ninety and forty.

Extension

- Include decimals in the calculations involving the digits 3 and 4.

Plenary

- Divide students into two teams. One team starts by saying a 2-digit number and the other team responds with the result of multiplying this number by 10. Continue back and forth between teams until the number exceeds 1 million. Now try dividing by 10.

Formative assessment

- Ask students to compare their results for the penultimate activity in the Main teaching and learning.
- Ask students to peer-assess their answers to Q1–4, and discuss the reasons given in answer to Q4b.

Homework

- Students find out the capacities of football stadiums in a country of their choice. Write a short report comparing these capacities with those of teams in the English Premiership.

Lesson 2

Objectives

- Choose number operations to solve problems
- Interpret scales using negative numbers

Starter

- Give students the number line from Resource sheet 1.2. This is in the form of a thermometer and includes negative numbers. Give a start temperature and then a series of temperature rises and decreases for the students to follow. A student who offers the correct final temperature takes over and gives a new start number and set of rises and decreases.

Main teaching and learning

- Divide students into groups and give each group a large sheet of paper with one of the symbols $+$, $-$, \times or \div written in the centre. Ask each group to list words and phrases used to describe their operation (e.g. difference, subtract, take away). Ask them to write down the inverse operation and give examples of calculations where their operation would be used, e.g. finding how many sweets are left after some have been eaten. Compare and discuss groups' results and emphasise links between the operations, e.g. link repeated addition to multiplication and repeated subtraction to division.
- Work through *Take a look*: Booking a holiday (p13).
- Ask students to think of a context where they might need to use the calculation $92 \div 16$. Remind them that division may be thought of as sharing (between 16) or grouping (into 16s). Then discuss a good estimate and the exact answer. Ask: *When would 5.75 be used as an answer? When would 5 remainder 12 be more suitable?*
- Discuss how the results of a division calculation may need to be rounded up or down according to the context. Use the following examples:
 - *Nine friends are going to a party by taxi. Each taxi holds four people. How many taxis do they need?*
 - *A student has £9 to buy files. A file costs £4. How many files can he buy?*
- Ask students to complete *Have a go* Q5–12.

Issues and misconceptions

- When dealing with negative numbers, students may not understand that -19 is less than -9 although 19 is greater than 9.
- Note the need to deal with remainders in context in Q11 and Q12.

Support

- Encourage students to visualise or draw a number line for each of Q6–8.

Extension

- Ask students to think of a theme and make up four questions in this context which involve each of addition, subtraction, multiplication and division.

Plenary

- As a class, work through Q15.

Formative assessment

- Ask students to peer-assess their answers to Q5–12.
- Contexts given for the calculation $92 \div 16$ will indicate students' confidence with division.

Homework

- Ask students to investigate the star rating system for domestic freezers and how it relates to temperature. They should find out the different recommended storage times in a freezer of each star rating shown on the packaging for a frozen food product.

Lesson 3

Objectives

- Choose the information needed
- Use appropriate mathematical operations
- Interpret results and solutions in the context of the question
- Make conclusions

Starter

- Write 64 in the centre of the board and ask students to imagine sharing 64 doughnuts between different numbers of people. Write various numbers (factors of 64 and others) around the 64 and ask students how many doughnuts would be left if they were shared between those numbers of people.

Main teaching and learning

- List ticket prices for various fairground rides and tell students to imagine they have £20 to spend. Ask them to work out how many tickets they could buy for each ride and the change they would have. Then ask them to find the various combinations of tickets they could buy to spend exactly £20. Discuss students' answers. What strategies did they use?
- Work through *Take a look: Mallory Towers* and *Take a look: Concrete* (pp15–17).
- Divide students into pairs. Ask them to:
 - Imagine a different group of people is going to Mallory Towers and calculate the cost of their visit.
 - Think of a different building job and calculate the cost of concrete.Students should write out their solutions in full.
- Discuss students' answers and ask pairs to explain their decisions. Then ask each pair of students to give their new group size and building job information to another pair of students to calculate to check accuracy.
- Ask students, in their pairs, to complete *Have a go* Q13 and Q14 and *Have a go* Q16–18.

Issues and misconceptions

- When using a calculator for division, students may not deal with decimals carefully. It will often be helpful to convert to a numerical remainder, especially when finding optimal solutions.

Support

- Encourage students to draw a sketch diagram for Q16.

Extension

- Ask students to design a spreadsheet that could be used to help them find the answers to Q17 and Q18.

Plenary

- Ask pairs of students to present their solution to one of Q16–18.

Formative assessment

- Ask students to peer-assess their answers to Q13, Q14 and Q16–18. They should check accuracy but also rate each other's responses for clarity of working and explanation.

Homework

- Ask students to find out the entry ticket prices for local tourist attractions. Ask: *If family or group tickets are available, what saving do they offer over the purchase of normal tickets?*

Lesson 4

Objectives

- Choose the mathematical information needed to solve a problem
- Use appropriate mathematical procedures
- Find and interpret results and solutions
- Make conclusions
- Present and communicate results

Starter

- Give students various amounts of money in pence to write in pounds and pence and vice versa. Include amounts that involve a final zero and emphasise correct notation.

Main teaching and learning

- Ask: *Why is it preferable to hire rather than buy tools or equipment?* Discuss how pricing is often structured according to the length of the hire period. For example, a carpet cleaner costs £39.25 for the first day, £19.63 for an additional day, £49.06 for a weekend and £78.50 for a week. Use www.hss.com to find other examples. Ask students to calculate the cost of hiring a carpet cleaner (or other item) for various periods of time. Ask: *Why do longer hire periods cost proportionally less?*
- Link to the pricing information for DEF and ONE in *Take a look: Gas bills* (p19). Highlight the crucial information and discuss why a gas company may set prices in this way.
- Divide students into pairs and give each pair a set of four cards for either DEF or ONE from Resource sheet 1.3. These show the calculations required to find the cost of 1900 units of gas. Students should put the cards into order and complete each calculation. Ask them to add the appropriate units and indicate the purpose of the calculation in the context of the problem. Each pair of students should then compare the steps of their calculations and the final answer with a pair working with the other gas company.
- Ask students to complete *Have a go* Q27, presenting their solutions appropriately. Encourage tabulation for various levels of usage between 700 and 1000 units.

Issues and misconceptions

- Students may have difficulty converting correctly between pounds and pence.
- Students have difficulty in using arithmetic operations and conversions together.

Support

- Students can follow the working given for *Take a look: Gas bills* to help them structure their own solution to Q27.

Extension

- Ask students to investigate the cost of less than 700 units of electricity from both companies in Q27 and present their findings graphically. Ask: *When would the cost from both companies be the same?*

Plenary

- Ask students to identify other utilities, services or products where costs vary depending on usage or other factors (e.g. mobile phones, mail order delivery charges).

Formative assessment

- Ask students to compare their answers with a partner's, with particular emphasis on whether work is set out clearly.

Homework

- Ask students to find out the actual cost of gas and/or electricity used in their home. Ask: *Would someone using half the amount pay half the cost?* They should show clear calculations to support their answer.

Lesson 5

Objectives

- Choose the mathematical information needed to solve a problem
- Use appropriate mathematical procedures
- Find and interpret results and conclusions
- Make conclusions
- Present and communicate results

Starter

- Show students a poster or listing advertising an event. Ask them to identify the most crucial pieces of information on the poster (e.g. date, time, place) and rewrite the information using the absolute minimum of words.

Main teaching and learning

- Linking to the Starter, emphasise the need to identify crucial information when solving problems. Use *Take a look: Eggs* (p20) as an example and ask students to find alternative solutions. Discuss possible factors which would lead to preferences for one alternative. Which one do they prefer?
- Encourage students to use a layering technique to build up towards a solution when solving multi-step open questions. Use three steps to:
 - highlight the key information
 - identify what the question is asking
 - identify the maths to be used.
- Ask students to read *Have a go* Q19, Q20 and Q22 or Q23 in pairs, using this layering technique, writing down the key information for the three steps above. Then ask some pairs to explain their reasoning to the class.
- Ask students to complete Q19, Q20 and Q22 or Q23 in their pairs, taking care to present their solutions clearly in the context of the question.
- Ask students to complete *Have a go* Q24 and Q25, again planning their solutions first.

Issues and misconceptions

- Students may find it hard to plan and think about the whole question, rather than rushing to solve it. Emphasise the advantages of planning and the fact that taking a moment to plan is likely to save time and improve accuracy in the end.

Support

- Help students to choose sensible starting points when solving optimisation questions. Such questions can prove time consuming and there are many possible solutions.

Extension

- Ask students to look at Q24 again. Ask: *David wants to burn 2000 calories a day as part of his exercise regime. Suggest a plan of exercises for David to do.*

Plenary

- Ask pairs of students who have worked together to split up and compare one of their solutions with that from another partnership. Students should then report back to their original partner on the other pairs' accuracy and technique.

Formative assessment

- Students peer-assess solutions to the *Have a go* questions during the Plenary activity.

Homework

- Ask students to find two different job advertisements that include information about earnings. These will be used in the next lesson.

Lesson 6

Objectives

- Choose the mathematical information needed to solve a problem
- Use appropriate mathematical procedures
- Find and interpret results and conclusions
- Make conclusions
- Present and communicate results

Starter

- Write the words 'year', 'month', 'century', 'hour', 'minute' and 'seconds' on the board. Invite students to draw arrows linking any two words to show the conversion factor. For example, the link between the words 'year' and 'week' would be labelled with the number 52.

Main teaching and learning

- Show students a variety of real job adverts (these may have been sourced by them as Lesson 5 Homework). Check that students understand all associated vocabulary such as salary, per annum, commission, bonus, etc. Discuss how the earnings for two or more of the jobs could be compared, and think about the other factors that a potential employee may consider.
- Ask students to complete *Have a go* Q21, then compare the earnings for two real job advertisements. They should produce a poster showing the actual adverts, with key information highlighted and comparisons shown. Other advantages and disadvantages of each job can also be identified so students choose which one they would prefer. Ask: *What is the most important factor when choosing a job?*
- Ask students to complete *Have a go* Q26.

Issues and misconceptions

- Students may not be aware of basic time conversions and may not take care to use information about time correctly when interpreting questions and presenting answers. (You can check this ability in the Starter.)

Support

- For Q26, suggest that students think about the possible mileage use and consider situations for low, medium and high use separately.

Extension

- Ask students to produce a ready-reckoner table or graph for the Most Motors hire charge calculations.

Plenary

- Ask students to present their work on real job advertisements to the rest of the group.

Formative assessment

- Ask students to peer-assess numerical answers to Q21 and Q26. They should give feedback on the clarity of all recommendations made and whether they are clearly backed up, with calculations shown.

Homework

- Ask students to make up their own multi-stage calculation question and provide a full solution showing the various steps needed to solve the problem.