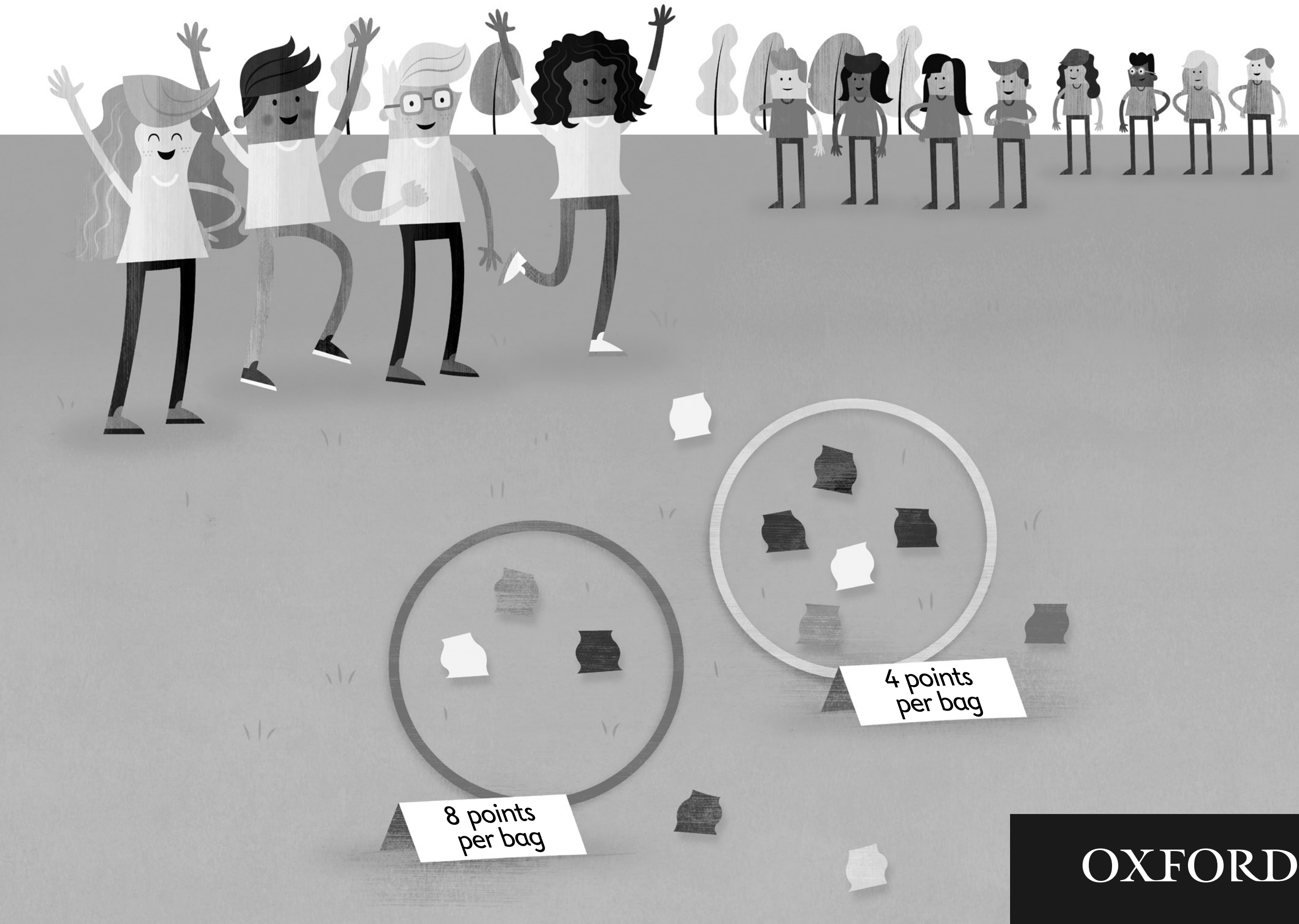
numicon®

Pupil Book 3 Answers



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www.oxfordprimary.co.uk/numicon

About Numicon

Numicon is a distinctive multi-sensory approach to children's mathematical learning that emphasizes three key aspects of doing mathematics: communicating mathematically, exploring relationships and generalizing.

Numicon was founded in the daily experience of intelligent children having real difficulty with maths, the frequent underestimation of the complexity of the ideas that young children are asked to face when doing maths and recognition of the importance of maths to them and to society as a whole.

Numicon aims to facilitate children's understanding and enjoyment of maths by using structured imagery that plays to children's strong sense of pattern. This is done through research-based, multi-sensory teaching activities.

Numicon takes into account the complexity of abstract number ideas and seeks to foster the self-belief necessary to achieve in the face of challenge or difficulty.

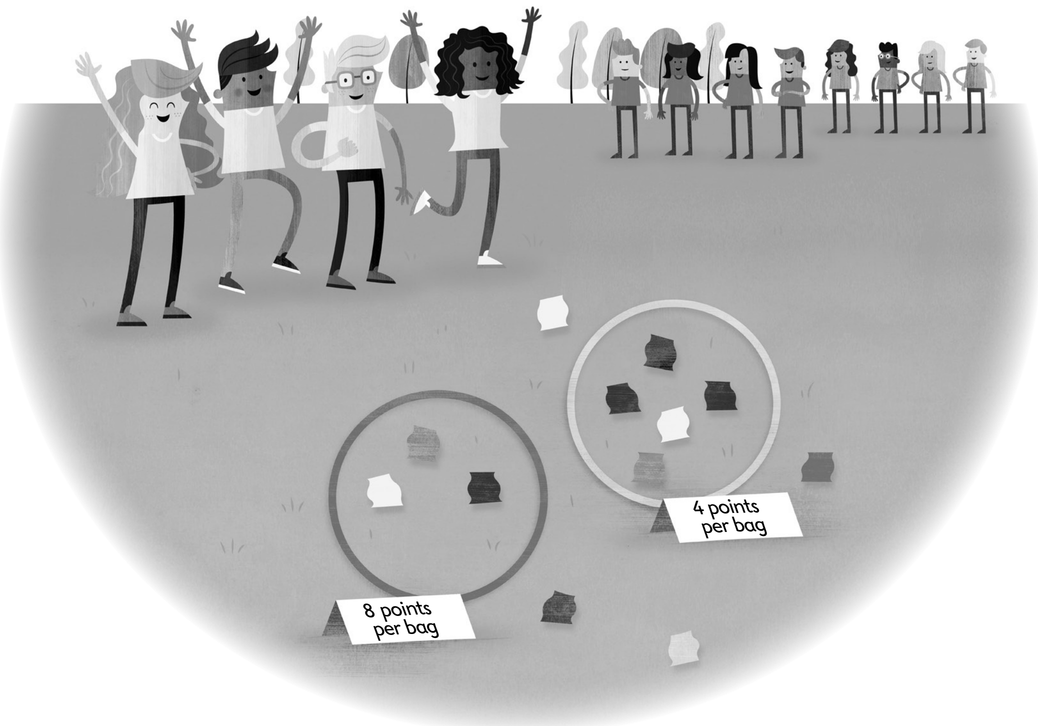
Through the combination of communicating mathematically (being active, talking and illustrating), exploring relationships and generalizing, children are given the support to structure their experiences: a vital skill for both their mathematical and their overall development.

A multi-sensory approach, particularly one that makes use of structured imagery, provides learners with the opportunity to play to their strengths, thereby releasing their potential to enjoy, understand and achieve in maths. By watching and listening to what children do and say, this enjoyment in achievement is also shared by teachers and parents.

Numicon strives to support teachers' subject knowledge and pedagogy by providing teaching materials, Professional Development and on-going support that will help develop a better understanding of how to encourage all learners in the vital early stages of their own mathematical journey.

Pupil Book 3 Answers

Written by Ruth Atkinson, Andrew Jeffrey,
Adella Osborne, Louise Pennington,
Romey Tacon and Dr Tony Wing



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Complete answers to the questions on the Pupil Book 3 cover and inside the book.

Using Numicon Pupil Books

Introduction

The Numicon Pupil Books have been created to help children develop mastery of the mathematics set out in Numicon Teaching Resource Handbook (TRH) activities. The questions in the Pupil Books extend children's experiences of live TRH activities, giving them the opportunity to reason and apply what they have learned, deepen their understanding, take on challenges and develop greater fluency.

Just like the teaching activities, all Pupil Book pages are designed to stimulate discussion, reasoning and rich mathematical communicating. The Numicon approach to teaching mathematics is about dialogue. It is about encouraging children to communicate mathematically using the full range of mathematical imagery, terminology, conventions and symbols.

All questions in the Pupil Books relate to specific Numicon TRH activities. At the top of each Pupil Book page you can find details of the Activity Group the page relates to (for example, Calculating 1). The number after the decimal point tells you which focus activities the page accompanies (so Calculating 1·2 goes with focus activity 2). It is crucial to teach the relevant focus activities before children work on the questions. The Pupil Book questions are designed for children who are succeeding with specific TRH activities, and will invite them to think more deeply about a topic. If you find that children are struggling with a focus activity, details are given in the Teaching Resource Handbooks of other live activities, provided earlier in the progression, which you can work through together to support them until they are ready to move on.

There's a recommended order to teach the Activity Groups in and the Pupil Book materials follow this order of progression, too, as you'll see from the contents page. You can use this order to help children see how their ideas and understanding build upon what they have learned before.

These Pupil Book questions have been developed as a large bank that you can select from to best meet the changing needs of the children in your class. You can decide which questions are suitable for which children at which time, and no child is expected to find every question useful. How you choose to use the questions might also vary, for example, you may find that particular questions are useful to discuss and work through together as a class.

Intelligent practice

The 'Practice' sections target two areas. Routine practice is used to promote fluency with particular aspects or techniques. Non-routine practice questions offer challenges in varied ways designed both to improve fluency and to deepen and extend understanding. Practice for simple fluency usually comes first and the questions on each page become progressively more challenging.

Going deeper

'Going deeper' questions are designed to develop children's growing mastery of an area, challenging their understanding beyond routine exercises. In these sections, children are commonly asked to check, explain and justify their strategies and thinking. Trying to explain something clearly helps promote, and is a key indicator, of developing mastery.

Using the Pupil Books

Doing mathematics involves much more than logic, and children's emotions are crucially important. Thoughtful progress is more likely to happen through encouraging curiosity and good humour, and engaging with children in a polite and calm way. This is why the phrasing and tone of Numicon Pupil Book questions are deliberately different to many mathematical textbooks. For example, we often begin questions for children with, "Can you … ?" If any child says simply, 'yes' or 'no' in response, we'd suggest replying with, "Can you show me how … ?" or "That's interesting, can you say anything about why not?" These invitations are effective beginnings to the kinds of open conversation and discussions that are at the heart of the Numicon approach.

Some Pupil Book questions have a pair work symbol to signal that these require specific work with a partner, and help with classroom management. These are not the only questions where working with a partner is likely to be beneficial, however. All Pupil Book questions should be seen as opportunities for rich mathematical communicating between anyone and everyone in the classroom at all times, and this should be actively encouraged wherever you think appropriate. The Numicon approach is crucially about dialogue – action, imagery, and conversation.

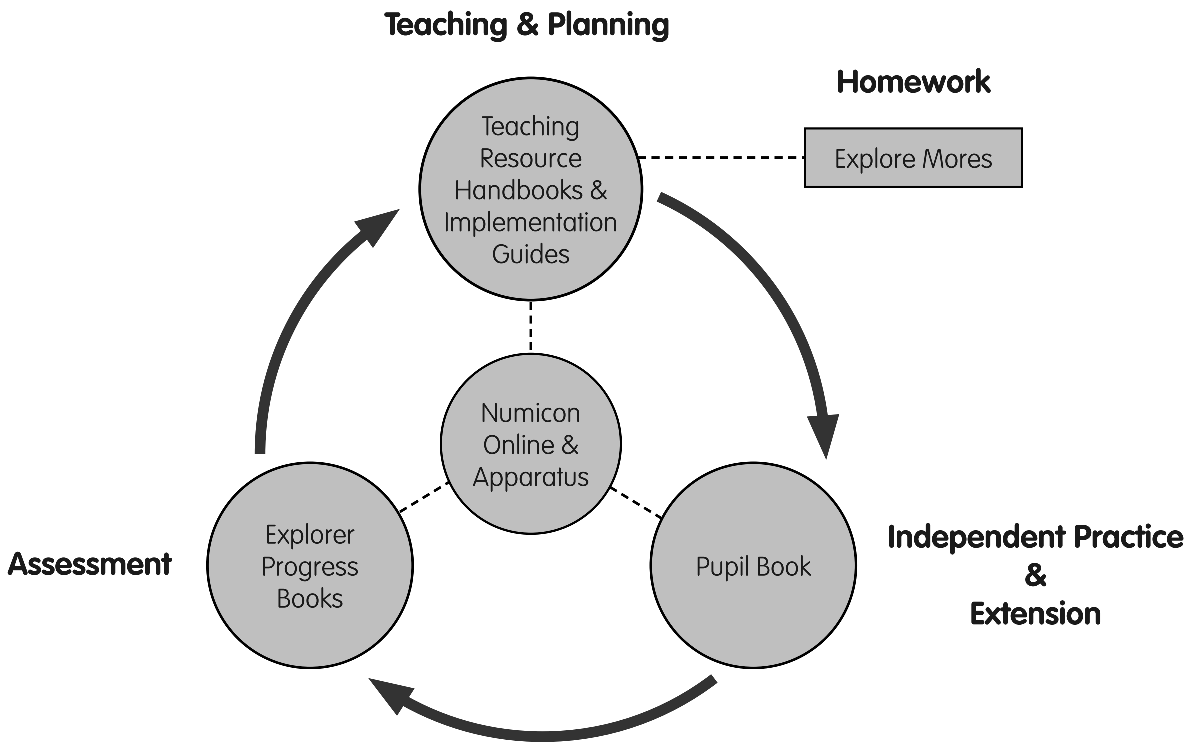
Finally, the Pupil Book questions are there to be enjoyed. Children who are supported, and who are succeeding, generally relish challenge and further difficulty. We hope you as teachers will also enjoy the journeys and pathways that these books will take children and their teachers jointly along.

Dr Tony Wing

A guide to the Numicon teaching resources

Numicon Pupil Books fit with the other resources shown here to fully support your teaching. You can also find additional resources, including an electronic copy of this answer book, on Numicon Online. This is available on the Oxford Owl website (www.oxfordowl.co.uk).

Numicon resources



Teaching Resource Handbooks

There is a Number, Pattern and Calculating and a Geometry, Measurement and Statistics Teaching Resource Handbook for each year group. The teaching in these handbooks is carried out through activities. You will find detailed support for planning and assessment here, along with vocabulary lists, the key mathematical ideas covered and photocopy masters.

Implementation Guides

Each Teaching Resource Handbook comes with an Implementation Guide. These provide guidance on the Numicon approach, how to implement this in the classroom and valuable information to support subject knowledge, including explanations of the key mathematical ideas covered and a glossary of mathematical terms used.

Explore More Copymasters

The Explore More Copymasters provide homework that enables children to practise what they are learning in school. For Geometry, Measurement and Statistics, these are given in the back of the Teaching Resource Handbook. For Number, Pattern and Calculating, these are provided in a separate book.

A homework activity is included for every Activity Group. Each one includes information for the parent or carer on the mathematics that has been learned in class beforehand and how to use the work together. These activities can also be used in school to provide extra practice.

Explorer Progress Books

There are four Explorer Progress Books for each year group (one for Geometry, Measurement and Statistics and three for Number, Pattern and Calculating). There are two pages in the Explorer Progress Books for each Activity Group which can be used to assess children's progress, either immediately after the Pupil Book questions or at a later point to find out what learning has been retained. These Progress Books give children the opportunity to apply what they have learned to a new situation.

Apparatus

Physical apparatus

Apparatus on the Interactive Whiteboard Software

A wide range of apparatus and structured imagery is used in Numicon to enable children to explore abstract mathematical ideas. You can find digital versions of this apparatus in the Interactive Whiteboard Software available through Numicon Online. Here you can manipulate the apparatus from the front of the class and save anything you have set up for future use.

Numicon Online for planning and assessment support

Many other resources are provided on Numicon Online to support your planning, teaching and assessment. There are editable planning documents, photocopy masters and videos to support teaching. Assessment resources here include assessment grids for the Explorer Progress Books and milestone tracking charts to monitor children's progress throughout the year. You can access all these resources, along with the Interactive Whiteboard Software, through the Oxford Owl website (www.oxfordowl.co.uk).

Planning chart

The chart below shows you how the Activity Groups in the Teaching Resource Handbooks and the Pupil Book pages fit together and the key learning that is covered. The order follows the recommended teaching progression.

Key to abbreviations used on the chart
NPC: *Number, Pattern and Calculating Teaching Resource Handbook*
GMS: *Geometry, Measurement and Statistics Teaching Resource Handbook*

NNS: Numbers and the Number System
Geo: Geometry
Calc: Calculating
PA: Pattern and Algebra
Mea: Measurement

Activity group title and pages in the Teaching Resource Handbook	Accompanying Pupil Book pages	Milestone statements covered
Calc 1: Developing fluency with adding and subtracting facts to 10 (Number, Pattern and Calculating 3, pages 120–125)	p2–5	**NPC Milestone 1** • Fluently recall adding and subtracting facts of all numbers to 10 and use these when adding lists of small numbers • Fluently recall most adding and subtracting facts of all numbers to 20 and use efficient strategies to calculate those not known
NNS 1: Finding how many by grouping in 10s and 100s (Number, Pattern and Calculating 3, pages 76–79)	p6–9	**NPC Milestone 1** • Give a sensible estimate of numbers of more than 100 objects
Calc 2: Developing fluency with adding and subtracting facts to 20 (Number, Pattern and Calculating 3, pages 126–132)	p10–13	**NPC Milestone 1 and 2** • Know and use patterns in adding and subtracting facts for any number to 20 and beyond to recall facts, to organize them systematically, and to check that all combinations have been found • Use known adding and subtracting facts to derive facts to 30 • Use understanding of equivalence, the '=' symbol and knowledge of the inverse relation between adding and subtracting to solve problems where the empty box symbol represents an unknown number
NNS 2: Exploring hundreds, tens and ones with base-ten apparatus (Number, Pattern and Calculating 3, pages 80–83)	p14–17	**NPC Milestone 1** • Count aloud across multiples of 100 and multiples of 1000 • Read, write and build (with apparatus) 2- and 3-digit numbers • Relate grouping and place value notation to say the value of each digit in a 3-digit number

Activity group title and pages in the Teaching Resource Handbook	Accompanying Pupil Book pages	Milestone statements covered
PA 1: Exploring the inverse relationship between adding and subtracting (Number, Pattern and Calculating 3, pages 44–48)	**p18–21**	**NPC Milestone 2** • Recognize when a given number is a multiple of 2, 3, 4, 5, 8 or 10 (at this stage a few children may recognize common multiples but this is not a milestone)
NNS 3: Keeping count and writing numbers down (Number, Pattern and Calculating 3, pages 84–87)	**p22–25**	**NPC Milestone 2** • Understand the use of zero as a place holder • Count forwards and backwards in sequences of multiples within their working range
Calc 3: Mental methods for adding single-digit numbers (Number, Pattern and Calculating 3, pages 133–137)	**p26–29**	**NPC Milestone 2** • Explain how three related numbers are connected through the inverse relation and write all the related adding and subtracting facts • Recall and use adding and subtracting facts to 10 and the bridging strategy in any adding and subtracting calculations that involves crossing multiples of 10, and explain the steps they have taken
Calc 4: Mental methods for subtracting single-digit numbers (Number, Pattern and Calculating 3, page 138–143)	**p30–33**	**NPC Milestone 2** • Know that multiples of 10 and 100 are important milestones on the number line • Know how to adjust calculations and compensate when adding and subtracting 9 and when to use this relationship
PA 2: Exploring steps of constant size through sequences of multiples (Number, Pattern and Calculating 3, pages 49–54)	**p34–37**	**NPC Milestone 2** • Notice patterns in sequences of multiples, explain the rule for the sequence and use this to find missing numbers
Geo 1: Investigating the parts and properties of polygons and polyhedra (Geometry, Measurement and Statistics 3, pages 27–33)	**p38–41**	**GMS Milestone 1** • Use resources to show, or find examples of, horizontal, vertical, parallel and perpendicular lines • Build 3D skeleton shapes, relating these to named 3D shapes and shapes in their everyday environment • Describe the properties of 3D shapes in different orientations, and consider the number of faces, vertices and edges
Calc 5: Revising multiplying as repeated adding (Number, Pattern and Calculating 3, pages 144–147)	**p42–45**	**NPC Milestone 2** • Understand that multiplying is a form of calculating used instead of repeated adding and recognize when they need to multiply to solve a problem • Read multiplying number sentences • Read and write multiplying sentences using the '×' symbol, model them with structured apparatus showing understanding of the word 'product'

Activity group title and pages in the Teaching Resource Handbook	Accompanying Pupil Book pages	Milestone statements covered
Calc 6: Exploring multiplying through arrays (Number, Pattern and Calculating 3, pages 148–152)	**p46–49**	**NPC Milestone 3** • Recall most multiplying facts of 2, 3, 4, 5, 8 and 10 multiplying tables • Know and use the commutative property of multiplying • Represent multiplying problems with structured apparatus and arrays • Know that changing the order of numbers in multiplying problems does not change the product
Calc 7: Revising dividing as 'How many ... in ...?' (Number, Pattern and Calculating 3, pages 153–159)	**p50–53**	**NPC Milestone 3** • Recognize that dividing can be expressed as finding 'how many groups are there in … ?' • Read, build with structured apparatus, and write dividing number sentences using the '÷' symbol • Notice and explain the inverse relation between dividing and multiplying and know that they can use multiplying facts to derive dividing facts • Explain and interpret a realistic context as one inviting either 'multiplying' or 'dividing' and use the inverse relation between multiplying and dividing when solving problems • Know that multiplying has a commutative property and use this to help when solving dividing questions • Interpret a remainder as what is left after grouping
Geo 2: Identifying and comparing angles by size (Geometry, Measurement and Statistics 3, pages 34–40)	**p54–57**	**GMS Milestone 1** • Move objects, or themselves, to show their understanding of an angle as a description of a turn • Show how the number of right angle turns relates to a half, three-quarters and full turn • Manipulate resources to make and order right angles and angles greater, or less than, a right angle
NNS 4: Partitioning 2- and 3-digit numbers with and without money (Number, Pattern and Calculating 3, pages 88–92)	**p58–61**	**NPC Milestone 3** • Relate pounds and pence notation to hundreds, tens and ones • Use knowledge of partitioning to solve money problems
Geo 3: Sorting and classifying 2D and 3D shapes (Number, Pattern and Calculating 3, pages 41–48)	**p62–65**	**GMS Milestone 1** • Recognize angles in 2D shapes and relate these to the properties of regular and irregular shapes • Use sorting diagrams to organize 2D or 3D shapes according to criteria they have chosen, and explain their reasoning

Activity group title and pages in the Teaching Resource Handbook	Accompanying Pupil Book pages	Milestone statements covered
NNS 5: Ordering and structuring numbers to 1000 (Number, Pattern and Calculating 3, pages 93–99)	**p66–69**	**NPC Milestone 3** • Understand relative values of numbers to 1000, including recognizing the idea of a range of numbers and use of symbols ‘–‘, ‘<‘ and ‘ >‘ for labelling a range of numbers • Partition numbers up to 1000 into hundreds, tens and ones and to derive other ways of partitioning them • Relate knowledge of patterns on a 100 square to an array for 1000 and use patterns when finding numbers in different arrays and number squares
Calc 8: Adding and subtracting multiples of 10 and 100 (Number, Pattern and Calculating 3, pages 160–166)	**p70–73**	**NPC Milestone 3** • Use fluent recall of adding and subtracting facts to 10 when adding and subtracting multiples of 10 and multiples of 100, first whole tens or whole hundreds moving on to add whole tens and whole hundreds to 2- and 3-digit numbers
Calc 9: Patterns of similar adding and subtracting calculations (Number, Pattern and Calculating 3, pages 167–175)	**p74–77**	**NPC Milestone 4** • Record work systematically in order to quickly spot patterns • Explain how they are using place value and known number facts to solve similar calculations • Use knowledge of equivalence and number relationships to adjust numbers involved in a variety of calculating situations and explain their reasoning • Use fluent recall of doubles of numbers to 10 when solving problems that involve doubling and halving higher numbers • Use fluent recall of adding and subtracting facts of 10 when finding complements to 100
PA 3: Reading and creating scales with different intervals (Number, Pattern and Calculating 3, pages 55–60)	**p78–81**	**NPC Milestone 4** • Use knowledge of sequences of multiples to label intervals • Use knowledge of number relationships to read values in-between marked intervals • Count in multiples of 25 and 50
NNS 6: Finding halfway, rounding to the nearest 10 or 100 (Number, Pattern and Calculating 3, pages 100–104)	**p82–85**	**NPC Milestone 4** • Find halfway between two multiples of 10 and two multiples of 100 • Round any 2- or 3-digit number to the nearest 10 or 100
Calc 10: Learning multiplying facts and looking for patterns (Number, Pattern and Calculating 3, pages 176–180)	**p86–89**	**NPC Milestone 4** • Develop fluent recall of many facts from 2, 3, 4, 5, 8 and 10 times tables • Recognize that some times tables have multiples in common • Use doubling and halving as a strategy for deriving related multiplying facts between the 2, 4 and 8 times tables and between the 5 and 10 times tables

Activity group title and pages in the Teaching Resource Handbook	Accompanying Pupil Book pages	Milestone statements covered
Calc 11: Introducing the sharing structure of dividing (Number, Pattern and Calculating 3, pages 181–185)	**p90–93**	**NPC Milestone 4** • Know that we use dividing to solve problems involving sharing as well as those involving grouping • Know that there can be remainders in sharing situations • Write dividing sentences in response to problems illustrated by arrays, Numicon Shapes or number rods • Use the inverse relation between multiplying and dividing when solving sharing problems
PA 4: Extending sequences and finding differences (Number, Pattern and Calculating 3, pages 61–67)	**p94–97**	**NPC Milestone 5** • Know that finding a constant difference is a useful strategy for finding the rule for a sequence
Calc 12: Partitioning strategies for adding and subtracting (Number, Pattern and Calculating 3, pages 186–192)	**p98–101**	**NPC Milestone 5** • Use partitioning into hundreds, tens and ones as a strategy for adding and subtracting 2- and 3-digit numbers • Use structured apparatus when adding and subtracting 2- and 3-digit numbers to show understanding of how these are partitioned, regrouped, recombined or redistributed and can transfer this to a written method of recording in columns
Mea 1: Telling the time to the minute on the 12-hour clock (Geometry, Measurement and Statistics 3, pages 57–62)	**p102–105**	**GMS Milestone 2** • Tell times to the nearest minute, both past and to, shown on analogue clocks • Discuss differences and similarities between digital and analogue clocks including analogue clocks with Roman numerals, and explain how they display the time • Say times shown on a 12-hour digital clock • Calculate a given number of minutes earlier and later than times shown on a 12-hour digital clock
Mea 2: Exploring units of time (Geometry, Measurement and Statistics 3, pages 63–68)	**p106–109**	**GMS Milestone 2** • Use terms such as midday, midnight, a.m. and p.m. to explain how time progresses and is labelled in a 24-hour day • Find and compare durations of time across 24 hours, including times starting at half past the hour • Compare and order units of time, and know the number of seconds in a minute, minutes in an hour and hours in a day • Recall, or know how to work out, the number of days in each month and the number of days in a year, or leap year

Activity group title and pages in the Teaching Resource Handbook	Accompanying Pupil Book pages	Milestone statements covered
Calc 13: **Using apparatus and imagery to introduce the written column method for adding** (Number, Pattern and Calculating 3, pages 193–198)	**p110–113**	**NPC Milestone 5** • Choose whether a mental or column method is the most appropriate before solving different adding and subtracting problems • Use rounding when making a reasonable estimate of the possible answer to an adding or subtracting problem • Add or subtract amounts of money over £1 using a written method
Calc 14: Using apparatus and imagery to support subtracting and introducing the written column method (Number, Pattern and Calculating 3, pages 199–204)	**p114–117**	**NPC Milestone 5** • Illustrate mental strategies for adding and subtracting 2- and 3-digit numbers on an empty number line • Use the inverse relation between adding and subtracting to check solutions to calculations
Calc 15: Exploring ratio and scaling problems and introducing the short written methods of multiplying and dividing (Number, Pattern and Calculating 3, pages 205–211)	**p118–121**	**NPC Milestone 5** • Illustrate scaling up and ratio problems with structured apparatus and use the language of scaling and ratio to explain their solutions • Make general statements about what happens when multiplying and dividing by 10 • Illustrate and find solutions to multiplying and dividing problems involving teen numbers using structured apparatus and recall of facts
Mea 3: Measuring accurately and calculating with metres, centimetres and millimetres (Geometry, Measurement and Statistics 3, pages 69–73)	**p122–125**	**GMS Milestone 3** • Show understanding of metres, centimetres and millimetres, by making sensible estimates of lengths using suitable units • Convert between metres and centimetres, and centimetres and millimetres • Solve real-life measure problems by adding and subtracting lengths, including those given in mixed units • Measure accurately to calculate the perimeter of rectangular shapes • Complete tally charts and pictograms to collect and present data, then discuss their findings

Activity group title and pages in the Teaching Resource Handbook	Accompanying Pupil Book pages	Milestone statements covered
Mea 4: Calculating with pounds and pence, and handling money (Geometry, Measurement and Statistics 3, pages 74–79)	**p126–129**	**GMS Milestone 3** • Use mathematical apparatus to model and discuss the relationship between the values of 1p, 10p and £1 coins • Make given amounts of money up to £10, using the fewest coins and/or notes • Calculate the total of two prices given in pounds and pence, and discuss their strategy, e.g. adjusting, rounding • Decide if goods are affordable, given a certain budget, and calculate the change they should receive
Calc 16: Making connections between dividing into equal parts and calculating with fractions (Number, Pattern and Calculating 3, pages 212–217)	**p130–133**	**NPC Milestone 6** • Fluently recall double and half facts and use these to find halves and quarters of numbers within their working range • Make connections between unit fractions as operators and division by integers (e.g. connect halving and quartering with dividing by 2 and 4, and finding thirds with dividing by 3) • Interpret remainders as fractions and notice that the context will affect how we deal with the remainder when dividing odd numbers into two or four parts • Differentiate between finding half of a number and finding how many halves are in a number
Mea 5: Measuring and calculating with grams and kilograms (Geometry, Measurement and Statistics 3, pages 80–87)	**p134–137**	**GMS Milestone 4** • Use a dial weighing scale to measure individual amounts in 100 g increments, up to 5 kg • Recognize equivalences between g and kg, e.g. 1000 g = 1 kg, 500 g = $\frac{1}{2}$ kg, 250 g = $\frac{1}{4}$ kg • Find the total mass of two or more items and the difference in mass between items • Interpret word problems involving mass, modelling with weights or other apparatus, as appropriate
Mea 6: Measuring and calculating with litres and millilitres (Geometry, Measurement and Statistics 3, pages 88–92)	**p138–141**	**GMS Milestone 4** • Recall that there are 1000 ml in 1 ℓ and know, or work out, the volume of $\frac{1}{2}\ell$, $\frac{1}{4}\ell$ and $\frac{3}{4}\ell$ in ml • Understand the term 'capacity' and make sensible estimates of volumes of liquid held in different containers • Measure out a precise volume of liquid using the scale on a jug or other scaled vessel • Solve capacity word problems, e.g. 'What is the total volume of...?', and 'How much is left if I pour out...?'

Activity group title and pages in the Teaching Resource Handbook	Accompanying Pupil Book pages	Milestone statements covered
NNS 7: Understanding fractions of a whole and fractions as numbers (Number, Pattern and Calculating 3, pages 105–110)	**p142–145**	**NPC Milestone 6** • Connect ordinal number names with names for fractions and understand that the denominator (i.e. the name of the fraction) tells us how many parts a whole has been divided into and the numerator tells us how many of those parts are represented • Know that fractions have places on the number line between whole numbers (integers) • Know that the greater the number of parts a number is divided into, the smaller each of the parts becomes
NNS 8: Using fraction notation to describe parts of a discrete set (Number, Pattern and Calculating 3, pages 111–117)	**p146–149**	**NPC Milestone 6** • Know that half can be represented by different equivalent fractions • Illustrate written fractions with apparatus and can write a fraction in response to seeing it built with apparatus • Add and subtract fractions with the same denominator within one whole Shape and within one set
PA 5: Finding all possibilities and investigating a general statement (Number, Pattern and Calculating 3, pages 68–74)	**p150–153**	**NPC Milestone 6** • Investigate suitable problems and work systematically to show that they have tried and tested all possibilities • Choose efficient recording systems • Express a general statement and explain their reasoning
Geo 4: Using grids and grid references (Geometry, Measurement and Statistics 3, pages 49–55)	**p154–157**	**GMS Milestone 4** • Present data that they have collected in tables and scaled bar charts • Notice patterns in tables and bar charts, e.g. 'The difference between the most and least popular is ... ' • Identify positions on a grid, using letter/number grid references, e.g. D6 • Describe movements on a grid with increasing accuracy, e.g. forward 2, left 1, down 3

Cover

Practice

The yellow team have scored 44 points. They scored 24 points in the red hoop and 20 points in the yellow hoop. Encourage children to use times tables facts as a quick way to work out the answer: red hoop: $8 \times 3 = 24$; yellow hoop: $4 \times 5 = 20$.
$24 + 20 = 44$
Some children may try to find the answer using repeated adding ($8 + 8 + 8 + 4 + 4 + 4 + 4 + 4$) or they may use this as a way of checking their answer.

Going deeper
There are three possibilities:
red hoop: 2; yellow hoop: 0
red hoop: 1; yellow hoop: 2
red hoop: 0; yellow hoop: 4
Encourage children to work systematically, and to use their times tables facts, to find all the possibilities.

Page 2: Exploring all the combinations of numbers to 10 (Calc 1·1 & 1·2)

Practice

1 a Three of the adding facts on the track total 7: 4 + 3, 5 + 2 and 6 + 1.

b Other ways that total 7 are: 3 + 4, 2 + 5, 1 + 6, 0 + 7, 7 + 0.

2 a Five of the adding facts on the track total 9: 1 + 8, 2 + 7, 6 + 3, 7 + 2, 4 + 5.

b Other ways that total 9 are: 9 + 0, 8 + 1, 5 + 4, 3 + 6, 0 + 9.

Going deeper

1 You can be sure that you have found all the ways of making 7 (or 9) by arranging apparatus for each combination of two numbers in order or by writing each combination (using two numbers) that equals 7 (or 9) in order. You can then see that you have them all and that you have not left any combinations out.

2 Children could use Numicon Shapes to explore the combinations here. If children want to show both ways of making the combinations, e.g. 2 and 6 and 6 and 2 they will need: two 1-shapes, two 2-shapes, two 3-shapes, two 4-shapes, two 5-shapes, two 6-shapes, two 7-shapes, two 8-shapes. The combinations are:

8 + 0

0 + 8

7 + 1

1 + 7

2 + 6

6 + 2

3 + 5

5 + 3

4 + 4

If children just want to show one way for each combination (because they understand they can then reverse the order of the numbers), they will need: one each of a 1-shape, a 2-shape, a 3-shape, a 5-shape, a 6-shape, a 7-shape, an 8-shape and two 4-shapes.

3 The numbers will be any two numbers with a difference of 5 that total less than 13, e.g.

3 + 5 = 0 + 8

3 + 6 = 1 + 8

3 + 7 = 2 + 8

3 + 8 = 3 + 8

3 + 9 = 4 + 8

Page 3: Subtracting numbers from 10 and below (Calc 1·3)

Practice

1 a Three facts on the track subtract from 6: 6 – 2, 6 – 0, 6 – 3.

b The missing ones are: 6 – 1, 6 – 4, 6 – 5, 6 – 6.

2 a Four facts on the track subtract from 8: 8 – 4, 8 – 3, 8 – 6, 8 – 5.

b Other possibilities are: 8 – 0, 8 – 1, 8 – 2, 8 – 7, 8 – 8.

Going deeper

1 3 + 4 = 7 and 7 – 3 = 4

2 + 6 = 8 and 8 – 6 = 2

5 – 4 = 1 and 4 + 1 = 5

2 Answers will vary but could include:

a when 0 is added to any number the number does not change

b when 1 is added to any number the answer is always the next whole number

c when 0 is subtracted from any number the number does not change

d when half of a number is subtracted the answer is always the same as the number being subtracted (children will have had to recognize the doubling and halving relationship between the numbers)

e when 2 is added to any number the answer is always the whole number after the next whole number

f when subtracting two consecutive numbers the answer is always 1

Page 4: Exploring adding strategies (Calc 1·4 & 1·5)

Practice

1 Answers will vary, e.g. 5 + 1 + 4 and 3 + 3 + 4 and 6 + 4 and 5 + 2 + 2 + 1

or 5 + 3 + 1 + 1 and 4 + 2 + 4 and 6 + 4 and 5 + 3 + 2

or 5 + 5 and 4 + 3 + 3 and 6 + 1 + 1 + 2 and 4 + 4 + 2

or 6 + 3 + 1 and 5 + 4 + 1 and 5 + 2 + 3 and 4 + 4 + 2

or 6 + 2 + 2 and 4 + 3 + 3 and 5 + 5 and 4 + 4 + 1 + 1

Numbers in each separate adding sentence can be in a different order.

2 **a** The total value is 20.

b Answers will vary.

Going deeper

1 Answers could vary but look for children who notice the fact of 10, i.e. 6 + 4 and then add the 10 to 15 to equal 25.

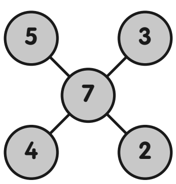
2 When estimating children should refer to the relationships between the numbers each child scored, e.g. Asmat and Zara both scored a 10 and a 5. Asmat scored a 9 and a 6, which are both higher numbers than Zara's 7 and 4. Although Zara scored a 3 to Asmat's 1, it is not enough to make her score higher than Asmat's.

Sam 29, Ann 26, Asmat 31, Zara 29 so Asmat has the highest score.

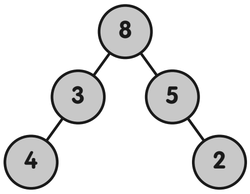
Page 5: Solving number puzzles (Calc 1·6)

Practice

1 **a** Answers will vary, e.g.



b Answers will vary, e.g.



Going deeper

1 **a** The answer to the smallest number that can be made is 8. 1 is in the middle with 2 and 5 on one diagonal and 3 and 4 on the other.

The highest number that can be made is 25. 10 is in the middle with 8 and 7 on one diagonal and 9 and 6 on the other.

b The answer to the smallest number that can be made is 6. (3 in middle, with 1 and 2 and/or 2 and 1 on the diagonals.)

The answer to the largest number that can be made is 27. (8 in middle, with 9 and 10 and/or 10 and 9 on the diagonals.)

NPC Milestone 1

- Fluently recall adding and subtracting facts of all numbers to 10 and use these when adding lists of small numbers.
- Fluently recall most adding and subtracting facts of all numbers to 20 and use efficient strategies to calculate those not known.

Page 6: Finding how many by grouping in 10s and 100s (NNS 1·1)

Practice

1 Answers will vary but children should set out counters in Numicon Patterns. Look for children who make sensible estimates.

2 **a** 42; forty-two; 4 tens and 2 ones

b 90; ninety; 9 tens

c 58; fifty-eight; 5 tens and 8 ones

d Answers will vary.

Going deeper

1 Children should show at least some of the following: 63, sixty-three, six 10-shapes and a 3-shape, six 10-rods and a 3-rod, 63 on a number line, 63 different objects either arranged in Numicon Patterns like Ben's collection and/or arranged in a different pattern, 63 objects drawn in Numicon Patterns and/or a different pattern, 63p as six 10p coins and three 1p coins. Some children may use a variety of calculations, e.g. 60 + 3 = 63.

2 Answers will vary.

Page 7: Exploring a Tens and Ones frame (NNS 1·2)

Practice

1 Ravi has 38 stickers.

2 **a** Tia has fewer in the ones column.

b Tia has more tens.

c Tia has 45 stickers and Ravi has 38 stickers so Tia has more stickers.

Going deeper

1 Initially children should build either 50, 51, 52, 53, 54, 55, 56, 57, 58 or 59 using five 10-shapes and the appropriate 'ones' Shape and then refer to all the other numbers as having 5 tens. They should explain that putting numbers in order means you can be sure you have them all.

2 Mike does not have enough money for the trainers. Children should explain that he has reversed the digits which means 2 tens are fewer than 6 tens and consequently he does not have enough money.

Page 8: Finding how many beyond 100 (NNS 1·3)

Practice

1 Ravi has 1 hundred, 2 tens and 7 ones.

2 **a** 133; one hundred and thirty-three

b 250; two hundred and fifty

c Answers will vary.

Going deeper

1 Ben's estimate is closer because the difference between Ben's estimate is smaller than Ravi's. (Ravi's estimate is 30 away from 170 whereas Ben's is only 6 away.)

2 Molly won the cake.

Page 9: Exploring a Hundreds, Tens and Ones frame (NNS 1·4)

Practice

1 Children should disagree as Molly does not have more shells than Ben. Children should mention they both have the same number of hundreds but Ben has more tens than Molly so he has more shells. They may then suggest that Molly may have thought she had a higher number as she does have more ones than Ben but the place of the numbers matters, i.e. hundreds are worth more than tens and tens worth more than ones.

2 **a** The highest number is 852. The lowest number is 258.

b 825, 582, 528, 285 come in between. Look for children who work systematically.

Going deeper

1 The value of the counters shows 3 in the hundreds column so 300; 4 in the tens column so 4 tens and 6 in the ones column so 6 ones, so the number is 346.

2 **a** The highest number you can show with ten counters is 811.

b The lowest number you can show with ten counters is 118.

c The lowest 2-digit number you can show with ten counters is 19.

NPC Milestone 1

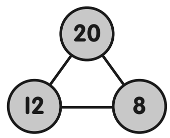
- Give a sensible estimate of numbers of more than 100 objects.

Page 10: Using adding facts of 10 to find other adding facts (Calc 2·3)

Practice

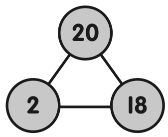
1 **a** 4 + 6 **b** 5 + 5 **c** 8 + 2 **d** 1 + 9

2 **a** 20, 12, 8 (20 in upper circle, 12 left lower circle, 8 right lower circle) 12 + 8 = 20, 8 + 12 = 20

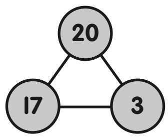


or

20, 2, 18 (20 upper circle, 2 left lower circle, 18 right lower circle) 2 + 18 = 20, 18 + 2 = 20

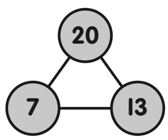


b 20, 17, 3 (20 in upper circle, 17 left lower circle, 3 right lower circle) 17 + 3 = 20, 3 + 17 = 20



or

20, 7, 13 (20 upper circle, 7 left lower circle, 13 right lower circle) 7 + 13 = 20, 13 + 7 = 20



3 **a** 65 + 5 = 70 adding fact 5 + 5

b 31 + 9 = 40 adding fact 1 + 9

c 6 + 24 = 30 adding fact 6 + 4

Going deeper

1 These calculations give a total of 20: 16 + 4, 3 + 17, 8 + 12.

An example of an explanation would point out that knowing facts of 10 and spotting those combinations of ones numbers is helpful (also knowing which combinations of ones do not equal 10, e.g. 3 + 8 is too many because 2 + 8 equals 10).

Page 11: Finding all combinations for teen numbers (Calc 2·5)

Practice

1 Numicon Shapes: 9 and 6, 8 and 7, 10 and 1 and 4 (to show 11 and 4), 10 and 2 and 3 (to show 12 and 3), 10 and 3 and 2 (to show 13 and 2), 10 and 4 and 1 (to show 14 and 1). Some children may write facts: 14 + 1 = 15, 13 + 2 = 15, 12 + 3 = 15, 11 + 4 = 15, 9 + 6 = 15, 8 + 7 = 15.

2 16 – 0 = 16
16 – 1 = 15
16 – 2 = 14
16 – 3 = 13
16 – 4 = 12
16 – 5 = 11
16 – 6 = 10
16 – 7 = 9
16 – 8 = **8**
16 – 9 = **7**
16 – 10 = **6**
16 – 11 = 5
16 – 12 = 4
16 – 13 = 3
16 – 14 = 2
16 – 15 = 1
16 – 16 = 0

Going deeper

1 **a** You can adjust 9 + 6 = 15 to show a total of 14 by subtracting 1 from the 6 to make 9 + 5 = 14 or by subtracting 1 from the 9 to make 8 + 6 = 14. If children make other adjustments it would be helpful to ask them to explain their thinking (some may just use a known fact).
b Answers will vary.

2 Some children may just know the answer. Some may refer to the relationship between 7 and 3 and the number trio being 7, 3 and 4 and therefore the answer is 14, because they also understand that when a single-digit number is subtracted from a 2-digit number the tens don't change

3 **a** Answers will vary. Some children may explain that they recognize that 5 is the missing number in the number trio 19, 14 and 5 and therefore know the missing number is 5. Some may refer to the inverse and find the answer because they know 14 + 5 = 19. Some may understand that if they subtract 14 from 19 they know the missing number is 5.
b Answers will vary. Some children may explain that they can subtract 6 from 18 which gives them the answer 12. Some may refer to the connection between knowing 2 + 6 = 8 and 12 + 6 = 18 so the missing number is 12. Some may explain relationships based on partitioning numbers, e.g. knowing the missing number will be more than 10 because 6 + 10 = 16 but the total of 18 means 2 more are needed and so 6 + 12 = 18.

4 Answers will vary but each should show a connection with 4 + 3, e.g. 54 + 3, 4 + 93 or 173 + 4.

Page 12: Relating adding and subtracting below 10 to adding and subtracting for teen numbers (Calc 2·6)

Practice

1 5 + 7 = 12, 7 + 5 = 12, 12 – 5 = 7, 12 – 7 = 5

2 The adjusted trio could show: 18, 15, 3 so the number sentences would be: 15 + 3 = 18, 3 + 15 = 18, 18 – 3 = 15, 18 – 15 = 3

or

The adjusted trio could also show: 18, 5, 13 so the number sentences would be: 5 + 13 = 18, 13 + 5 = 18, 18 – 5 = 13, 18 – 13 = 5.

3 **a** 14 + 5 = 19 or 4 + 15 = 19 **b** 13 + 1 = 14 or 3 + 11 = 14
c 12 + 3 = 15 or 2 + 13 = 15

Going deeper

For Going deeper questions **1b** and **2**, you could give children a copy of number trios cut out from the photocopy master 35 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook*.

1 **a** Luca needs to save £6 more.
b Number trio: 18, 12, 6
c He should use the calculation 18 – 12 because it is a subtracting problem (even though the language used is 'how much more').

2 Number sentences: 30 + 30 = 60 and 60 – 30 = 30
Number trio: 60, 30, 30
Children should notice that there are only two possible number sentences for this type of trio and refer to the double fact having the same digits which does not result in a different commutative fact.

Page 13: Solving missing number problems (Calc 2·9 & 2·10)

Practice

1 3 + 7 = 10

2 **a** The answer is 9. Knowing 1 + 9 = 10 could help you solve this.
b The answer is 12. Knowing 8 + 2 = 10 could help you solve this.
c The answer is 14. Knowing 6 + 4 = 10 could help you solve this.
d The answer is 3. Knowing 7 + 3 = 10 could help you solve this.
e The answer is 20. Knowing 5 + 5 = 10 could help you solve this.
f The answer is 11. Knowing 9 + 1 = 10 could help you solve this.

Going deeper

1 Answers may vary but an example of an explanation would point out the relationship between 32 and 40 and show understanding that knowing 2 + 8 = 10 helps to work out 32 + 8 = 40. So the missing number will be 8. You would then point out that 32 = 40 – $\square$ is the same number trio and therefore 8 will be the missing number again.

2 **a** He needs to run 9 km further.

b Some children may see the problem as a subtracting problem and therefore use 20 – 11 = 9.

Some children may see the missing part of the problem and express it themselves using an empty box, e.g. 20 = 11 + $\square$ or may use 11 + $\square$ = 20 because it is an option given. 20 – $\square$ = 11 does not really express the problem although it uses the same numbers.

3 **a** Answers may vary as some children may show the answer using a calculation, i.e. £1 – 60p = 40p. Others may explain that because they know about the relationship between 100 and 60 (relating to facts of 10) and understand they have to find how much more to calculate change, they know the answer is 40 and therefore 40p.

b Answers will vary: four 10p coins, two 20p coins, one 20p and two 10p coins, any one or more of the coins in any of these suggestions could be replaced with the equivalent 5p, 2p or 1p coins.

NPC Milestones 1 and 2

- Know and use patterns in adding and subtracting facts for any number to 20 and beyond to recall facts, to organize them systematically, and to check that all combinations have been found.
- Use known adding and subtracting facts to derive facts to 30.
- Use understanding of equivalence, the '=' symbol and knowledge of the inverse relation between adding and subtracting to solve problems where the empty box symbol represents an unknown number.

Page 14: Exploring hundreds, tens and ones (NNS 2·1)

Practice

1 **a** 8 packs **b** 5 packs **c** 7 packs

2 **a** 60 sixty **b** 90 ninety **c** 40 forty

Going deeper

1 Numbers inside the circle could be 1–9, 11–19, 21–29, 31–39, 41–49, 51–59, 61–69, 71–79, 81–89, 91–99. Numbers inside the rectangle but outside the circle could be: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100.

2 **a** 3 packs **b** 6 packs **c** 9 packs **d** 2 packs **e** 13 packs

Page 15: Exploring multiples of 10 further (NNS 2·2)

Practice

1 Answers may vary depending how far children continue the table and whether they realize it could go on indefinitely. The value is in children recognizing that the number of tens in each multiple of 10 is seen within the multiple of 10, e.g. 12 and 120.

2 **a** 19 tens **b** 24 tens **c** 75 tens
d 8 tens **e** 61 tens **f** 33 tens

Going deeper

1 **a** Answers will vary but each set of numbers should include each digit shown. For example: 120, 460, 70, 90.

b Answers will vary.

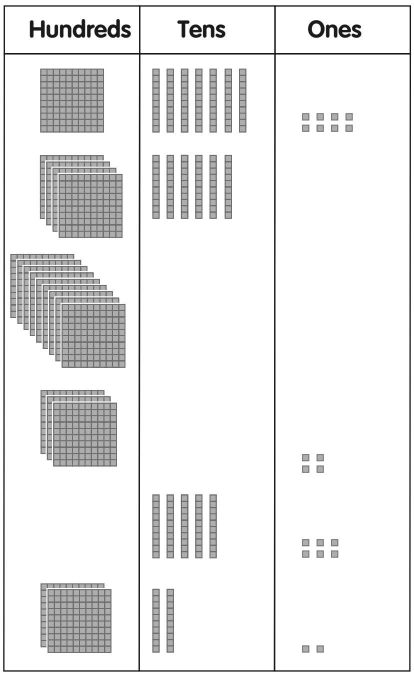
c Answers will vary.

Page 16: Exploring base-ten apparatus (NNS 2·3)

Practice

1 The box of milk could be represented using one 100-flat or ten 10-sticks or one hundred 1-cubes.

2



3 **a** 500 **b** 900 **c** 700 **d** 400

Going deeper

1 160 cubes

2 This is not correct. Ten of the 10-rods should be removed from the tens column leaving just five 10-rods, and another 100-flat should be placed in the hundreds column. The hundreds digit should be changed from 3 to 4. One of the ones should be removed or the 6 changed to a 7. So the new number could be 456 or 457.

Page 17: Exploring hundreds, tens and ones (NNS 2·4 & 2·5)

Practice

1 195 has 19 tens and 5 ones

241 has 24 tens and 1 one

759 has 75 tens and 9 ones

586 has 58 tens and 6 ones

612 has 61 tens and 2 ones

443 has 44 tens and 3 ones

2 **a** 823 **b** 139

c 217 **d** 514

e 748, 848, 948. Some children may extend, e.g. 1748, 1848, 1948.

Going deeper

1 4 hundreds, 6 tens and 9 ones

Other ways might include:

46 tens and 9 ones

469 ones

4 hundreds and 69 ones.

2 **a** 236 **b** 241

c 482 **d** Answers will vary.

NPC Milestone 1

- Count aloud across multiples of 100 and multiples of 1000.
- Read, write and build (with apparatus) 2- and 3-digit numbers.
- Relate grouping and place value notation to say the value of each digit in a 3-digit number.

Page 18: Exploring adding, subtracting and equivalence (P&A 1·1 & 1·2)

For the questions on this page you could give children a copy of number trios cut out from the photocopy master 35 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook.*

Practice

1 17, 14, 3 or 17, 13, 4

2 14 + 4 = 18 or 4 + 14 = 18

19 – 12 = 7 or 19 – 7 = 12

9 + 7 = 16 or 7 + 9 = 16

19 – 5 = 14 or 19 – 14 = 5

17 – 15 = 2 or 17 – 2 = 15

16 + 3 = 19 or 3 + 16 = 19

18 – 5 = 13 or 18 – 13 = 5

12 + 5 = 17 or 5 + 12 = 17

11 + 5 = 16 or 5 + 11 = 16

16 – 4 = 12 or 16 – 12 = 4

Going deeper

1 There are nine number trios for 19 unless children include the trio 19, 0, 19 and decide there are ten trios: 1, 18, 19; 2, 17, 19; 3, 16, 19; 4, 15, 19; 5, 14, 19; 6, 13, 19; 7, 12, 19; 8, 11, 19; 9, 10, 19

2 **a** Una paid £7. Number trio: 12, 5, 7

b Answers will vary.

Page 19: Relating adding and subtracting facts (P&A 1·3)

Practice

1 Answers will vary but an example of an explanation would point out that because 10 has been added to the total, e.g. 8 to make 18, 10 also needs to be added to one of the other smaller numbers, e.g. 3 to make 13, to make the number trio correct. Some children may decide that 10 was added to the 3 making 13 first so therefore 10 needed to be added to the total, 8 to make 18. Answers should continue to explain how 10 more has been added to the total and one of the smaller numbers from the second trio to the third. Some children may identify the connection between the first and third trios as being 20 more and may explain how the 20 needed to balance the trio has been shared between both smaller numbers.

2 13 + 15 = 28, 15 + 13 = 28, 28 –13 = 15, 28 – 15 = 13

3 For Practice question 3 you could give children a copy of number trios cut out from the photocopy master 35 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook.*

Answers could vary as they could include higher numbers, e.g. 49, 34, 15 but will probably follow the pattern 19, 14, 5 or 19, 15, 4 and 29, 14, 15.

Going deeper

1 a Could be 4 or 32.

b Could be 6 or 16.

2 Answers will vary but an example of an explanation would point out that when adding numbers together it does not matter which order the numbers are written down or spoken, the answer is always the same. The total is the largest number.

3 Answers will vary slightly but children should agree that these trios are related because the same ones digits are used in both of them.

Page 20: Recording families of related facts (P&A 1·4)

Practice

1 12 + 13 = 25

13 + 12 = 25

25 – 12 = 13

25 – 13 = 12

25 = 12 + 13

25 = 13 + 12

12 = 25 – 13

13 = 25 – 12

2 The answer is 28. Using two 10-shapes and an 8-shape.
14 + 14 = 28, 28 – 14 = 14, 28 = 14 +14

Going deeper

1 Suggestions should include understanding that double numbers do not have commutative facts as both digits are identical and they also only have one subtracting sentence.

2 It matters which order the numbers are written in for a subtracting sentence (unless children understand negative numbers). If there were 23 apples you could not take 25 away. The answer for subtracting questions is always smaller than the amount you start with (for whole numbers). Although 23 is smaller than 25 and can be subtracted from 25 the answer should be smaller (not 48). Some children may just say the subtracting symbol should be an adding symbol but should be encouraged to explain further.

3 For Going deeper question 3 you could give children a copy of number trios cut out from the photocopy master 35 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook.*

The number trio for each problem is the same: 39, 21, 18. George counts 39 cars altogether. 18 more cars can park in the car park.

Page 21: Solving empty box number problems (P&A 1·5)

Practice

1 Answers will vary but should point out relationships between numbers, e.g. inverse property between adding and subtracting, how tens don't change when subtracting single digits from 2-digit numbers, and also show understanding about equivalence.

a 24 + 5 = 29

b 4 + 23 = 27

c 6 + 24 = 30

d 26 = 23 + 3

e 28 = 22 + 6

f 27 = 12 + 15

Going deeper

For these Going deeper questions you could give children a copy of number trios cut out from the photocopy master 35 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook*

1 a The answer is 14. The number trio is 26, 14, 12.

b Other missing number problems could be 26 = 14 + ? or 14 = 26 – ? or 12 = 26 – ?

2 Answers will vary but possible number trios are:

38, 25, 13, and 18, 15, 3 (cannot use 5, 8, 32)

or

38, 25, 13 and 8, 5, 3 (cannot use 18, 15, 32)

or

13, 8, 5 and 18, 15, 3 (cannot use 38, 25, 32)

or

18, 13, 5 (cannot use 38, 25, 15, 8, 3, 32)

Some children may notice that the number that can never be used is 32.

NPC Milestone 2

- Recognize when a given number is a multiple of 2, 3, 4, 5, 8 or 10 (at this stage a few children may recognize common multiples but this is not a milestone).

Page 22: Keeping count (NNS 3·1 & 3·2)

Practice

1 There was 1 counter in the 100s pot, 4 counters in the 10s pot, 5 counters in the 1s pot.

2

Days of the week	Tallies	Total
Monday	卌 卌 卌 卌 卌 卌 II	32
Tuesday	卌 卌 卌 卌 卌	25
Wednesday	卌 卌 卌 卌 卌 卌 卌 I	36
Thursday	卌 卌 卌 卌 卌 III	28
Friday	卌 卌 卌 IIII	19

Going deeper

1 Answers will vary but could include a tally chart, counters in a pot, etc. with an explanation of how the method is used.

2 Children will need to organize the collection of data. They will see they can answer the question from this without having to draw a graph.

Page 23: Exploring number lines (NNS 3·3)

Practice

1 **a** 100, 110, 120, 130, 140, 150, 160, 170, 180, 190

b 460, 470, 480, 490, 500, 510, 520, 530, 540

c 601, 602, 603, 604, 605, 606, 607, 608, 609

d 200, 300, 400, 500, 600, 700, 800, 900

2 186

Going deeper

1 **a** 131, 132, 133, 134, 135, 136, 137, 138, 139 or

140, 150, 160, 170, 180, 190, 200, 210, 220

Some children might suggest: 230, 330, 430, 530, 630, 730, 830, 930, 1030.

b 510, 520, 530, 540 – 560, 570, 580, 590, 600 or

546, 547, 548, 549 – 551, 552, 553, 554,555 or

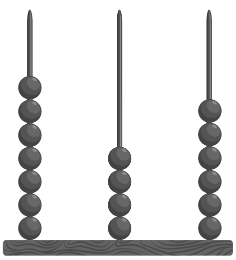
350, 400, 450, 500 – 600, 650, 700, 750, 800.

2 **a** 2 m **b** twenty 10-rods **c** forty 5-rods

Page 24: Exploring an abacus (NNS 3·5)

Practice

1



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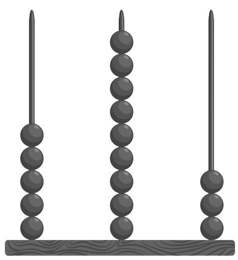

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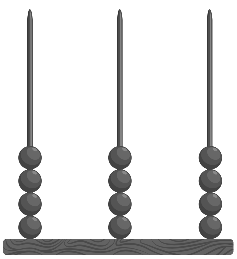

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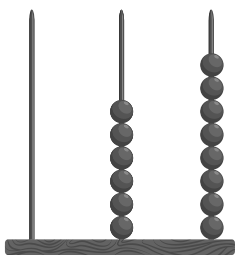

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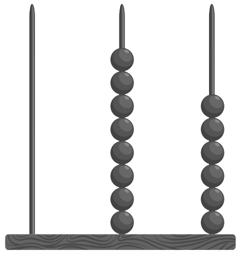

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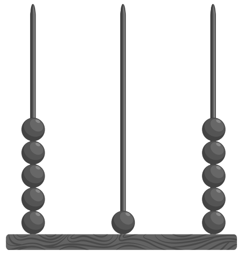

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2 For Practice question 2 if you don't have number cards you can use photocopy master 19 from the *Geometry, Measurement and Statistics 3 Teaching Resource Handbook*.

Children should show understanding that when they add their number each time once it reaches 10 ones, those are removed and 1 is placed on the tens column (and any remainder are left on the ones column). Also, when 10 tens are reached they are removed and 1 is placed on the hundreds column (the remainder being left on the tens column).

Going deeper

1 The highest number that can be made on a hundreds, tens and ones abacus is 999. It would need 27 counters.

2 Answers will vary depending on rules that children agree. If they agree there must be at least one counter on each column then you can show six numbers. If they agree the counters can be placed anywhere you can show 12 numbers.

3 374 is not correct because there are only 4 counters representing 40 in the tens column (not 7 to represent 70) and 7 counters representing 7 ones in the ones column (not 4 counters representing 4 ones). The 3 counters in the hundreds column is correct. The correct number is 347.

Page 25: Zero as a place holder (NNS 3·5)

Practice

1 62 – 620 and 602

37 – 370 and 307

14 – 140 and 104

83 – 830 and 803

26 – 260 and 206

59 – 590 and 509

Going deeper

1 02-01-07

2 **a** 0002 and 0011 **b** 0010 and 0019 **c** 0090 and 0099

d 0120 and 0129 **e** 0241 and 0250 **f** 0500 and 0509

g 0710 and 0719 **h** 1000 and 1009

NPC Milestone 2

- Understand the use of zero as a place holder.
- Count forwards and backwards in sequences of multiples within their working range.

Page 26: Bridging multiples of 10 when adding (Calc 3·1)

Practice

1 Answers may vary but some children may say they would double 6 to equal 12 and add 1. Others may suggest doubling 7 to equal 14 and subtracting 1. Some will suggest using bridging, e.g. by partitioning the 6 into 3 and 3; adding 3 to the 7 to equal 10 then adding 3 more to equal 13.

2 Children may use Numicon Shapes or number rods to show how they have used Ravi's bridging method and/or they may write a calculation, e.g. for 9 + 6, they may write 9 + 1 + 5 = 15. Answers will include any three of the following: 9 + 6 = 15, 9 + 5 = 14, 9 + 4 = 13, 8 + 6 = 14, 8 + 5 = 13, 8 + 4 = 12, 7 + 6 = 13, 7 + 5 = 12, 7 + 4 = 11.

Going deeper

1 Children may say they would find the total of 6 + 8 first to know how many the equivalent calculation should be (by partitioning 8 into 4 and 4, adding 4 to the 6 to equal 10 then adding 4 more to equal 14). They should then say they would know 4 is needed in the empty box because 10 needs 4 more to be added to equal 14.

2 Children should point out that this can be solved by bridging, i.e. by partitioning the 8 into 5 + 3, adding 5 to 35 to equal 40 and then adding the 3 to equal 43, thus giving the total 143. They should also recognize that the 100 doesn't change. Some children may write 135 + 5 + 3 = 143.

Children may check by using apparatus, a number line or by using inverse.

Page 27: Adding 9 (Calc 3·2)

Practice

1 23 + 9 = 32, 47 + 9 = 56, 172 + 9 = 181, 384 + 9 = 393, 96 + 9 = 105

2 28 + 9 = 37, 39 + 9 = 48, 256 + 9 = 265, 465 + 9 = 474

Going deeper

1 The answer is usually in the row below and diagonally back one column from the starting number (apart from when you add 9 to a number where the unit number is 1 when the answer is the last number in the same row as the 1). Some children may also mention that the tens digit is always 1 more and the ones digit is always 1 fewer.

2 **a** 43 + 9 = 50 + 1 could be changed to 43 + 9 = 50 + 2 or 42 + 9 = 50 + 1

b 376 + 9 = 380 + 6 could be changed to 376 + 9 = 380 + 5 or 377 + 9 = 380 + 6

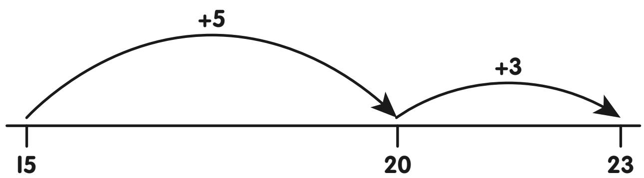
3 Answers will vary.

Page 28: Bridging multiples of 10 (Calc 3·3)

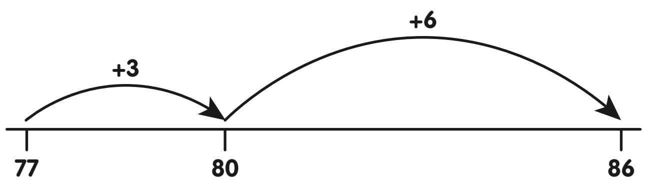
Practice

1 Answers will vary, depending on the numbers chosen. There are 16 possible answers. Two examples are given:

15 + 8 = 23



77 + 9 = 86

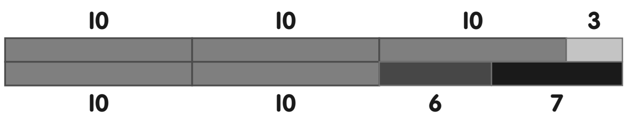


2 **a** 9 + 8 + 6 = 20 + 3 (or 10 + 10 + 3)

b 8 + 8 + 7 = 20 + 3 (or 10 + 10 + 3)

Going deeper

1 Children should explain that it is not necessary to show 100 made with rods as the hundreds do not change. Some children may show rods in the Number Rod Track or along the 0–100 Number Line and should also explain that it is possible to use the Number Rod Track and Number Line to show other number ranges, e.g. in this case 101–200.



2 36 + 4 = 40 40 + 3 = 43 36 + 7 = 43

Page 29: More bridging and adding lists of numbers (Calc 3·3)

Practice

1 Answers will vary, though will include any three of the following calculations. However, the individual calculations may have the same numbers used but in a different order: 6 + 7 + 8 = 21; 6 + 7 + 9 = 22; 6 + 7 + 10 = 23; 7 + 8 + 9 = 24; 7 + 8 + 10 = 25; 9 + 10 + 6 = 25; 9 + 10 + 7 = 26; 9 + 10 + 8 = 27; 6 + 8 + 9 = 23; 6 + 8 + 10 = 24. Explanations will vary depending on which numbers are chosen but should identify good strategies, e.g. using near doubles, adding 9 strategy, bridging.

2 **a** 67 + 8 = 70 + 5 **b** 5 + 98 = 3 + 100
c 150 + 6 = 147 + 9 **d** 416 + 7 = 420 + 3
e 4 + 330 = 8 + 326

Going deeper

1 Answers will vary but should identify the connection between 8 + 6. Some children may calculate using bridging to add 8 and 6 and then use 54 + 40. Some children may calculate 40 + 40 to equal 80 then add 14.

2 Answers may vary but should suggest adding 3 to 157 to reach 160 then adding 5 to reach 165 – bridging to the next multiple of 10 then adding any remaining amounts.

NPC Milestone 2

- Explain how three related numbers are connected through the inverse relation and write all the related adding and subtracting facts.
- Recall and use adding and subtracting facts to 10 and the bridging strategy in any adding and subtracting calculations that involves crossing multiples of 10, and explain the steps they have taken.

Page 30: Exploring subtracting strategies (Calc 4·1 & 4·2)

Practice

1 **a** The missing number is 8. 10 – 8 = 2
b The missing number is 7. 10 – 7 = 3
c The missing number is 5. 40 – 5 = 35
d The missing number is 3. 60 – 3 = 57

2 20 – 7; 120 – 7; 620 – 7
90 – 2; 290 – 2; 490 – 2
60 – 6; 460 – 6; 760 – 6
The following are not connected: 495 – 2, 406 – 6, 350 – 7

Going deeper

1 Answers will vary slightly but explanations will suggest that because each number ends with 70, only the tens and ones will change; the hundreds stay the same so the calculation is just like subtracting 4 from 70 (or a single digit from a 2-digit multiple of 10).

2 **a** Children may suggest using inverse and adding 43 and 7 to find the answer of 50. Look for children who understand the missing number should be higher than 43 and notice the fact of 10, 3 + 7, which can help when calculating.
b Children may notice that the problem is the same as part **a** but just uses different numbers and therefore use inverse, adding 165 and 5, to find the answer of 170.

Page 31: Subtracting a single-digit number (Calc 4·3)

Practice

1 Answers may vary slightly, but should show understanding that the 6 needs to be partitioned into 4 and 2 so that 4 can be subtracted to reach back to 10 and then the remaining 2 can be subtracted from the 10. The answer is 8.

2 Answers will vary, but should be four of the following possible answers: 12 – 6 = 6, 13 – 6 = 7, 14 – 6 = 8, 15 – 6 = 9, 12 – 7 = 5, 13 – 7 = 6, 14 – 7 = 7, 15 – 7 = 8, 12 – 8 = 4, 13 – 8 = 5, 14 – 8 = 6, 15 – 8 = 7, 12 – 9 = 3, 13 – 9 = 4, 14 – 9 = 5, 15 – 9 = 6

Going deeper

1 Ravi's method would work. Children should explain the bridging process, e.g. partitioning the 7 into 5 and 2, subtracting the 5 to reach the multiple of 10 then subtracting the further 2 to give the answer 208. They may also explain using apparatus.

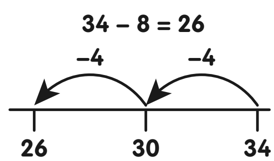
2 $\square$ – 6 = 7

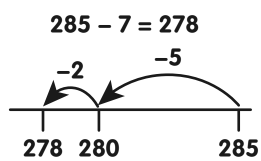
3 Answers will vary.

Page 32: Bridging multiples of 10 when subtracting (Calc 4·4)

Practice

1 Answers will vary, depending on the numbers chosen. There are 16 possible answers. Two examples are given:





2 **a** Children should write 62 – 5 = 57 but some children may also write: 62 – 2 = 60 and 60 – 3 = 57.

b Children should write 195 – 9 = 186 but some children may also write: 195 – 5 = 190 and 190 – 4 = 186.

Going deeper

1 Answers will vary but should use the numbers 57, 62 and 5 and show understanding of needing to use bridging to solve the problem.

2 Answers may vary slightly but should show understanding that when bridging 10 and subtracting a single-digit number from a 3-digit number the hundreds stay the same.

Page 33: Subtracting 9 (Calc 4·5)

Practice

1 Children should point out that 6 should be subtracted from the 9 to reach 20 and then a further 3 should be subtracted from the 20 to give the answer 17. Or that they could subtract 10 instead of 9 and adjust the answer by adding 1.

2 25 – 9 = 16, 57 – 9 = 48, 174 – 9 = 165, 93 – 9 = 84

3 28 – 9 = 19, 139 – 9 = 130, 56 – 9 = 47, 65 – 9 = 56, 382 – 9 = 373

Going deeper

1 Zahra is correct because both sides are equivalent as both equal 44. 53 is 1 fewer than 54 and 9 is 1 fewer than 10 so the calculations balance.

2 **a** 32 **b** 75 **c** 158

Children may have noticed that when 9 is subtracted the tens digit is always 1 ten fewer and the ones digit is always 1 more.

NPC Milestone 2

- Know that multiples of 10 and 100 are important milestones on the number line.
- Know how to adjust calculations and compensate when adding and subtracting 9 and when to use this relationship.

Page 34: Exploring multiples (P&A 2·3 & 2·5)

Practice

1 16 is the eighth number.

24 is the twelfth number.

32 is the sixteenth number.

40 is the twentieth number.

62 is the thirty-first number.

Some children may notice the halving and doubling relationship between the number and its position in the sequence, i.e. by halving the number shown in the sequence of 2s it gives you the ordinal number in that sequence.

2 Multiples of 2 will always end in 0, 2, 4, 6 or 8.

3 **a** 888, **887**, 886, **885**, **884**, 883, **882**

b 221, **220**, **219**, 218, **217**

Going deeper

1 Answers may vary depending on which sorting diagram children choose to use. The numbers must be sorted as:

Multiples of 2: 342, 836, 110, 728, 694, 392, 704

Not multiples of 2: 469, 287, 121

2 There are five multiples of 2 between 12 and 20 including the end numbers and five between 42 and 50, and between 112 and 120. They are the pattern of even numbers.

Page 35: Exploring sequences of multiples of 3, 4 and 8 (P&A 2·4 & 2·5)

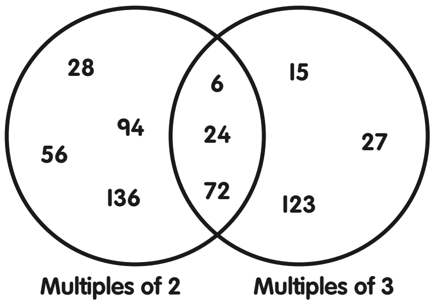
Practice

1 **a** 36, **39**, 42, 45, **48**, 51, **54**, **57**

b 99, **96**, **93**, 90, 87, **84**

c 117, **120**, 123, 126, **129**, **132**

2 You could use photocopy master 50 of a Venn diagram from the *Number, Pattern and Calculating 2 Teaching Resource Handbook*.



3 **a** The list shows multiples of 4.

b 8, 16, 24, 32, 40, 48

Going deeper

1 Not all multiples of 3 are odd numbers, e.g. 6, 12, 18, 24, 30 because the pattern of multiples of 3 is odd, even, odd, even. Some children may notice that this is connected with adding two odd numbers; they always equal an even number. Some children may also notice that if you add the digits of a multiple of 3 together the number is always divisible by 3. Some may notice that the ones digits are repeated from 33 and then again from 66, etc.

2 64

Page 36: Exploring sequences of multiples of 5 and 10 (P&A 2·4 & 2·5)

Practice

1

	Multiple of 5	Not multiple of 5
Odd	25 35 75 125	49 51 17
Not odd	40 50 120	12 26 48 34

2 65

Going deeper

1 Yes, the statements are correct. Children should talk about the doubling and halving relationship between 5 and 10, e.g. that 10 is double 5 so if 20 is the fourth step in the sequence of multiples of 5 then 20 would be half the amount of steps in the sequence of multiples of 10.

2 They could not both have the saved £1·25 because it is not a multiple of 10. To save the same amount in 10p coins as with 5p coins the number would have to be a multiple of 10. (Some children may mention that Rob could have saved £1·25 because it is a multiple of 5.)

3 There are ten multiples of 5 between 0 and 50. Children should mention the relationship from 50 to 100 is also a gap of 50 and the doubling relationship, so there will be another ten multiples of 5 giving a total of 20 between 0 and 100. So knowing how many multiples of 5 between 0 and 50 can help you find out how many there are between 0 and 100.

Page 37: Finding sequences on the 100 square (P&A 2·6)

Practice

1 The missing multiples are: 15, 21, 30, 36, 48, 54, 63, 72, 78, 84, 90, 99.

It is the sequence of 3s.

2

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Children may notice how the pattern of numbers to 40 is then repeated to 80 (and that it has begun again with 88). Some may notice that reading the ones digits from the sequence of 8s is the sequence of 2s backwards.

Going deeper

1 a This is the sequence of 2s.

26	28	30	32
24	22	20	18
10	12	14	16
8	6	4	2

b This is the sequence of 5s.

25	20	15	10	5
30	35	40	45	50
75	70	65	60	55
80	85	90	95	100
125	120	115	110	105

2 a False **b** True

c True **d** False

NPC Milestone 2

- Notice patterns in sequences of multiples, explain the rule for the sequence and use this to find missing numbers.

Page 38: Perpendicular, horizontal and vertical lines (Geo 1·1)

For Practice question 2 and Going deeper question 1, if you don't have geo strips, you can use photocopy masters 12 and 13 from the *Geometry, Measurement and Statistics 3 Teaching Resource Handbook.*

Practice

1 a 4 **b** 8

2 Responses will vary.

3 E, F, H, L, T

Going deeper

1 a Responses will vary but ensure words have fewer than 4 vertical strips and fewer than 8 horizontal strips, e.g. H A T

b Responses will vary. Example: M A T H E M A T I C A L

2 T

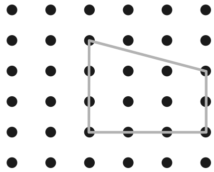
3 Responses will vary.

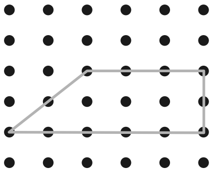
Page 39: Exploring parallel lines (Geo 1·2)

Practice

1 **a** Yes, Ravi's statement is true.

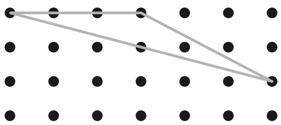
b The shapes are all trapeziums, e.g.





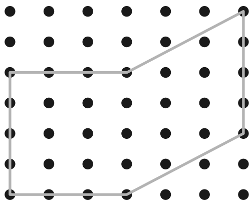
2 Responses will vary.

Example:



3 Responses will vary.

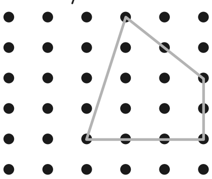
Example:



Going deeper

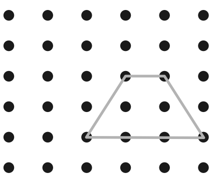
1 Responses will vary.

Example:



2 Responses will vary.

Example:



3 Sorting diagrams will vary according to shapes made.

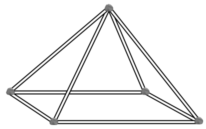
Criteria example:

- Parallel lines
- No parallel lines
- Perpendicular lines
- No perpendicular lines

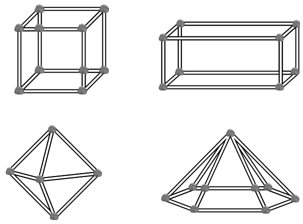
Page 40: Building 3D shapes (Geo 1·3)

Practice

1

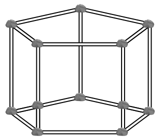


2 Cube, cuboid, octahedron, hexagonal pyramid:



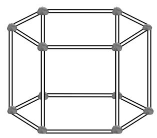
3 Pentagonal prism:

15 straws.



Going deeper

1



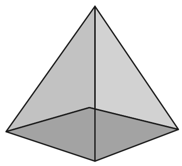
Hexagonal prism

2 Responses will vary.

Page 41: Investigating faces, edges and vertices (Geo 1·4)

Practice

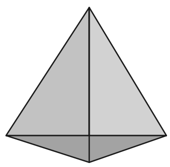
1 Square-based pyramid: 5 faces, 8 edges, 5 vertices.



(5 + 5) – 8 = 2. Yes, the rule works.

2 Children may explore a range of different shapes but should find at least two that satisfy the rule, e.g. a cube/cuboid, a triangular-based pyramid, a triangular prism.

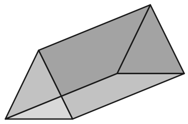
3 A triangular-based pyramid. It must have 6 edges.



Going deeper

1 (8 + **6**) – 12 = 2

2 (**5** + 6) – 9 = 2



NPC Milestone 1

- Use resources to show, or find examples of, horizontal, vertical, parallel and perpendicular lines.
- Build 3D skeleton shapes, relating these to named 3D shapes and shapes in their everyday environment.
- Describe the properties of 3D shapes in different orientations, and consider the number of faces, vertices and edges.

Page 42: Revising multiplying as repeated adding (Calc 5·1)

Practice

1 **a** 2 wheelbarrows (each with one wheel) 1 + 1 = 2

b 4 scooters 2 + 2 + 2 + 2 = 8

c 4 tricycles 3 + 3 + 3 + 3 = 12

d 3 cars 4 + 4 + 4 = 12

2 0 + 0 + 0 + 0 + 0 = 0

Going deeper

1 4 × 3 and 3 + 3 + 3 + 3. Children will explain that there are four lots of £3 as seen in the repeated adding sentence and that 4 × 3 also shows four lots of three or four times three.

2 Answers will vary but should be about the facts shown, i.e. 5 lots of 4.

Page 43: Using the word 'times' and finding the product (Calc 5·2)

Practice

1 **a** 2 + 2 + 2 + 2 + 2 + 2 = 12

b 5 + 5 + 5 + 5 + 5 = 25

c 10 + 10 + 10 = 30

d 4 + 4 + 4 + 4 + 4 = 20

2 **a** 6 × 2 = 12

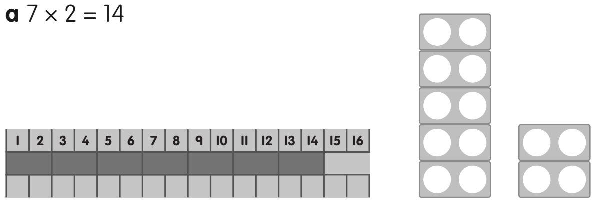
b 5 × 5 = 25

c 3 × 10 = 30

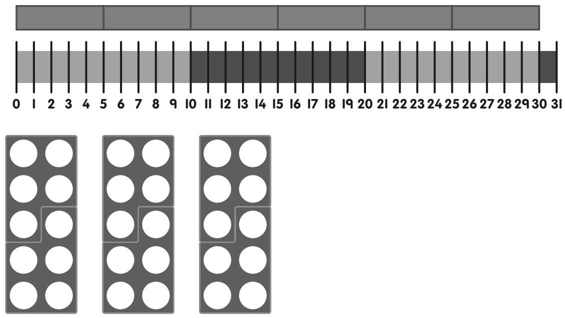
d 5 × 4 = 20

3 The Shapes and rods have been shown in different ways. Children may use any of these and may also like to use a Numicon 10s Number Line.

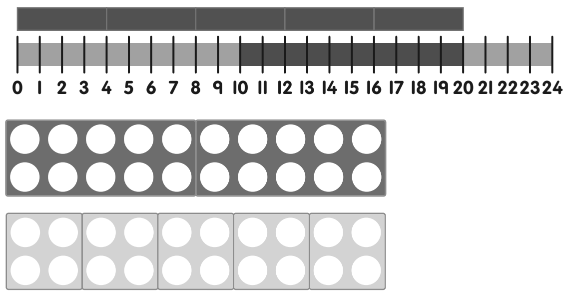
a 7 × 2 = 14



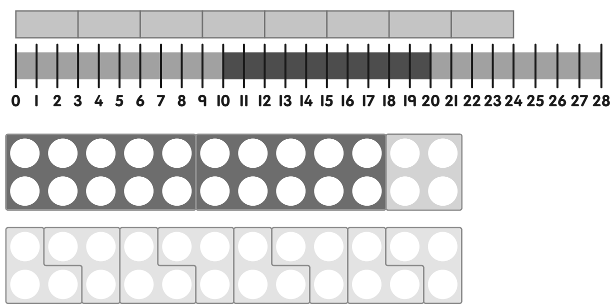
b 6 × 5 = 30



c 5 × 4 = 20



d 8 × 3 = 24



Going deeper

1 Answers will vary depending on how many of each item is used. However there should be four lots of each amount.

Page 44: More multiplying (Calc 5·3)

Practice

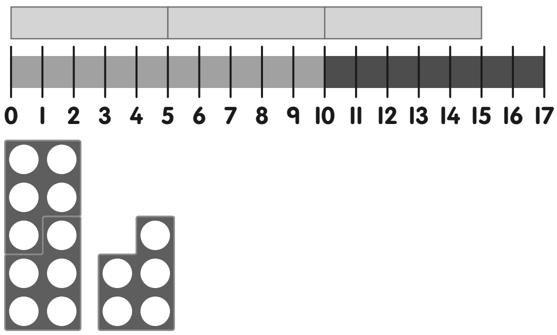
1 **a** 3 × 6 = 18

b 2 × 8 = 16

c 4 × 4 = 16

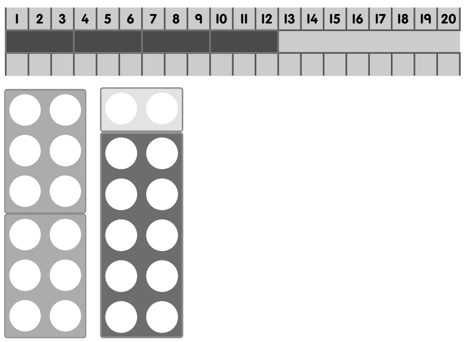
d 1 × 10 = 10

2 **a**



15 lemons

b



12 avocados

Going deeper

1 Children should notice that when you multiply by 1 the answer is the same as the number being multiplied. An example might be, 8 × 1 = 8 or 1 × 12 = 12. A rule could be: when you multiply by 1 the answer is the same as the number being multiplied.

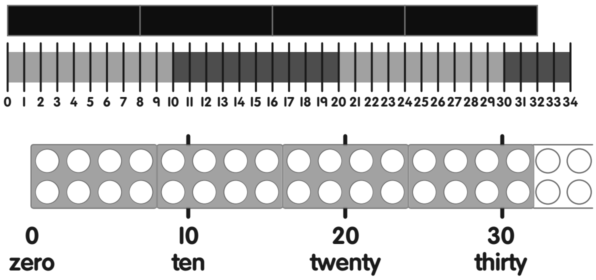
2 Answers will vary.

Page 45: Knowing when to multiply (Calc 5·4)

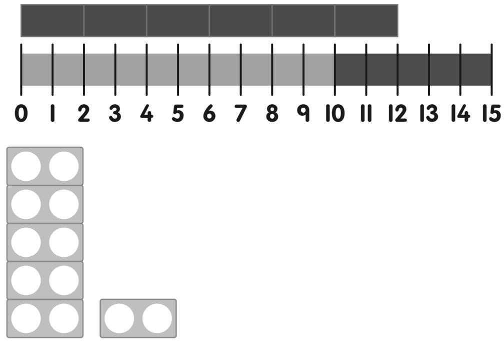
Practice

1 6 × 3 = 18 and 3 + 3 + 3 + 3 + 3 + 3 = 18

2 **a** 8 + 8 + 8 + 8 = 32 and 4 × 8 = 32



b 2 + 2 + 2 + 2 + 2 + 2 = 12 and 6 × 2 = 12



Going deeper

1 Possible answers are shown. Children may say they prefer to write the multiplying sentence because it is quicker. Answers could vary.

eggs: 10 + 10 + 10 + 10 + 10 = 50 or 5 × 10 = 50

packets of butter: 3 + 3 + 3 + 3 + 3 or 5 × 3 = 15

loaves of bread: 4 + 4 + 4 + 4 + 4 = 20 or 5 × 4 = 20

packets of cereal: 5 + 5 + 5 + 5 + 5 or 5 × 5 = 25

litres of milk: 8 + 8 + 8 + 8 + 8 = 40 or 5 × 8 = 40

jars of spread: 2 + 2 + 2 + 2 + 2 or 5 × 2 = 10

2 2 + 2 + 2 + 4 can be written as: 5 × 2 = 10

3 + 3 + 9 + 3 can be written as: 6 × 3 = 18

NPC Milestone 2

- Understand that multiplying is a form of calculating used instead of repeated adding and recognize when they need to multiply to solve a problem.
- Read multiplying number sentences.
- Read and write multiplying sentences using the '×' symbol, model them with structured apparatus showing understanding of the word 'product'.

Page 46: Making arrays and writing multiplying sentences (Calc 6·1)

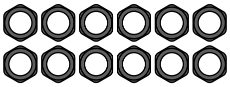
Practice

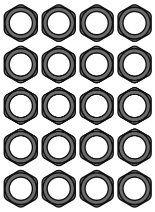
1 2 × 8 = 16

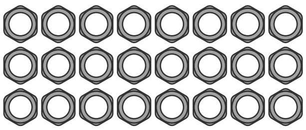
2 **a** 6 × 4 = 24 **b** 7 × 2 = 14

c 1 × 9 = 9 **d** 3 × 5 = 15

3 The arrays have been shown using Numicon Pegs but children may draw using, e.g. circles, squares, or their own ideas.

a 2 × 6 = 12 

b 5 × 4 = 20 

c 3 × 8 = 24 

Going deeper

1 4 × 4, 1 × 16 or 16 × 1 arrays should be drawn.

2 This could be proved by using apparatus and rearranging it systematically to show the possibilities, and arrangements that do not work, e.g. rows of 5. The possible arrays are: 1 × 12, 12 × 1, 2 × 6, 6 × 2, 3 × 4, 4 × 3.

Page 47: Exploring the commutative property of multiplying (Calc 6·2)

Practice

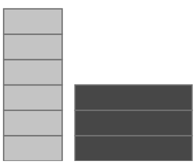
1 5 × 2 = 10 and 2 × 5 = 10

2 **a** 4 × 5 = 20 and 5 × 4 = 20

b 6 × 3 = 18 and 3 × 6 = 18

c 3 × 10 = 30 and 10 × 3 = 30

3



The commutative multiplying sentence is 3 × 6 = 18.

Going deeper

1 Three 4-rods and four 3-rods are connected as they are commutative, 3 × 4 and 4 × 3. The three 5-rods are not connected.

2 Answers will vary slightly but one explanation could be: You could have 18 counters (or other objects) and arrange them to show which arrays can be made. So 3 × 6 and 6 × 3 are the commutative facts (as well as 1 × 18 and 18 × 1 and 2 × 9 and 9 × 2). Some children may explain that 18 is a product of the 3 times table and also of the 6 times table. Some children may explain that 3s go into 18 exactly and so do 6s so they know 3 and 6 are multiplying facts of 18. Others may know that 3, 6 and 18 are connected (as a multiplying trio – though not using that language).

Page 48: Using multiplying facts when solving problems (Calc 6·3 & 6·4)

Practice

1 Three 2-rods and two 3-rods; one 5-shape and five 1-shapes; 10 × 3 and three 10-shapes; 9 × 2 and two 9-rods; four 5-shapes and five 4-rods.

5 × 5 and 7 × 3 are not any commutative facts.

2 Look for children who recognise that 10 × 2 children and 2 × 10 arrangement of children on the benches are commutative facts. Therefore, 2 benches are needed for all the children.

Going deeper

1 **a** Because three parts of this calculation have been given there is only one possible answer: 0 × 4 is the commutative fact for 4 × 0.

b Because the calculation needs to balance, the obvious commutative facts would be 7 × 5 = 5 × 7. Some children may realize that there are other possible balancing answers, e.g. 14 × 5 = 10 × 7.

c 1 × 3 is the commutative fact for 3 × 1 and when multiplying by 1 there are no other possibilities.

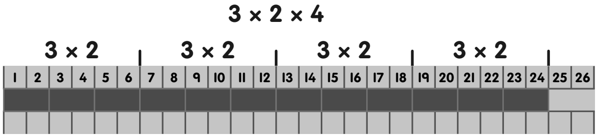
2 Look for children who refer to the commutative facts immediately, 6 × 4 and 4 × 6. Others may reason that both families will have the same number of meatballs because the Jones family uses 24 (6 × 4) and the Smith family uses 24 (4 × 6).

3 **a** and **b** Children should notice that the calculations are commutative. Answers will vary as to which they find easier to solve.

Page 49: Exploring the associative property (Calc 6·5)

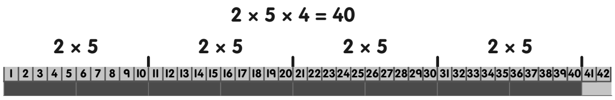
Practice

1



Children should notice that the numbers used in the calculation are still the same. The calculation is written in a different order. The product is the same even though the rods are arranged differently.

2 2 × 5 × 4



Going deeper

1 **a** Molly is correct. Children should explain that when multiplying numbers it does not matter which order the multiplying is done. The product is always the same.

b 2 × 10 × 3 and 3 × 2 × 10 and 3 × 10 × 2 and 10 × 3 × 2

2 Children should refer to both products of the calculations being 80 and the commutative possibilities when multiplying.

Other possible calculations are: 10 × 2 × 4, 4 × 2 × 10, 2 × 4 × 10, 4 × 10 × 2, 2 × 10 × 4, 20 × 4, 8 × 10, 40 × 2, 1 × 80. Some children might explore much further, e.g. 10 × 2 × 2 × 2 or 5 × 2 × 4 × 2.

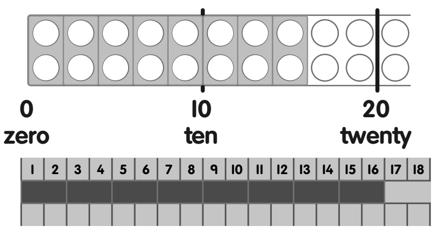
NPC Milestone 3

- Recall most multiplying facts of 2, 3, 4, 5, 8 and 10 multiplying tables.
- Know and use the commutative property of multiplying.
- Represent multiplying problems with structured apparatus and arrays.
- Know that changing the order of numbers in multiplying problems does not change the product.

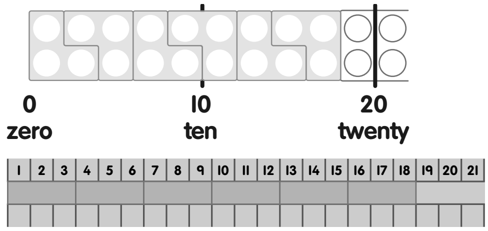
Page 50: Exploring dividing problems (Calc 7·1 & 7·2)

Practice

1 **a** 8 toys



b 6



2 **a** 7 **b** 6 **c** 8

Going deeper

1 **a** All of them.

b $4\overline{)12}^{\,3}$ and 12 ÷ 4 = 3

c Answers will vary.

Page 51: Finding 'how many tens' in different multiples of 10 (Calc 7·3)

Practice

1 Children may use Shapes along the Number Line and 10p coins but others may show understanding of how many 10s in each of the amounts.

a 15 **b** 10

c 7 **d** 20

2 **a** 30 ÷ 10 = 3 **b** 100 ÷ 10 = 10

c 20 ÷ 10 = 2 **d** 90 ÷ 10 = 9

e 80 ÷ 10 = 8

3 40 ÷ 10 = 4 and 4 × 10 = 40

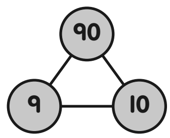
Going deeper

1 The missing number in the trio is 7.

The multiplying and dividing number sentences are: 7 × 10 = 70, 10 × 7 = 70, 70 ÷ 7 = 10, 70 ÷ 10 = 7. Some children may also write: 70 = 7 × 10, 70 = 10 × 7, 10 = 70 ÷ 7, 7 = 70 ÷ 10.

2 **a** The calculations are connected because they both use numbers that are part of a multiplying number trio. Dividing is the inverse of multiplying and multiplying is the inverse of dividing so **90** ÷ 10 = 9, 9 × **10** = 90.

b For Going deeper question **2b** you could give children a copy of number trios cut out from the photocopy master 35 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook*.



Pages 52 to 54

Page 52: Solving dividing problems (Calc 7·4)

Practice

1 **a** $15 \div 3 = 5$ and $15 \div 5 = 3$ **b** $12 \div 2 = 6$ and $12 \div 6 = 2$

c $27 \div 9 = 3$ and $27 \div 3 = 9$

2 **a** $20 \div 5 = \boxed{4}$, $4 \times 5 = 20$ **b** $18 \div 2 = \boxed{9}$, $9 \times 2 = 18$

c $16 \div 4 = \boxed{4}$, $4 \times 4 = 16$

Going deeper

For Going deeper questions 1 and 2 you could give children a copy of number trios cut out from the photocopy master 35 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook.*

1 $8 \times 5 = \boxed{40}$ $40 \div \boxed{5} = 8$

$5 \times \boxed{8} = \boxed{40}$ $\boxed{40} \div 8 = \boxed{5}$

Because of the inverse property between multiplying and dividing (doing and undoing between multiplying and dividing) once you have found the answer to the first calculation you have the number trio and can use the numbers to help fill in the other empty boxes. The numbers 40, 5 and 8 are a multiplying and dividing trio of numbers.

2 Possible answers are:

24, 2, 12: $2 \times 12 = 24$, $12 \times 2 = 24$, $24 \div 2 = 12$, $24 \div 12 = 2$ or

24, 3, 8: $3 \times 8 = 24$, $8 \times 3 = 24$, $24 \div 3 = 8$, $24 \div 8 = 3$ or

24, 4, 6: $4 \times 6 = 24$, $6 \times 4 = 24$, $24 \div 4 = 6$, $24 \div 6 = 4$

Page 53: Introducing remainders – how many are left over? (Calc 7·6)

Practice

1 **a** $17 \div 5 = 3$ r 2 **b** $36 \div 5 = 7$ r 1 **c** $24 \div 5 = 4$ r 4

d $40 \div 5 = 8$ **e** $43 \div 5 = 8$ r 3 **f** $22 \div 5 = 4$ r 2

2 They will have 7 balloons each and there will be 2 left over.

Going deeper

1 $23 \div 4 = 5$ r 3 $\begin{array}{r} 5\text{ r}3 \\ 4\overline{)23} \end{array}$

2 The highest remainder if you are dividing by 5 is 4. You can't have remainder 5 or you would be able to divide 5 into the amount another time.

3 The multiples of 10 because they always divide into 10s exactly.

NPC Milestone 3

- Recognize that dividing can be expressed as finding 'how many groups are there in … ?'
- Read, build with structured apparatus, and write dividing number sentences using the '÷' symbol.
- Notice and explain the inverse relation between dividing and multiplying and know that they can use multiplying facts to derive dividing facts.
- Explain and interpret a realistic context as one inviting either 'multiplying' or 'dividing' and use the inverse relation between multiplying and dividing when solving problems.
- Know that multiplying has a commutative property and use this to help when solving dividing questions.
- Interpret a remainder as what is left after grouping.

Page 54: Making journeys using quarter turns (Geo 2·1)

Practice

1 To get to the vegetable patch:
Forward 2 squares
Quarter turn anti-clockwise
Forward 1 square
Quarter turn clockwise
Forward 2 squares
Quarter turn anti-clockwise
Forward 2 squares
[Predict 3 turns to get to the vegetables]

To get back to where it started from the edge of the vegetable patch:
Quarter turn anti-clockwise
Forward 2 squares
Quarter turn anti-clockwise
Forward 1 square
Quarter turn clockwise
Forward 2 squares
Quarter turn anti-clockwise
Forward 2 squares
[Predict 4 more turns to turn around and get back to where it started.]

2 Answers will vary, but the snail's route must include 3 more turns than its original route (10 turns in total).

Going deeper

1 The fewest number of turns is one, because if the snail moves forward to directly above the vegetables, it only needs to make one turn anti-clockwise to be facing the vegetables. It then moves forwards to get to the vegetables.

2 Answers will vary but will include any 6-sided trail. Each trail will have six turns in, three clockwise and three anti-clockwise.

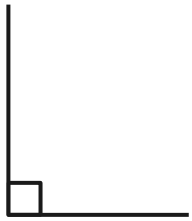
Page 55: Linking turns and angles (Geo 2·2)

Practice

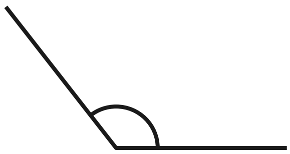
1 **a** It is smaller than a right angle.

b It is bigger than a right angle.

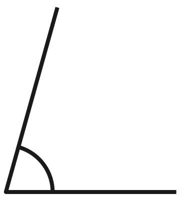
2 **a**



b Angles will vary. Example:



c Angles will vary. Example:



d Responses will vary depending on the angles made.

3 A right angle – 90 degrees

Going deeper

1 Approximately 3:33. The minute hand will need to be between the 6 and 7 to form a right angle with the hour hand, which will be approximately halfway between the 3 and the 4.

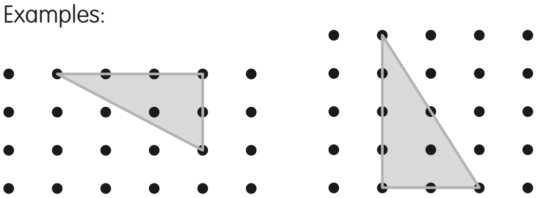
2 Responses will vary.

Page 56: Angles in triangles and four-sided shapes (Geo 2·3)

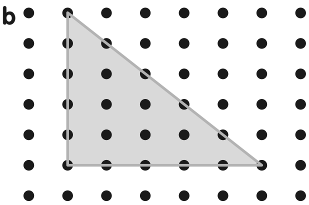
Practice

1 **a** Answers will vary. Children should draw a right-angled triangle.

Examples:



b



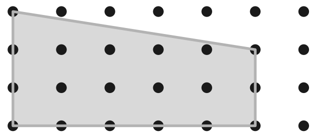
2 Responses will vary.

3 Responses will vary.

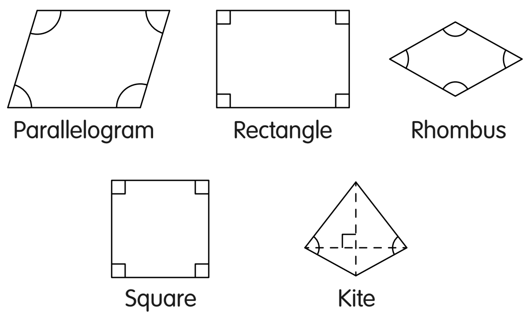
Going deeper

1 Responses will vary.

Example shape:



2



Page 57: Regular and irregular polygons (Geo 2·4)

Practice

1 The pentagon and two octagons because all the angles and side lengths are the same.

2 Children's people will vary but could use squares, equilateral triangles, regular pentagons, hexagons, octagons, etc.

3 Responses will vary but shapes should become irregular by changing the side length and/or the angle, e.g. rectangle, isosceles triangle.

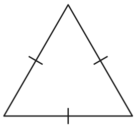
Pages 58 to 59

Going deeper

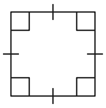
1 Because the side lengths are not all equal.

2 Regular shapes have equal sides and equal internal angles.

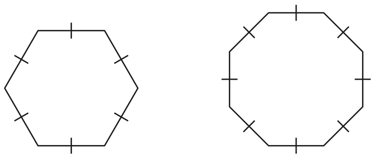
3 **a** Equilateral triangle



b Square



c Example response: Regular hexagon, regular octagon



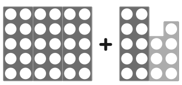
GMS Milestone 1

- Move objects, or themselves, to show their understanding of an angle as a description of a turn.
- Show how the number of right angle turns relates to a half, three-quarters and full turn.
- Manipulate resources to make and order right angles and angles greater, or less than, a right angle.

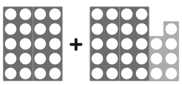
Page 58: Partitioning 2- and 3-digit numbers (NNS 4·1 & 4·2)

Practice

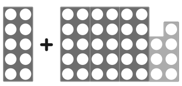
1 More ways to partition 47, e.g.



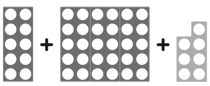
30 + 17



20 + 27

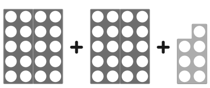


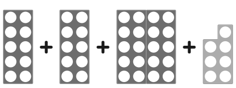
10 + 37



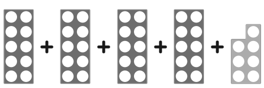
10 + 30 + 7

20 + 20 + 7





10 + 10 + 20 + 7



10 + 10 + 10 + 10 + 7

Children will need to decide whether 10 + 20 + 17 is the same partition as 20 + 10 + 17.

30 + 17 20 + 27 10 + 37

10 + 30 + 7 20 + 20 + 7 10 + 10 + 20 + 7 10 + 10 + 10 + 10 + 7

2 **a** 50 + 8 40 + 18 30 + 28 20 + 38 10 + 48

40 + 10 + 8 30 + 20 + 8 20 + 20 + 18 30 + 10 + 18

20 + 20 + 10 + 8 20 + 10 + 10 + 18

20 + 10 + 10 + 10 + 8 10 + 10 + 10 + 10 + 18

10 + 10 + 10 + 10 + 10 + 8

b 200 + 30 + 2 200 + 20 + 10 + 2 200 + 10 + 10 + 10 + 2

200 + 20 + 12 200 + 10 + 22 200 + 32

The above partitions may be repeated but with the hundreds partitioned.

Going deeper

1 Children can be encouraged to use apparatus to help them explain where needed.

a 30 + 26 = 20 + 36 **b** 49 + 40 = 69 + 20

2 **a** 75 = 30 + 20 + 10 + 15 20 + 20 + 10 + 25

20 + 10 + 10 + 35 10 + 10 + 10 + 45

Some children may use other partitioning ideas, e.g. 25 + 25 + 10 + 15

b A simple way to partition 184 into 2-digit numbers is 50 + 50 + 84. Answers will vary but look for children who are systematic.

Page 59: Exploring amounts (NNS 4·3)

Practice

1 **a** 623p **b** 469p **c** £3·94 **d** £2·41

2 710p and £7·10

£8·19 and 819p

£3·73 and 373p

602p and £6·02

£6·20 has no equivalent

Going deeper

1 **a** 180 – 80 = 100: Partitioning 180 into 100 + 80 helps you see that 80 is missing because the answer is 100.

b 360 – 60 = 300: You could use inverse to help find the answer, 300 + 60 = 360.

c 507 – 7 = 500: If 500 is the answer and the highest number is 507 by partitioning into 500 + 7 you find the answer.

d 905 – 5 = 900: You could use inverse to help find the answer, 900 + 5 = 905.

2 £1·23 123p £123

The hundreds, tens and ones frame could also show 123 cm or 123 m or 1 m 23 cm or 123 ℓ or 123 ml or 1 ℓ 23 ml 123 g or 123 kg or 1 kg 23 g.

Page 60: Finding different ways to make the same amount (NNS 4·5)

Practice

1 As an extension here, you could ask children to find all the possibilities and look for those working systematically to find the answer.

50p + 20p + 10p + 5p or

50p + 10p + 10p + 10p + 5p or

20p + 20p +20p + 20p + 5p or

20p + 20p + 20p + 10p + 10p + 5p or

20p + 20p + 10p + 10p + 10p + 10p + 5p or

20p + 10p + 10p + 10p + 10p + 10p + 10p + 5p or

10p + 10p + 10p + 10p + 10p + 10p + 10p + 10p + 5p

2 **a** Answers will vary, e.g. £1 + 50p + 2p + 2p.

b Answers will vary, e.g. £1 + 50p + 20p + 5p + 2p.

c Answers will vary, e.g. £2 + 20p + 20p + 5p.

d Answers will vary, e.g. 50p + 20p + 10p + 5p + 2p + 2p.

e Answers will vary, e.g. £2 + £2 + 10p + 5p + 1p.

Going deeper

1 The £20 will need to be exchanged for four £5 notes so each child can have a £5 note.

Two £5 notes will need to be exchanged for ten £1 coins so each child can have three £1 coins.

or

The £20 note will need to be exchanged for one £10 note and two £5 notes so each child can have a £5 note.

The £10 note will need to be exchanged for ten £1 coins so each child can have three £1 coins.

or

The £20 note will need to be exchanged for ten £1 coins and two £5 notes so each child can have a £5 note and three £1 coins.

One £1 coin will need to be exchanged for ten 10p coins so each child can have three 10p coins.

One 10p coin will need to be exchanged for ten 1p coins so each child can have three 1p coins.

Each child will then have £8·33. There will be 1p left over.

2 Rob is missing 52p made up of 20p + 20p + 10p + 2p.

Page 61: Solving problems with partitioning (NNS 4·5)

Practice

1 Three coins: £1 + 50p + 20p

2 Notebook, key ring, bag

3 £3·88

Going deeper

1 Answers will vary. Some children may suggest 50p + 20p (or other combinations of 70p) three times. Others may calculate 3 × 70p to equal £2·10 and then suggest combinations of coins to equal this amount, e.g. £1 + £1 + 10p.

2 Possible combinations are:

250 ml + 250 ml

250 ml + 50 ml + 100 ml + 100 ml

100 ml + 100 ml + 100 ml + 100 ml + 100 ml

100 ml + 100 ml + 100 ml + 100 ml + 50 ml + 50 ml

100 ml + 100 ml + 100 ml + 50 ml + 50 ml + 50 ml + 50 ml

100 ml + 100 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml

100 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml

50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml + 50 ml

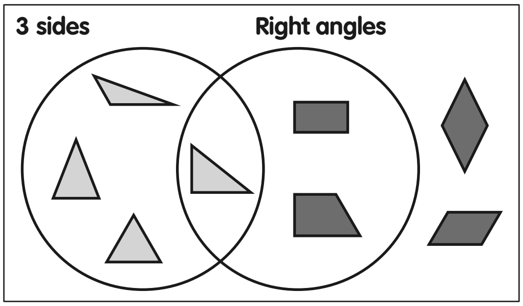
NPC Milestone 3

- Relate pounds and pence notation to hundreds, tens and ones.
- Use knowledge of partitioning to solve money problems.

Page 62: Sorting shapes using a Venn diagram (Geo 3·1)

Practice

1

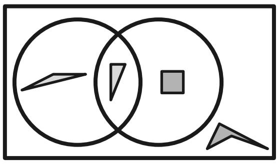


2 Children's choice of criteria will vary, e.g. parallel lines and right angles.

3 Children's shapes and sorting diagrams will vary.

Going deeper

1 Children's shapes will vary. Example:



2 **a** and **b** Answers will vary.

Page 63: Sorting shapes using a Carroll diagram (Geo 3·2)

Practice

1 **a** The triangular prism does Not have 8 vertices.

The hexagonal prism does Not have 6 faces.

b The triangular prism should go in the cell labelled Not 8 vertices and Not 6 faces.

The hexagonal prism should go in the cell labelled Not 6 faces and Not 8 vertices.

2 Cuboid

3 Responses will vary.

Going deeper

1 Yes, he is correct because a cuboid (including a cube) is the only shape with 6 faces and 8 vertices.

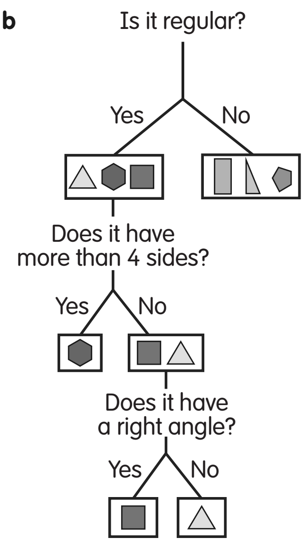
2 Answers will vary.

Page 64: Making a tree diagram to sort shapes (Geo 3·4)

Practice

1 Hexagon

2 **a** and **b**



Going deeper

1 Regular pentagon or octagon

2 Answers will vary. For example:

Shape selection: cube, cuboid, cylinder, tetrahedron, cone

Does it have 8 faces?

Yes: cube, cuboid

- Are all the faces the same shape?
  - Yes: cube
  - No: cuboid

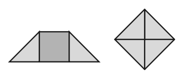
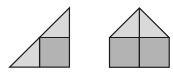
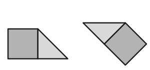
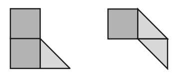
No: cylinder, cone, tetrahedron

- Does the shape have a circular face?
  - Yes: cone, cylinder
    - Does the shape have 2 edges?
      - Yes: cylinder
      - No: cone
  - No: tetrahedron

Page 65: Sorting 2D shapes based on symmetry (Geo 3·5)

Practice

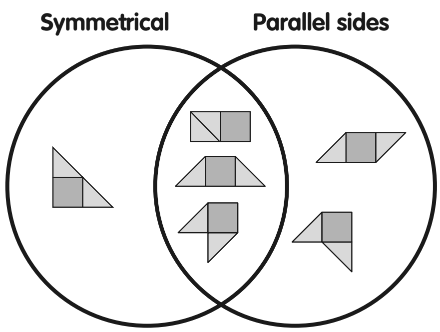
1 Answers will vary, e.g.

	Quadrilateral	**Not a quadrilateral**
Symmetrical		
Not symmetrical		

2 **a** Responses will vary. **b** Responses will vary.

Going deeper

1 Answers will vary, e.g.



GMS Milestone 1

- Recognize angles in 2D shapes and relate these to the properties of regular and irregular shapes.
- Use sorting diagrams to organize 2D or 3D shapes according to criteria they have chosen, and explain their reasoning.

Page 66: Ordering numbers (NNS 5·1 & 5·2)

Practice

1

						27	28		
	42								50
51									
	62	63							
		73							

2 Children should refer to the patterns of the tens and ones which helps them know where to place numbers.

3

5			
		11	
			16

Going deeper

1 They belong to a 25 number square.

2 1 will be in the bottom right corner.

3 Children should refer to the tens and ones remaining in order but how the patterns change from increasing to decreasing.

Page 67: Comparing heights and lengths (NNS 5·3 & 5·4)

Practice

1 320 cm, 300 cm, 265 cm, 200 cm, 230 cm, 205 cm

2 Answers will vary.

3 2 m 30 cm

Going deeper

1 **a** 780 m, 8 m, 760 m **b** 760 cm

2 Answers will vary. Children may choose to order the numbers from smallest to largest or largest to smallest but they should show a difference of 200 between two of the numbers.

Page 68: Ordering 3-digit numbers (NNS 5·5 & 5·6)

Practice

1 Friday

2 Molly

3 Molly on Wednesday

4 985 > 876 > 839 > 793 > 645

Going deeper

1 Children should show understanding that putting numbers in order (and explaining their system for doing this) allows them to check whether they have missed any out.

2 To put 3-digit numbers in order you look at the hundreds first to see which number has the highest amount of hundreds. If you have more than one number with the same amount of hundreds you look at the tens to see which has the highest amount of tens. If numbers you are ordering have the same amount of hundreds and tens you look at the ones to see which has the highest amount of ones.

3 If you don't have number cards you can use photocopy master 36 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook*.

Answers will vary but children should be making numbers where the digits always have the highest of their three numbers as the hundreds and the second highest digit as the tens.

Page 69: Working with number lines (NNS 5·8, 5·9 & 5·10)

Practice

1 8 pages were missing.

2 Answers will vary,for example,
8 and 49 could be in the number range 0–49

73 and 99 could be in the number range 0–99 or 50–99

121 and 134 could be in the number range 100–149

156 and 182 could be in the number range 150–199

3 **a** The '>' symbol could be changed to '<' or 827 could be changed to a higher number or 872 could be changed to a lower number.

b 486 could be changed to 386 or the number range could be changed to 401–499.

Going deeper

1 0–10 or multiples of 10 or multiples of 100 or multiples of 50. Some children may decide on higher number ranges.

2 35 groups. Because you know that there are two groups of 50 in 100 you can work out how many in 1000 and then how many in 500 and then how many in 250.

NPC Milestone 3

- Understand relative values of numbers to 1000, including recognizing the idea of a range of numbers and use of symbols '–', '<' and ' >' for labelling a range of numbers.
- Partition numbers up to 1000 into hundreds, tens and ones and to derive other ways of partitioning them.
- Relate knowledge of patterns on a 100 square to an array for 1000 and use patterns when finding numbers in different arrays and number squares.

Page 70: Adding and subtracting multiples of 10 and 100 (Calc 8·1, 8·2 8·3 & 8·4)

Practice

1

Multiples of 10	Numbers to 10	Multiples of 100
40 + 30 = 70	4 + 3 = 7	**400 + 300 = 700**
50 – 10 = 40	5 – 1 = 4	**500 – 100 = 400**
90 – 70 = 20	**9 – 7 = 2**	900 – 700 = 200
10 + 80 = 90	1 + 8 = 9	**100 + 800 = 900**
70 – 60 = 10	**7 – 6 = 1**	**700 – 600 = 100**

2 The difference between 80 and 30 is 50. 80 – 50 = 30

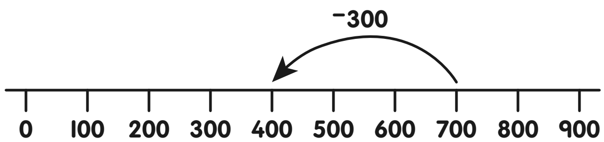
Going deeper

1 **a** 100 less

b Tia 900 > Ravi 800 > Molly 700 > Ben 500 or 500 < 700 < 800 < 900

c Answers will vary.

2



700 – 300 = 400

Some children may be able to solve this without using a number line because they understand the relationship between 7, 3 and 4.

Page 71: Calculating change from multiples of 10 and 100 (Calc 8·5)

Practice

1 **a** 40p change, because 60 and 40 equals 100. Some children may use 6 + 4 = 10 because they understand the relationship between facts of 10 and facts of 100.

b 20p change. 8 + 2 = 10 so 80 + 20 = 100

c 70p change. 7 + 3 = 10 so 70 + 30 = 100

d £1 change.

Going deeper

1 As 10 + 90 = 100 (or 1 + 9 = 10) it is possible to know that you would have 90p change if you were paying £9. Because it is £10 you need an extra £1 change so you would receive £1·90.

2 100 take away 80 equals 20.

100 subtract 80 equals 20.

100 minus 80 equals 20.

The difference between 100 and 80 is 20.

3 £90. Some children may subtract 30 from 130 to reach 100 and then subtract another 10 to leave 90.

Page 72: Adding and subtracting multiples of 10 (Calc 8·6)

Practice

1 5 + 3 = 8 helped Tia know 50 + 30 = 80 so 56 + 30 = 86

2 95 – 30 = 65, 95 – 50 = 45, 95 – 40 = 55

68 – 30 = 38, 68 – 50 = 18, 68 – 40 = 28

187 – 30 = 157, 187 – 50 = 137, 187 – 40 = 147

Going deeper

1 **a** 81 – 51 = 30 **b** 8 – 5 = 3 **c** 30 + 51 = 81 or 51 + 30 = 81

a 94 – 44 = 50 **b** 9 – 4 = 5 **c** 50 + 44 = 94 or 44 + 50 = 94

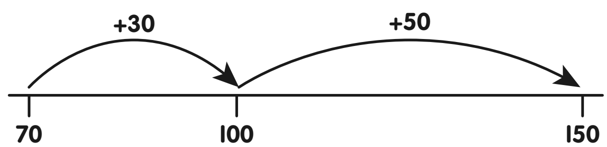
a 89 – 69 = 20 **b** 8 – 6 = 2 **c** 20 + 69 = 89 or 69 + 20 = 89

2 Children should talk about the tens digits changing because only 'tens' are being added. Only one number has any hundreds and only one number has any ones, so there are no other hundreds or ones to be added.

Page 73: Adding and subtracting multiples of 10 and bridging hundreds (Calc 8·7 & 8·8)

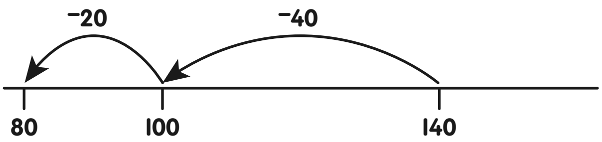
Practice

1 **a** 150

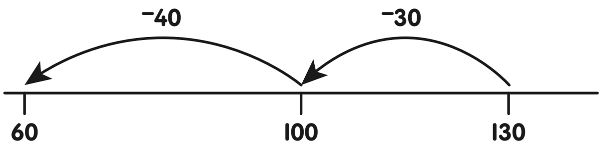


b 140

c 80



d 60



Going deeper

1 70 + 30 = 100, 100 + 60 = 160, 70 + 90 = 160
160 – 60 = 100, 100 – 30 = 70, 160 – 90 = 70

2 **a** Ali's class: 700, Ruby's class: 700 – 100 = 600, Leo's class: 700 + 100 = 800

b 2100 coins

c £21

NPC Milestone 3

- Use fluent recall of adding and subtracting facts to 10 when adding and subtracting multiples of 10 and multiples of 100, first whole tens or whole hundreds, moving on to add whole tens and whole hundreds to 2- and 3-digit numbers.

Page 74: Using patterns of similar calculations (Calc 9·2 & 9·3)

Practice

1 49 – 46 = 3
39 – 36 = 3
29 – 26 = 3
19 – 16 = 3
9 – 6 = 3

2 22 + 14 = 36
12 + 24 = 36
2 + 34 = 36

Going deeper

1 **a** The answer is 99 because knowing 4 + 5 = 9 also helps to calculate 4 tens + 5 tens equals 9 tens.

b Other facts could include: 55 + 44 = 99, 445 + 554 = 999, 545 + 454 = 999, 544 + 455 = 999, and the commutative fact for each calculation. Some children may continue into thousands, e.g. 5454 + 4545 = 9999.

Page 75: Doubling, halving and near doubles (Calc 9·4 & 9·5)

Practice

1 Double 14 is 28
Double 31 is 62
Double 26 is 52
Double 47 is 94
Half of 46 is 23
Half of 82 is 41
Half of 70 is 35
Half of 38 is 19

2 **a** What is half of 20? What is double 5?

b What is half of 48? What is double 12?

3 Max spent £1·80 in total so the cars were 90p each.

Going deeper

1 It is not correct. Mia has doubled the tens to make 60 but not doubled the ones which should be 4 to make 64.

2 **a** Some children may suggest doubling 25 (because they recall double 25) and subtracting 1. Some children may suggest partitioning and recombining by adding 2 tens and 2 tens to equal 4 tens then adding 4 and 5 to equal 9 and can quickly see 49. Some children may suggest doubling 24 (because they understand partitioning of tens and ones and recombining and can quickly see 48) but then they need to add 1. This method is obviously not as efficient since tens and ones can be added in this way without the necessity of adjusting.

b Some children may explain that they would round 38 to 40 and then adjust the numbers by subtracting 2 from 37 to equal 35, then add a simpler calculation of 40 and 35 to equal 75. Some may add 3 tens and 3 tens to equal 60, then combine the 8 and 7 to equal 15 and then add 60 and 15 to equal 75. Others may add 3 tens to 38 to equal 68 and then add 7 to equal 75. Some may double 35 to equal 70 and then adjust the calculation by adding the extra 3 and 2, i.e. 5. Others may double 40 to equal 80 and then subtract the extra 5.

c Children may double 19 or 18 because they recall those doubles and then adjust by adding or subtracting 1 to give the answer 37. Some children may double 20 and then adjust by subtracting the extra 3 to find 37. Some children may round 19 to become 20, subtract 1 from 18 to give 17, then combine 20 and 17 to equal 37 (some may combine 20 and 18 and then subtract 1).

3 Some children may consider that as they know 50 + 50 = 100 if they subtract 6 from 13 to equal 7 they will know the missing number is 57. Some children may 'add on', saying 56 to 60 equals 4. 60 to 100 is 40. 100 to 113 is 13. 4 + 40 + 13 = 57.

Page 76: Adjusting numbers (Calc 9·7, 9·8, 9·9 & 9·10)

Practice

1 **a** 84 – 30 = 54 **b** 56 + 30 = 86 **c** 97 – 50 = 47

d 88 – 60 = 28 **e** 270 + 24 = 294 **f** 160 + 18 = 178

2 **a** 58 has been adjusted to 60 by adding 2 so 2 has been added to 187 to make it 189 to keep the calculation equal.

b 127 has been adjusted to become 130 by adding 3 so 546 has had 3 subtracted to become 543 to keep the calculation equal.

Going deeper

1 **a** 160 + 732 **b** 185 – 40 **c** 427 + 540

d 359 – 10 or 360 – 11

2 **a** First you look for numbers that are closest to a multiple of 10 but then you have to decide whether the adjusted calculation is an easier calculation or not. Sometimes it can be easier to adjust another number even though it may not be the closest, e.g. 361 – 12 could be adjusted to 360 – 11 but by adjusting 12 to become 10 (although it is not the closest number to a multiple of 10) the calculation 359 – 10 is much easier to solve.

b In adding calculations if you adjust one number by adding more you have to adjust the other number by subtracting the same amount. Or if you subtract from one number (to reach a multiple of 10) you have to add the same amount to the other number in the calculations.

c In subtracting calculations if you adjust one number by adding more you have to adjust the other number by adding the same amount. Or if you subtract from one number you have to subtract the same amount from the other number.

Page 77: Reasoning to solve different problems (Calc 9·11 & 9·12)

Practice

1 Although these two numbers are 3-digit numbers they can be added easily by partitioning into hundreds, tens and ones, and then recombining as there is no crossing tens involved. So double 240 equals 480. Their journey was 480 miles long.

2 Children may decide to find how many more from 165 to 187 using a number line to help. They could jump 5 from 165 to 170, then either 10 more to 180 then 7 more to 187 and then add 5 + 10 + 7 to equal 22. Or they could jump 17 from 170 to 187 and then add 5 and 17 to equal 22.

Children could subtract by partitioning, knowing that 8 tens subtract 6 tens equals 2 tens, i.e. 20. They could then subtract 5 from 7 to equal 2. They would recombine 20 + 2 to equal 22.

22 people can't have seats.

3 Children could add 79 to 120 by using partitioning because 2 tens and 7 tens equals 9 tens (90) and 0 ones plus 9 ones equals 9. There is only one hundred so when recombining the answer is 199.

Children could round the £79 to £80 and then add to the £120 to find £200 (because 8 and 2 equals 10 so 80 and 20 equals 100) then subtract 1 to adjust the extra 1 that had been added to the 79 giving the answer of 199.

They raised £199.

4 Children should recognize that 5 can be added to the 86 (by bridging, knowing 4 of the 5 are needed to reach 90 then 1 more equals 91). They should then remember to include the hundreds that do not change as no more are being added to give the total of 191.

Molly and Ravi have 191 cards altogether.

Going deeper

1 **a** Children may say you would need to choose a number smaller than 28 for one of the empty boxes, and then work out the second number (knowing how many more are needed) to reach 28. Children could easily choose known facts 27 and 1 or 20 and 8. Some may know that double 14 equals 28. This could be made more challenging by having no doubles or multiples or 10 or asking for 2-digit numbers as the answers.

b The method used for question **1a** could work for this empty box problem except you would need to choose a number at least 2 smaller than the total because you have two other empty boxes to fill.

Some children may like to partition the total into tens and ones, the ones for one empty box and then share the tens between the other two boxes. They could adjust those starting numbers.

NPC Milestone 4

- Record work systematically in order to quickly spot patterns.
- Explain how they are using place value and known number facts to solve similar calculations.
- Use knowledge of equivalence and number relationships to adjust numbers involved in a variety of calculating situations and explain their reasoning.
- Use fluent recall of doubles of numbers to 10 when solving problems that involve doubling and halving higher numbers.
- Use fluent recall of adding and subtracting facts of 10 when finding complements to 100.

Page 78: Exploring scales (P&A 3·1 & 3·2)

Practice

1 The missing number on the large jug is 400.

The missing number on the small jug is 150.

2 15 minutes

Going deeper

1 Yes, either measuring jug could be used because although they are different sizes they both have the capacity to hold 200 ml. It may be more accurate to use the smaller jug as there is a division to show 140 ml. The larger jug has a division for 150 ml so 140 ml would be just below that line.

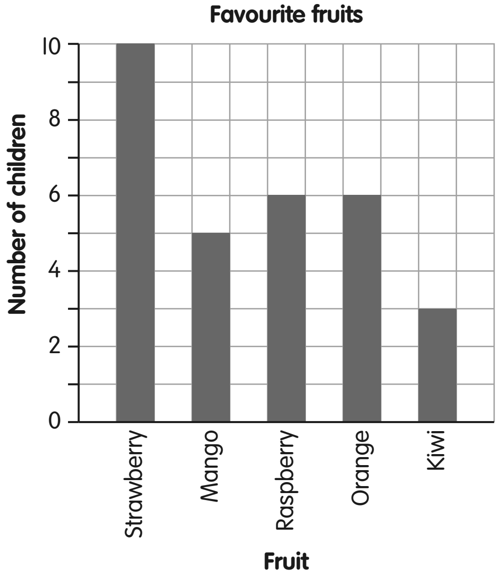
2 Children should point out that the tens digits and the hundreds digits follow the same increasing in 1s pattern (1, 2, 3, 4, etc.) and that there is one zero in each of the tens numbers but two in each of the hundreds. Some may mention the change from the 100 to the 1000.

3 Yes, these two number rods could represent 150 because the 10-rod could represent 100 and the 5-rod could represent 50. They could also represent 1500 or even 15 000. They could also represent 1·5, the 10-rod representing 1 and the 5-rod 0·5 or half or $\frac{5}{10}$th, etc.

Page 79: Exploring intervals of 2 and 20 (P&A 3·3, 3·4 & 3·5)

Practice

1



2 **a** 80, 100, **120**, 140, **160**, **180**, 200, **220**

b **400**, 420, **440**, 460, 480, **500**, **520**

3 Children should point out that the zero has been placed in the ones place and the other digits have remained the same but have moved from being ones to tens, or tens to hundreds. (Some may point out that each number has been multiplied by 10.)

The multiples of 20 are: 80, 120, 380, 640, (20) 200, 560 (20 was already a multiple of 20 before it changed to 200).

Going deeper

1 The scale would need intervals of 20. The missing numbers on the scale would be: 80, 100, 120, 140, 160, 180, 200, 220, 240.

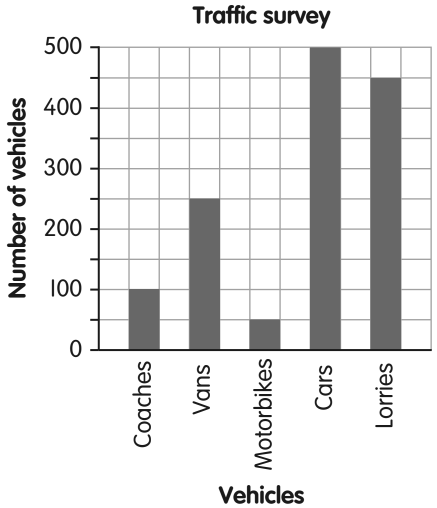
Page 80: Exploring intervals of 5 and 50 (P&A 3·6)

Practice

1 5p, 10p, 15p, 20p, 25p, 30p, 35p, 40p, 45p, 50p, 55p, 60p, 65p, 70p, 75p

50p, £1, £1·50, £2, £2·50, £3, £3·50, £4, £4·50, £5, £5·50, £6, £6·50, £7, £7·50 or children may write each £1 as £1·00

2



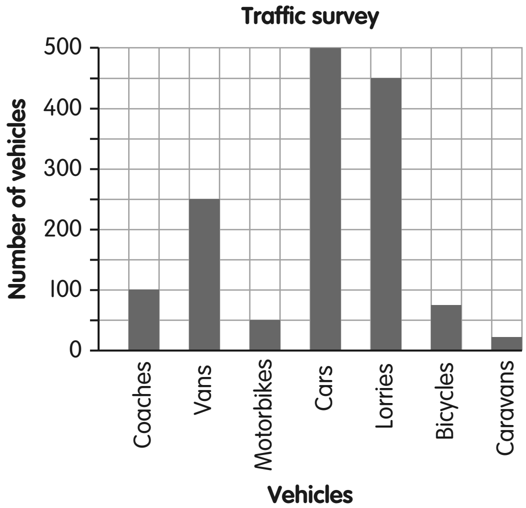
3

	Multiple of 50	Not multiple of 50
< 499	50, 100, 150, 200, 250, 300, 400, 450	Any number smaller than 499 that is not in the Multiple of 50 < 499 answer
> 499	500, 550, 600, 650, 700, 750, 850, 900, 950, 1000 and any multiples of 50 above this	Any number larger than 499 that is not in the Not a multiple of 50 < 499 or either of the other boxes

Going deeper

1 Most children will probably answer 20 (though some may decide that only 19 comes between 0 and 100). They should explain that multiplying by 10 or writing an extra 0, e.g. 20 as 200 (or 19 as 190) will provide the connecting answer.

2



Page 81: Exploring scales and intervals (P&A 3·7)

Practice

1 a Two 10-rods and one 5-rod for each sequence of 25 so, to reach 200, Ben will need sixteen 10-rods and eight 5-rods. Children may notice other patterns.

b 125, 150, 175, 200 Children may discuss the repeating pattern of 25, 50, 75 and hundreds. Some may see the 5, 0, repeating pattern from the 5 times table.

c 225, 250, 275, 300, 325 ...

2 a 125, **150**, 175, **200**, **225**, 250, **275**, **300**

b 475, **500**, **525**, 550, **575**, 600, **625**

c **325**, 350, **375**, 400, 425, **450**, **475**

Going deeper

1 The savings are measured over time, therefore the scale needs to start at 0 to show the £500 already saved, because this is an achievement the school will be celebrating. Some children may choose a scale of 100, others a scale of 50 (or show 50 marks), which would make it easier to record amounts of £30.

2 Since there are 28 children in the class, the scale should use intervals of 2.

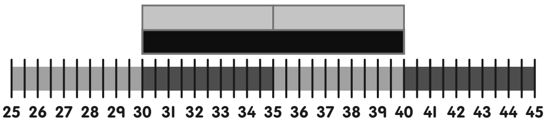
NPC Milestone 4

- Use knowledge of sequences of multiples to label intervals.
- Use knowledge of number relationships to read values in-between marked intervals.
- Count in multiples of 25 and 50.

Page 82: Finding halfway (NNS 6·1, 6·2 & 6·3)

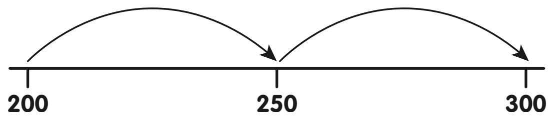
Practice

1 a

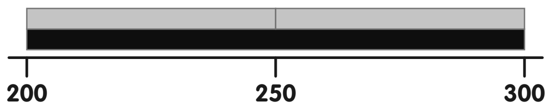


Halfway between 30 and 40 is 35.

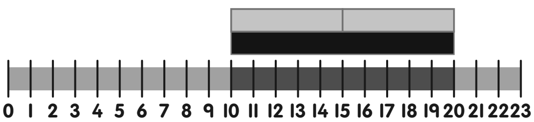
b



Children could use 10-rods to represent 100s, with 5-rods representing 50. So they could show halfway between 200 and 300 like this.



c



Halfway between 110 and 120 is 115. The 0–100 number line can be used to show 100–200.

2 The following are probably the easiest answers for children but some children may find other solutions such as finding the numbers before and after each of the halfway numbers, so answers could vary.

Number	Halfway number	Number
80	85	90
120	130	140
400	500	600
340	345	350

3 The race is 25 metres.

Going deeper

1 a The two multiples of 10 closest to 65 are 60 and 70.

b Answers will vary. Two examples are: 50 and 80, or 15 and 115.

c Answers will vary. Two examples are: 340 and 360, or 200 and 500.

Page 83: Reading scales (NNS 6·4)

Practice

1 **a** 450 ml **b** 125 ml **c** 70 ml

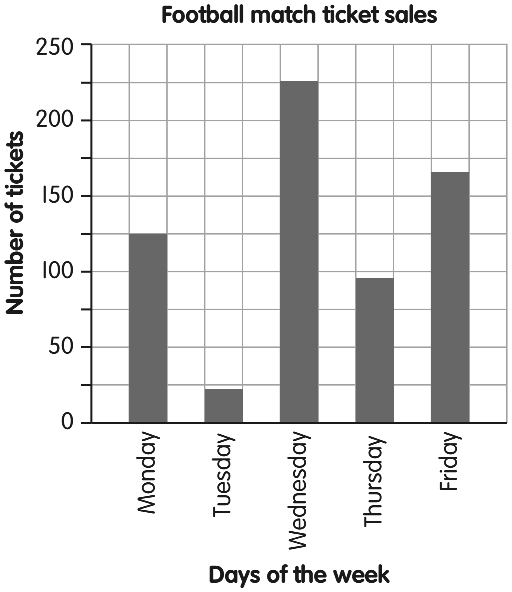
2 **a** Zak can fill his jug to 250 ml and then refill it to 250 ml so he has 500 ml.

b Answers will vary but will show understanding of having to partition 300. Three examples are: fill the jug to 250 ml, then refill it to 50 ml to make 300 ml or fill to 200 ml and refill to 100 ml or fill to 150 ml twice.

3 120 km

Going deeper

1 **a**



b Answers will vary.

Page 84: Rounding and estimating (NNS 6·5 & 6·7)

Practice

1 25, 26, 27, 28, 29, 31, 32, 33, 34

2 **a** 4 m 40 cm

b 3 m 70 cm

c 3 m

d 3 m 40 cm

3 **a** Rounds to 10 cm: 6 cm, 12 cm, 14 cm

Rounds to 50 cm: 45 cm, 49 cm, 53 cm

Rounds to 90 cm: 88 cm, 91 cm

b 16 cm, 59 cm, 83 cm, 97 cm

These numbers will not fit into the sets because they come within different number ranges from the numbers given for the sets, e.g. 16 cm would round to 20 cm, 59 cm would round to 60 cm, 83 cm would round to 80 cm and 97 cm would round to 100 cm.

Going deeper

1 Luca will need to buy the 110 ml bottle of vanilla essence to get the best buy. He would have enough if he bought the 120 ml bottle but would have more left over. The 75 ml bottle would not be enough as he needs 100 ml for 5 cakes.

Page 85: Rounding to the nearest 100 (NNS 6·9)

Practice

1 150–249

2 **a** 400 cm **b** 100 cm **c** 900 cm

3 1 kg bag. Jay needs 550 g of flour so the 500 g bag will not be big enough.

Going deeper

1 Answers will vary but should be in these ranges:

Rounds to 300 cm: > 249 cm and < 350 cm

Rounds to 700 cm: > 649 cm and < 750 cm

Rounds to 1000 cm: > 949 cm and < 1050 cm

2 You could buy:

whistle + cap = £7·90

water bottle + cap = £9·15

whistle + water bottle = £4·05

football = £8·99

whistle = £1·40

water bottle = £2·65

cap = £6·50

The water bottle + cap would give the least amount of change from £10 (85p).

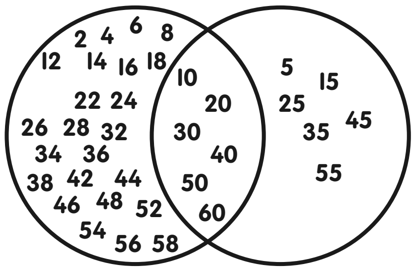
NPC Milestone 4

- Find halfway between two multiples of 10 and two multiples of 100.
- Round any 2- or 3-digit number to the nearest 10 or 100.

Page 86: Exploring patterns in the times tables (Calc 10·2)

Practice

1



2 Multiples of 2 and 5. They are also all multiples of 10.

Going deeper

1 a The stops that tram 5 and tram 10 will both stop on are:

10, 20, 30, 40, 50, 60, 70, 80, 90 and 100.

b The stops that tram 2 and tram 4 will both stop on are:

4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88, 92, 96 and 100.

c The stops that tram 3 and tram 6 will both stop at are:

6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90 and 96.

d Explanations may include working with or checking with equipment, using known times table facts, counting in steps, seeing a pattern.

Page 87: Number lines and the 2 times table (Calc 10·3)

Practice

1 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

2 a 4, 12, 16: 2 × 2 = 4, 6 × 2 = 12, 8 × 2 = 16

b 10, 16, 24: 5 × 2 = 10, 8 × 2 = 16, 12 × 2 = 24

Going deeper

1 a 24

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

2 4 6 8 10 12 14 16 18 20 22 24

3 6 9 12 15 18 21 24

4 8 12 16 20 24

6 12 18 24

8 16 24

12 24

24

b 30

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

3 6 9 12 15 18 21 24 27 30

5 10 15 20 25 30

6 12 18 24 30

10 20 30

15 30

30

c 42

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42

3 6 9 12 15 18 21 24 27 30 33 36 39 42

6 12 18 24 30 36 42

7 14 21 28 35 42

14 28 42

21 42

42

d 50

1 2 3 4 5 6 7 8 9 … 50

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50

5 10 15 20 25 30 35 40 45 50

10 20 30 40 50

25 50

50

2 Explanations may refer to checking with equipment, counting in steps, using times tables facts, known facts. Note that highlighted answers may not be found by all children.

Page 88: Exploring relationships between the 2, 4 and 8 times tables (Calc 10·4 & 10·5)

Practice

1 a 2, 4, 6, **8**, 10, 12, **14**, 16, 18, **20**, **22**, 24

b 4, 8, **12**, 16, 20, **24**, 28, 32, **36**, **40**, 44, **48**

c Explanations could refer to: multiples, counting in 2s or 4s, 2 and 4 times tables answers or doubling pattern in sequence 1 to sequence 2.

2 8, 16, **24**, 32, 40, **48**, 56, 64, 72, **80**, **88**, 96

Going deeper

1 **a** If 3 × 2 = 6 then 3 × 4 = 12

b If 7 × 2 = 14 then 7 × 4 = 28

c If 6 × 2 = 12 then 6 × 4 = 24

d If 5 × 4 = 20 then 5 × 8 = 40

2 Any related pairs of multiplication facts are accepted here from the 2, 4 and 8 times tables.

Page 89: Using times tables (Calc 10·6)

Practice

1 20; 10 × 2 = 20 or 2 × 10 = 20

2 40; 8 × 5 = 40 or 5 × 8 = 40

3 7 days or a week; 10 × 7 = 70 or 7 × 10 = 70

Going deeper

1 Explanations should refer to doubling to get the 8 times table facts and halving for the 2 times table.

2 2, 4 and 8; 3, 6 and 9; 5 and 10; 6 and 12. Children may also notice that 7 and 11 do not connect to the other times tables. Explanations may refer to checking with equipment, patterns in the facts, patterns on the 100 square, doubling and halving, etc.

NPC Milestone 4

- Develop fluent recall of many facts from 2, 3, 4, 5, 8 and 10 times tables.
- Recognize that some times tables have multiples in common.
- Use doubling and halving as a strategy for deriving related multiplying facts between the 2, 4 and 8 times tables and between the 5 and 10 times tables.

Page 90: Exploring Sharing and dividing (Calc 11·1)

Practice

1 Yes, Tia has enough drinks. If each of her 4 cousins has 5 drinks that is 20 in total.

2

Number of children	Number of drinks each	Multiplying sentence
4	2	4 × 2 = 8
4	3	4 × 3 = 12
4	4	4 × 4 = 16

Going deeper

1 8 ÷ 2 = 4

12 ÷ 3 = 4

16 ÷ 4 = 4

2 Children's explanations will vary, but include recognizing that the numbers used in the two calculations are the same and recognizing the link between multiplication and division. Because these have an inverse relation to each other if you know 132 ÷ 11 = 12, you also know that 11 × 12 = 132.

3 No, 12 ÷ 3 is not the same as 3 ÷ 12 because division is not commutative; it cannot be done in any order. 12 ÷ 3 = 4; 3 ÷ 12 is $\frac{1}{4}$.

Page 91: Using the language of sharing (Calc 11·2)

Practice

1 15 ÷ 3 = 5. They will get 5 crackers each.

2 **a** 4 because 16 shared between 4 makes 4. 16 ÷ 4 = 4.

b 6 because 18 shared between 3 makes 6. 18 ÷ 3 = 6.

c 3 because 18 shared between 6 makes 3. 18 ÷ 6 = 3.

Going deeper

1 **a** 16 ÷ 4 = 4 or $4\overline{)16}^{\,4}$

b 18 ÷ 3 = 6 or short method as above

c 18 ÷ 6 = 3

2 **a** Answers will vary.

b Finding a way to check could include using known multiplication facts, checking with equipment, etc.

Page 92: Using arrays (Calc 11·3)

Practice

1 This is an array of 12 pegs set out as 3 rows of 4. This can be used to help with the multipying facts 3 × 4 = 12 and 4 × 3 = 12, and the dividing facts 12 ÷ 4 = 3 and 12 ÷ 3 = 4.

2 **a** Four arrays of 15: arrays laid out to show 15 × 1, 1 × 15, 3 × 5, 5 × 3

b 15 ÷ 5 = 3, 15 ÷ 3 = 5, 15 ÷ 1 = 15, 15 ÷ 15 = 1

c For Practice question **2c** you could give children a copy of number trios cut out from the photocopy master 35 from the *Number, Pattern and Calculating 3 Teaching Resource Handbook.*

3, 5, 15; 1, 15

3 **a** Six arrays of 12 laid out to show 1 × 12, 12 × 1, 2 × 6, 6 × 2, 3 × 4, 4 × 3

12 ÷ 1 = 12, 12 ÷ 12 = 1, 12 ÷ 2 = 6, 12 ÷ 6 = 2, 12 ÷ 3 = 4, 12 ÷ 4 = 3

Number trios: 3, 4, 12 and 6, 2, 12 and 12, 1

b Six arrays of 18 laid out to show 1 × 18, 18 × 1, 2 × 9, 9 × 2, 3 × 6, 6 × 3

18 ÷ 1 = 18, 18 ÷ 18 = 1, 18 ÷ 2 = 9, 18 ÷ 9 = 2, 18 ÷ 3 = 6, 18 ÷ 6 = 3

Number trios: 2, 9, 18 and 3, 6, 18 and 12, 1

c Eight arrays of 24 laid out to show 1 × 24, 24 × 1, 2 × 12, 12 × 2, 3 × 8, 8 × 3, 4 × 6, 6 × 4

24 ÷ 1 = 24, 24 ÷ 24 = 1, 24 ÷ 2 = 12, 24 ÷ 12 = 2, 24 ÷ 3 = 8, 24 ÷ 8 = 3, 24 ÷ 4 = 6, 24 ÷ 6 = 4

Number trios: 4, 6, 24 and 3, 8, 24 and 2, 12, 24 and 24, 1

Going deeper

1 **a** 5 because 30 ÷ 6 = 5

b 7 because 42 ÷ 6 = 7

Children may use equipment, arrays, trios, dividing/multiplying facts or known facts, etc. to show how they reached the answers.

2 As this is an open task, there is a large variety of possible answers.

Page 93: Finding remainders (Calc 11·4)

Practice

1 A remainder is an amount that is left over in a dividing calculation such as 23 ÷ 10 = 2 remainder 3.

2 **a** 12 ÷ 5 = 2 r 2. You can put 2 marbles in each bag.

b 37 ÷ 6 = 6 r 1. There will be 6 books in each box.

c 27 ÷ 8 = 3 r 3. There will be 3 bags and 3 single bananas.

Going deeper

1 **a** 6 because if you do the calculation in reverse order you can work out the divisor: 32 – 2 (the remainder) = 30. 30 ÷ 5 = 6.

b 19 because you first take away the remainder from the calculation then do an inverse calculation: 3 x 6 = 18, then add the remainder back on = 19.

c 6 r 5 because you know that 60 divided by 10 is 6 and that there are 5 left over.

2 Answers will vary.

NPC Milestone 4

- Know that we use dividing to solve problems involving sharing as well as those involving grouping.
- Know that there can be remainders in sharing situations.
- Write dividing sentences in response to problems illustrated by arrays, Numicon Shapes or number rods.
- Use the inverse relation between multiplying and dividing when solving sharing problems.

Page 94: Extending sequences (P&A 4·1)

Practice

1 13

2 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21 Children may have used equipment to generate the sequence so any pictorial representations are also acceptable here.

3 3 5 7 9 11 13 15

5 7 9 11 13 15 17

7 9 11 13 15 17 19 and so on.

Any explanation that refers to the 7th term being the next odd number is acceptable, for example:

The 7th term is next odd number each time.

The 7th term gives one more odd number to the sequence.

Also references to the 7th term being 12 more than the first term because you're adding 2 each time and doing this 6 times.

Going deeper

1 5. Explanations should refer to decreasing odd numbers or reversing the patterns explored in Practice question **3**.

2 27 25 23 21 19 17 15 13 11 9. Answers referring to decreasing odd numbers or reversing the patterns explored in Practice question **3**.

Page 95: Following rules to extend sequences (P&A 4·3)

Practice

1 Adding 3 each time

2 7, 12, 17, 22, 27, 32, 37, 42, 47, 52

3 **a** Multiples of 4 add 1 or alternate odd numbers starting from 5

b 41, because if you follow the rule that it is the multiple of 4 add 1 then 10 × 4 = 40 + 1 = 41.

Going deeper

1 a This sequence is made by adding 5 each time, starting from 1, so all the numbers are multiples of 5 add 1.

b 36, 51, 96, 101, because they all follow the rule that they are multiples of 5 add 1.

2 A variety of answers are acceptable here depending on the sequences generated by children.

Page 96: Sequences with decreasing patterns (P&A 4·5)

Practice

1 Rule is: decreasing by 4 / subtract 4 each time, starting from 15.

2 a Rule is: decreasing by 5 / subtract 5 each time, starting from 35.

b Rule is: decreasing by 5 / subtract 5 each time, starting from 41.

c Rule is: decreasing by 5 / subtract 5 each time, starting from 151.

3 a ... 24, 21, 18, 15, 12, 9

b ... 41, 39, 37, 35, 33

4 a Rule is: subtract 3 each time, starting from 36.

b Rule is: subtract 2 each time, starting from 51, or count back in odd numbers from 51.

Going deeper

1 a 53, 51, 49, 47, 45 because the rule is: decreasing odd numbers / subtract 2.

b 36, 34, 32, 30, 28 because the rule is decreasing even numbers / subtract 2.

2 A variety of answers could be produced from this investigation.

Page 97: Finding missing numbers in sequences (P&A 4·6)

Practice

1 12, 14, 26

2 a **19**, 22, 25, 28, **31**, 34, 37

b **95**, 90, **85**, **80**, 75, 70, **65**

c 190, 185, **180**, 175, 170, **165**, 160

d **116**, **119**, 122, 125, **128**, 131, 134, **137**

3 Any explanation referring to finding the steps between consecutive terms. Also, take note of those who see the related patterns in **a** and **d** and **b** and **c**.

Going deeper

1 a Because children have been asked to devise their own sequences with missing numbers, there will be a variety of answers to consider for this question.

b Compare and discuss your strategies. Strategies relating to finding the steps between consecutive terms / working right to left if the sequence is decreasing to check / building with apparatus to help expose the pattern, etc.

2 Answers will vary.

NPC Milestone 5

- Know that finding a constant difference is a useful strategy for finding the rule for a sequence.

Page 98: Adding and subtracting multiples of 10 and 100 (Calc 12·1)

Practice

1 a Rob – £8·75

Marta – £9·30

b Rob – £8·55

Marta – £9·10

2 a 75 **b** 36 **c** 272 **d** 195 **e** 512 **f** 435

3 Children should recognize only the tens digit changes.

Going deeper

1 a £8·95 **b** £9·10

2 a You go over £6 to £6·10 **b** 5 days

Page 99: Adding and subtracting mentally (Calc 12·2 & 12·3)

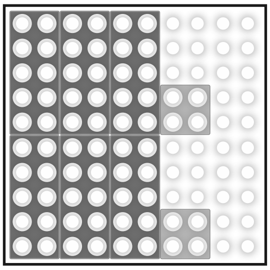
Practice

1 a Combine the tens, combine the ones to give 57.

b 11. Children may use different strategies but encourage them to lay the 34 over the 23.

2 a 46

b 68



3 a 73 **b** 159 **c** 84 **d** 121

Going deeper

1 **a** Answers will vary, e.g. 22 + 35.

b Answers will vary, e.g. 21 + 36.

c Answers will vary, e.g. 35 – 24.

d Answers will vary, e.g. 36 – 25.

2 Example response for one of above:

22 + 35 = 57

35 + 22 = 57

57 – 22 = 35

57 – 35 = 22

Page 100: Crossing 10s and 100s when adding (Calc 12·5 & 12·6)

Practice

1 Year R – 51

Year 1 – 59

Year 2 – 58

2 59 – 18 = 41 girls

3 168

4 242

Going deeper

1 Answers will vary. Example response:

	Class 1	Class 2	Class 3	Total
Year R	25	25	31	81
Year 1	30	32	33	95
Year 2	30	30	28	88

2 Answers will vary.

Page 101: Subtracting when crossing 10s (Calc 12·7)

Practice

1 Ben has counted back to find the difference between 17 and 35 bridging through 20.

Tia has subtracted 20 (3 too many) and so then added a further 3 back onto her answer.

2 87 – 62 = 25

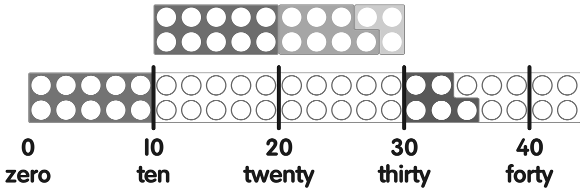
Strategies will vary, e.g. counting on to find the difference, bridging through 70 and 80: 62 + 8 = 70, 70 + 10 = 80. 80 + 7 = 87: 10 + 8 + 7 = 25

3 **a** 54 **b** 45 **c** 29 **d** 6

4 Strategies will vary.

Going deeper

1 Children should show that taking away 20 is 3 too many:



2 Calculations will vary, e.g. 36 – 21; 34 – 19.

3 Calculations will vary. Example response for each:

a 84 – 30 **b** 65 – 20

c 59 – 30 **d** 40 – 34

NPC Milestone 5

- Use partitioning into hundreds, tens and ones as a strategy for adding and subtracting 2- and 3-digit numbers.
- Use structured apparatus when adding and subtracting 2- and 3-digit numbers to show understanding of how these are partitioned, regrouped, recombined or redistributed and can transfer this to a written method of recording in columns.

Page 102: Exploring Roman numerals (Mea 1·1 & 1·2)

Practice

1 4, 7, 9, 12

2 **a** 4 o'clock **b** Half past 7 **c** 5 to 9

Going deeper

1 **a** 12 other adding calculations.

b II + XV = XVII; IV + IX = XIII; IV + XI = XV; V + XII = XVII; VI + IX = XV; VI + XI = XVII; X + VII = XVII; XI + IV = XV; XI + VI = XVII; XII + V = XVII; XIV + I + XV; XV + II = XVII; XVI + I = XVII

Page 103: Telling the time on a 12-hour digital clock (Mea 1·3)

Practice

1 Answers will vary and any reasonable activities appropriate to the given times should be accepted. For example:

Times in the morning

1:05 Sleeping; 7:15 a.m. Breakfast; 11:00 a.m. Break time.

Times in the afternoon

12:15 p.m. Lunch; 2:45 p.m. Lessons; 6:45 p.m. Dinner.

2 Analogue clock faces showing the correct times: 5 minutes past 1, quarter past 7, 11 o'clock, quarter past 12, quarter to 3 and quarter to 7.

Going deeper

1 **a** Answers will vary.

b Answers will vary.

2 **a** Answers will vary. Make sure answers are between 6 a.m. and 12 p.m.

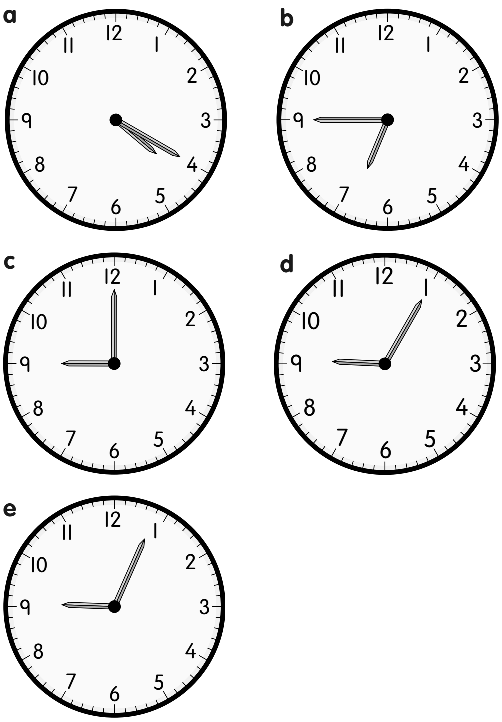
b Answers will vary.

Page 104: Telling the time to the nearest minute (Mea 1·4)

Practice

1 **a** 9 o'clock **b** Half past 7 **c** Quarter past 5
d Five to 3 **e** Twenty to 2 **f** Two minutes past 8

2



Going deeper

1 4:15 and clock face showing 4:15; 2:15 and quarter past two; quarter to two, clock face showing 1:45 and 1:45; 3:10 and ten past three.

Page 105: Solving problems with time (Mea 1·5)

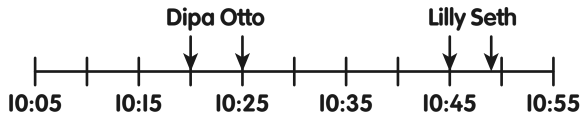
Practice

1 **a** 8:30 **b** 8:35 **c** 8:45 **d** 8:55. Children could also be encouraged to practise using 'past' and 'to' when giving their answers here so they could say: **a** half past eight, **b** twenty-five to nine, **c** a quarter to nine, **d** five to nine.

2 Ella at 3:30, Ali at 3:10 and Holly at 3:35. Again, children can also be encouraged to practise using 'past' and 'to' when giving their answers here: Ella left at half past three, Ali left at ten minutes past three and Holly left at twenty-five minutes to four.

Going deeper

1 Dipa won. Dipa 10:20, Otto 10:25, Lilly 10:45, Seth 10:49. Suggest that children draw a timeline to help them work out the answer.



GMS Milestone 2

- Tell times to the nearest minute, both past and to, shown on analogue clocks.
- Discuss differences and similarities between digital and analogue clocks including analogue clocks with Roman numerals, and explain how they display the time.
- Say times shown on a 12-hour digital clock.
- Calculate a given number of minutes earlier and later than times shown on a 12-hour digital clock.

Page 106: The 24-hour day (Mea 2·1 & 2·2)

Practice

1 2 a.m., 10 a.m., 5 p.m., 11 p.m.

2 11 a.m., 7 p.m., 2 a.m., 8 a.m.

Going deeper

1 10:45 a.m.

2 4:45 a.m.

3 10:35 a.m.

4 4·5 hours

Page 107: Exploring seconds, minutes, hours, days and weeks (Mea 2·3)

Practice

1 **a** 60 **b** 60 **c** 24 **d** 7 **e** 4 **f** 12

Going deeper

1 120 seconds, 2 minutes; a fortnight, 2 weeks, 14 days; quarter of an hour, 15 minutes; $\frac{1}{2}$ year, 6 months; 48 hours, 2 days

2 Answers will vary.

Page 108: Exploring the number of days and months in a year (Mea 2·4)

Practice

1 26 months

2 62 days

3 99 months

Going deeper

1 Children need to remember the number of days in each month and to add these together. The answer will vary depending on whether or not it is a leap year. For a non-leap year: 31 (Oct) + 30 (Nov) + 31 (Dec) + 31 (Jan) + 28 (Feb) + 31 (Mar) = 182 days in total. For a leap year February will have 29 days instead of 28 so the total number of days will be 183.

2 **a** 183 days **b** 365 – 183 = 182, or 183 in a leap year

Page 109: Exploring years, decades, centuries and millennia (Mea 2·5)

Practice

1 **a** 10	**b** 100	**c** 10	**d** 10
e 1000	**f** 20	**g** 300	**h** 4000

Going deeper

1 21st century, 20th century

2 20th century

3 200 runs

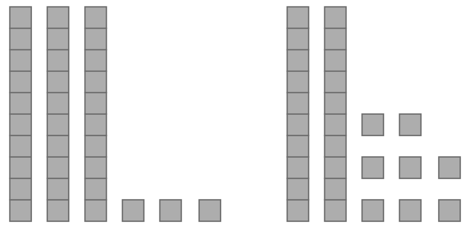
GMS Milestone 2

- Use terms such as midday, midnight, a.m. and p.m. to explain how time progresses and is labelled in a 24-hour day.
- Find and compare durations of time across 24 hours, including times starting at half past the hour.
- Compare and order units of time, and know the number of seconds in a minute, minutes in an hour and hours in a day.
- Recall, or know how to work out, the number of days in each month and the number of days in a year, or leap year.

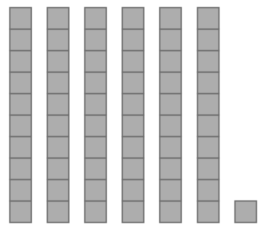
Page 110: Adding using grouping and regrouping (Calc 13·1)

Practice

1 **a** **Ravi** **Molly**



Altogether



$$\begin{array}{r} 33 \\ +\ 28 \\ \hline 61 \\ \hline {\scriptstyle 1} \end{array}$$

2 **a**, **b** and **c** Children's estimates and calculations will vary.

Going deeper

1 61 + 80 = 141

2 Responses will vary. **a** Example: 45 + 28 **b** Example: 86 + 55

Page 111: Adding hundreds, tens and ones (Calc 13·2)

Practice

1 Ben: 254 + 617 = 871

Tia: 522 + 258 = 780

2 Answers will vary.

Going deeper

1 Example response:

258 + 259 = 517

2 Example responses:

515 + 130 = 645

870 + 135 = 1005

520 + 255 = 775

Page 112: Adding using an abacus (Calc 13·3 & 13·4)

Practice

1 Molly: 371 and Tia: 613

2 984

3 396

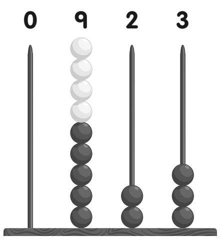
4
$$\begin{array}{r} 235 \\ +\ 132 \\ 116 \\ \hline 483 \\ \hline {\scriptstyle 1} \end{array}$$

Going deeper

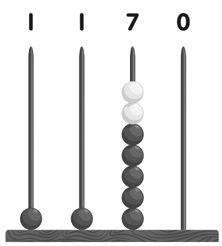
1 **a** 475 **b** 444

2 **a** For the calculation 247 + 923, the abacus will need a 4th column for the thousands.

Before:



After adding 247:



b When you get 10 of anything in any one column, it needs to be regrouped to give 1 in the next column to the left.

Page 113: Deciding when to use the column method for adding (Calc 13·5 & 13·6)

Practice

1 199 + 345 in the Mental method section because you can add 200 and then take 1 away.

124 + 235 in where the circles intersect because you can do it in your head by adding each column or recording it.

167 + 154 in the Written method section as there are two lots of regrouping to do.

2 **a**, **b** and **c** Children's decisions and strategies will vary. For example,

56 + 48 = 104 (mental)

103 + 78 = 181 (mental)

132 + 58 = 190 (mental)

£5·80 + £2·20 = £8 (mental)

56p + 28p + 67p = £1·51 (written)

432 + 521 = 953 (either)

258 + 379 = 637 (written)

£1·55 + 78p + £1·65 = £3·98 (written)

397 + 253 = 650 (mental)

Going deeper

1 **a**
$$\begin{array}{r} 15\mathbf{4} \\ +\ 4\mathbf{6}2 \\ \hline 616 \\ \hline {\scriptstyle 1} \end{array}$$

b
$$\begin{array}{r} 2\mathbf{8}9 \\ +\ 275 \\ \hline \mathbf{5}64 \\ \hline {\scriptstyle 1\,1} \end{array}$$

NPC Milestone 5

- Choose whether a mental or column method is the most appropriate before solving different adding and subtracting problems.
- Use rounding when making a reasonable estimate of the possible answer to an adding or subtracting problem.
- Add or subtract amounts of money over £1 using a written method.

Page 114: Solving subtracting problems to 100 (Calc 14·1)

Practice

1 **a** 32 cm **b** 46 cm **c** 14 cm

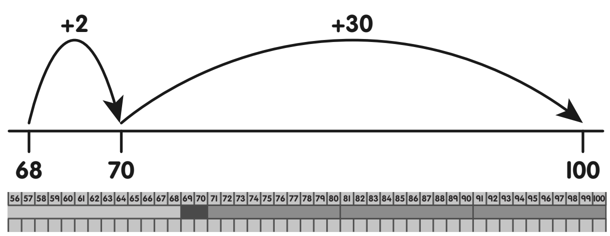
2 Molly's – 65 ml

Ben's – 54 ml

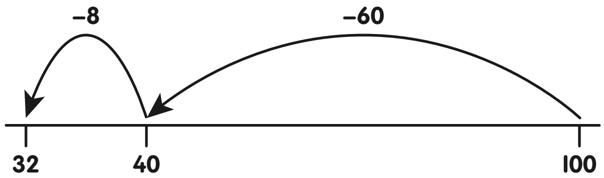
Going deeper

1 100 – 68 = 32

Counting on to find the difference:



Counting back 68 from 100 to land on 32:



2 Take away 7 from 32 to give 25 cm.

Page 115: Subtracting by mentally counting on (Calc 14·2 & 14·4)

Practice

1 27 g

2 114 g

3 **a** 86 – 68 = **18**

b 122 – 118 = **4**

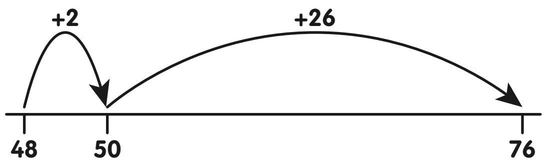
c 164 – 145 = **19**

4 Methods will vary but encourage children to notice a small difference between the numbers.

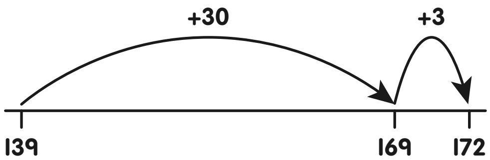
Going deeper

1 Strategies will vary. Example:

a



b



c Responses will vary.

2 **a** Answers will vary. Example response: 60 – 23 = 37

b Any two numbers with a difference of 37.

Page 116: Deciding when to use a written method (Calc 14·3 and 14·5)

Practice

1 Because there is no regrouping required for 874 – 631.

2 Responses will vary.

3 Responses will vary.

4 **a** 73 **b** 233 **c** 63

Going deeper

1 874 – 631 = 243

71 – 42 = 29

Strategies will vary.

2 Responses will vary. Example:

546 – 2**4**1 = 305

546 – 2**3**5 = 311

546 – 2**2**9 = 317

3 For Going deeper question 3 if you don't have number cards you can use photocopy master 19 from the *Geometry, Measurement and Statistics 3 Teaching Resource Handbook*. Answers will vary.

Page 117: The column method for subtracting (Calc 14·6)

Practice

1 **a** Exchange one ten for ten ones and then complete the calculation by taking away.

b Because you need to exchange whereas you don't need to for 875 – 652.

2 **a** 217 **b** 548 **c** 273

Going deeper

1 Responses will vary. Example:

875 – 258

875 – 382

875 – 487

2 **a** 562 – 235 = 327

b 468 – 129 = 339

NPC Milestone 5

- Illustrate mental strategies for adding and subtracting 2- and 3-digit numbers on an empty number line.
- Use the inverse relation between adding and subtracting to check solutions to calculations.

Page 118: How many times bigger? (Calc 15·1 & 15·2)

Practice

1 **a** 2 times bigger 2 × 2 **b** 2 times bigger 3 × 2

c 3 times bigger 3 × 3

2 Multiplied by 2: 4 red, 4 yellow, 4 blue. The multiplying sentence for each colour will be 2 × 2 = 4.

Multiplied by 3: 6 red, 6 yellow, 6 blue. The multiplying sentence for each colour will be 2 × 3 = 6.

3 **a** 3 × 1 and 3 × 3; 3 cubes of different colours and 3 cubes of each different colour (any orientation but same order)

b 4 × 1 and 4 × 2; 4 cubes of different colours and 2 cubes of each different colour (any orientation but same order)

c 3 × 2 and 4 × 2; 6 cubes, 2 each of 3 different colours and 2 cubes of 4 different colours (any orientation but same order)

Going deeper

1

Ingredients	Serves 1	Serves 2	Serves 6
3 eggs	3	**6**	**18**
1 cup of flour	1	**2**	6
10 ml milk	10 ml	**20 ml**	**60 ml**
5 spoons of sugar	**5**	10	**30**

2. Multiply the ingredients by 5 or make the recipe amounts five times bigger. Explanations should refer to multiplying by the number of people along with pattern, times tables etc.

Page 119: How many times smaller? How many times longer? (Calc 15·3 & 15·4)

Practice

1 1 yellow, 1 red, 1 blue circle 6 ÷ 2 = 3

2 red, blue, red, blue, red, blue, red, blue, red, blue, red, blue 4 × 3 = 12

3 Answers will vary.

Going deeper

1 **a** 8 **b** 16 **c** 40

2 **a** and **b** Answers will vary.

3 Explanations may include recognizing the link to times tables and related dividing facts and using these, patterns, doubling and halving.

a The blue number rod is three times the length of the light green number rod.

The light green number rod is a third of the length of the blue number rod.

b The brown number rod is four times longer than the red number rod.

The red number rod is a quarter of the length of the brown number rod.

Page 120: Finding rules for multiplying and dividing by 10 (Calc 15·5 & 15·6)

Practice

1 **a** 1 × 10 = 10 5 × 10 = 50

2 × 10 = 20 6 × 10 = 60

3 × 10 = 30 7 × 10 = 70

b Explanations may refer to patterns in the calculations, known facts, etc.

2 **a** 10 ÷ 10 = 1 50 ÷ 10 = 5

20 ÷ 10 = 2 60 ÷ 10 = 6

30 ÷ 10 = 3 70 ÷ 10 = 7

b Explanations may refer to patterns in the calculations, known multiplication facts, inverse of multiplication, etc.

Going deeper

1 **a** 100 60 120 70 90 10

b 8 5 11 2 3 4

c Explanations may refer to work in class with equipment, TO frames, multiplication and related division facts, patterns in calculation, etc.

2 As this is an open-ended task, there is a variety of accepted answers. Children should be recording number trios, pairs or families of facts such as: 2 × 10 = 20, 10 × 2 = 20, 20 ÷ 10 = 2, and 20 ÷ 2 = 10.

Page 121: Short written methods for multiplying and dividing (Calc 15·7 & 15·8)

Practice

1 **a** 75 **b** 45 **c** 90 **d** 135

2 **a** 10 **b** 2 **c** 11 **d** 8

Going deeper

1 **a** 11 packs **b** 22 cards in each pack

2 **a** 84 cards **b** 108 cards

NPC Milestone 5

- Make general statements about what happens when multiplying and dividing by 10.
- Illustrate and find solutions to multiplying and dividing problems involving teen numbers using structured apparatus and recall of facts.
- Illustrate scaling up and ratio problems with structured apparatus and use the language of scaling and ratio to explain their solutions.

Page 122: Exploring perimeters (Mea 3·2)

Practice

1 **a** 24 cm **b** 28 cm **c** 24 cm

2 Children's own artwork of rectangles: **a** is 7 by 5 cm, **b** is 10 by 4 cm, **c** is 9 by 3 cm.

Going deeper

1 **a** 30 cm **b** 18 cm **c** 28 cm

2 Nine different rectangles are possible, with the following side lengths:

1 cm × 9 cm

2 cm × 8 cm

3 cm × 7 cm

4 cm × 6 cm

5 cm × 5 cm

6 cm × 4 cm

7 cm × 3 cm

8 cm × 2 cm

9 cm × 1 cm

Page 123: Exploring millimetres, centimetres and metres (Mea 3·3 & 3·4)

Practice

1 Brick 10 mm, car 23 mm, bike 14 mm, boat 59 mm, lorry 80 mm. Order is 10 mm, 14 mm, 23 mm, 59 mm, 80 mm.

2 45 mm

3 152 cm

Going deeper

1 Answers will vary.

2 **a** 208 mm or 20 cm 8 mm **b** 356 mm or 35 cm 6 mm

Page 124: Calculating with lengths (Mea 3·5)

Practice

1 400 mm, or 40 cm

2 120 mm tall, 100 mm wide

Going deeper

1 140 mm tall, 80 mm wide

2 **a** 80 mm by 100 mm; 60 mm by 120 mm

b 8 cm by 10 cm; 6 cm by 12 cm

Page 125: Collecting and presenting data (Mea 3·6)

Practice

1

Name	Tally
Ravi	卌 卌
Tia	卌 II
Molly	卌 卌 II
Ben	卌

2

Name	Books
Ravi	● ● ● ● ●
Tia	● ● ● ◐
Molly	● ● ● ● ● ●
Ben	● ● ◐

Going deeper

1 **a** 4

b Ravi 16 socks, Tia 8 socks, Molly 12 socks, Ben 24 socks

GMS Milestone 3

- Show understanding of metres, centimetres and millimetres, by making sensible estimates of lengths using suitable units.
- Convert between metres and centimetres, and centimetres and millimetres.
- Solve real-life measure problems by adding and subtracting lengths, including those given in mixed units.
- Measure accurately to calculate the perimeter of rectangular shapes.
- Complete tally charts and pictograms to collect and present data, then discuss their findings.

Page 126: Finding amounts and paying in coins (Mea 4·2)

Practice

1 **a** Water **b** T-shirt **c** Bat

2 **a** 10p, 5p, 2p, 2p **b** £1, 20p, 10p

c 20p, 10, 2p, 2p **d** 50p, 20p, 20p, 5p

e 50p, 20p, 5p, 2p

Going deeper

1 **a** 20p, 20p, 5p, 5p; 20p, 10p, 10p, 10p

b 50p, 20p, 10p, 10p, 5p, 5p; 20p, 20p, 20p, 20p, 10p, 10p

2 Apple and orange: 55p: 50p, 1p, 1p, 1p, 1p, 1p; 10p, 10p, 10p, 10p, 10p, 5p

Apple and banana: 68p: 50p, 10p, 5p, 1p, 1p, 1p; 20p, 20p, 20p, 5p, 2p, 1p

Orange and banana: 73p: 20p, 20p, 20p, 10p, 2p, 1p; 50p, 10p, 10p, 1p, 1p, 1p

Page 127: Receiving change (Mea 4·3)

Practice

1 **a** £2 **b** £2·70 **c** 75p **d** £2·35 **e** £3·15 **f** £1·53

2 **a** £1·50 **b** £4·23 **c** £6·30 **d** £4·35

Going deeper

1 Ravi: scissors and glue £3·45 + £2·30 = £5·75 with £4·25 change; Molly: pen and box of paperclips £3·00 + £2·65 = £5·65 with £4·35 change; Tia: pen and envelopes £3·00 + £3·47 = £6·47 with £3·53 change; Ben: glue and ruler £2·30 + £1·85 = £4·15 with £5·85 change.

Page 128: Adjusting and totalling money amounts (Mea 4·4)

Practice

1 **a** 75p **b** £1·55 **c** 41p **d** £3·50

Going deeper

1 **a** £2 coin, 2 lots of 20p **b** £2 coin, £1 coin, 10p, 5p

c £2 coin, £1 coin, 20p **d** £2 coin, 50p, 20p, 20p, 5p, 2p, 2p

2 £8·26

Page 129: Buying multiple items and working out the savings (Mea 4·5)

Practice

1 **a** Crisps: You save 35p.

b Fruit: You save 20p.

b Drinks: You save 30p.

2 £11

Going deeper

1 £1

2 Sadie saves £1·40 on crisps; 60p on fruit and £1·80 on drinks. She saves £3·80 altogether.

GMS Milestone 3

- Use mathematical apparatus to model and discuss the relationship between the values of 1p, 10p and £1 coins.
- Make given amounts of money up to £10, using the fewest coins and/or notes.
- Calculate the total of two prices given in pounds and pence, and discuss their strategy, e.g. adjusting, rounding.
- Decide if goods are affordable, given a certain budget, and calculate the change they should receive.

Page 130: Exploring fractions and dividing (Calc 16·1)

Practice

1 $6 \div 2 = 3$

$\frac{1}{2}$ of 6 is 3

2 $3 \div 2 = 1\frac{1}{2}$

$\frac{1}{2}$ of 3 is $1\frac{1}{2}$

Encourage children to share out 3 between 2; they will need to break one carrot in half.

3 **a** $8 \div 4 = 2$

$\frac{1}{4}$ of $8 = 2$

b $5 \div 4 = 1\frac{1}{4}$

$\frac{1}{4}$ of $5 = 1\frac{1}{4}$

Going deeper

1 $5 \div 2 = 2\frac{1}{2}$ This is more.

$9 \div 4 = 2\frac{1}{4}$

2 You don't get an answer that is a whole number.

3 **a** Answers will vary. Example:

$24 \div 4 = 6$, $6 \div 2 = 3$, $3 \div 2 = 1\frac{1}{2}$

b Answers will vary.

Example:

$20 \div 4 = 5$, $5 \div 2 = 2\frac{1}{2}$, $2\frac{1}{2} \div 2 = 1\frac{1}{4}$

Page 131: Halving numbers (Calc 16·2 and 16·3)

Practice

1 Find two numbers that are the same that total 16: 8 ∆ 8

2 **a** 14 ∆ 14

b 16 ∆ 16

c 27 ∆ 27

3 25p because two 20ps and two 5ps make 50p.

Going deeper

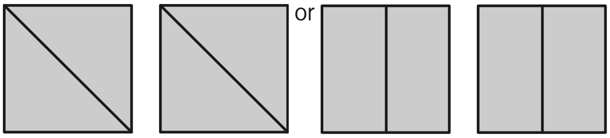
1 12, 14, 16 or 18

2 Answers will vary.

3 45 g

Page 132: Finding how many halves (Calc 16·4)

Practice

1 

2 8

3 3

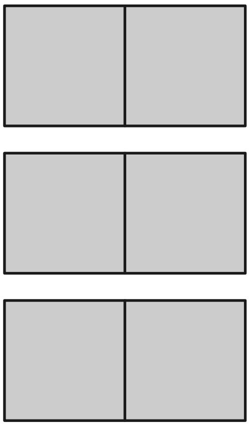
4 24

Going deeper

1 10 because you can cut 2 pieces of 50 cm from 1 m.

2 12

3 $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=3$



Page 133: Finding quarters (Calc 16·5 and 16·6)

Practice

1 Children should see that 12 has been broken up into halves and quarters and can give some related facts, e.g. $\frac{1}{2}$ of 12 is 6, $\frac{1}{4}$ of 12 is 3.

2 **a** $\frac{1}{4}$ of 24 = 6

b $\frac{1}{4}$ of 40 = 10

c $\frac{1}{4}$ of 64 = 16

3 **a** 3

b 32

Going deeper

1 **a** Halve it and halve it again or divide it by 4.

b A multiple of 4 because only multiples of 4 can be divided exactly by 4.

c 8

2 20 because $\frac{1}{4}$ of £1 is 25p so you can have 4 goes for £1. For £5 you can have 5 times this amount.

NPC Milestone 6

- Fluently recall double and half facts and use these to find halves and quarters of numbers within their working range.
- Make connections between unit fractions as operators and division by integers (e.g. connect halving and quartering with dividing by 2 and 4, and finding thirds with dividing by 3).
- Interpret remainders as fractions and notice that the context will affect how we deal with the remainder when dividing odd numbers into two or four parts.
- Differentiate between finding half of a number and finding how many halves are in a number.

Page 134: Using grams and kilograms (Mea 5·1 & 5·2)

Practice

1 **a** 400 g **b** 700 g

2 **a** $3\frac{1}{2}$ kg 3500 g **b** $2\frac{3}{4}$ kg 2750 g

Going deeper

1 **a** There's 1000 g in the left pan and 1250 g (750 g + 500 g) in the right pan. 1000 g – 1250 g = 250 g, so 250 g needs to be added to the left pan for the scales to balance. There is only one possible way to do this: one bag of flour (250 g) needs to be added to the left pan.

b There's 1500 g in the left pan (1 kg weight and 500 g mug). In the right pan there's a 250 g bag of flour. 1500 g – 250 g = 1250 g, so 1250 g needs to be placed in the right pan for the scales to balance.

There are several ways of making a further 1250 g:

1 kg weight + a bag of flour

car + 2 bags of flour

car + mug

2 mugs + a bag of flour

1 mug + 3 bags of flour

5 bags of flour

Page 135: Scaling recipe quantities (Mea 5·3)

Practice

1, 2, 3

1 person	200 g carrots	1 tbsp oil	500 ml stock	150 g onions	75 g celery
2 people	400 g	2 tbsp	1 litre	300 g	150 g
3 people	600 g	3 tbsp	1500 ml	450 g	225 g
4 people	800 g	4 tbsp	2 litres	600 g	300 g

Going deeper

1 1250 g butter, 15 eggs, 750 g caster sugar, 500 g flour, 10 tbsp milk, 1250 g icing sugar

2

6 people	3 people	2 people
450 g beef	225 g beef	150 g beef
1 onion	$\frac{1}{2}$ onion	$\frac{1}{3}$ onion
600 ml sauce	300 ml sauce	200 ml sauce
150 g cheese	75 g cheese	50 g cheese
12 lasagne sheets	6 lasagne sheets	4 lasagne sheets

Page 136: Measuring and calculating with grams (Mea 5·4 & 5·5)

Practice

1 300 g

2 50 g

3 500 g

4 250 g

5 50 g

Going deeper

1 He should buy 2 packets of butter, one packet of flour, 2 boxes of eggs and one carton of milk, and can make 5 cakes.

Page 137: Money and data handling (Mea 5·6 & 5·7)

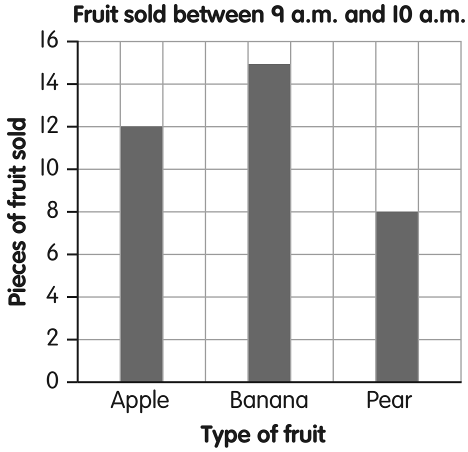
Practice

1 **a** 60p **b** 75p **c** £1·20 **d** 70p **e** £1·50
f £2·30 **g** £2 **h** £2·50 **I** £3

2 **a**

Fruit	Tally
Apples	𝍸 𝍸 II
Banana	𝍸 𝍸 𝍸
Pears	𝍸 III

b For Practice question **2b** photocopy master 16a of an empty graph with scale 0–20 shown in 2s is available if needed from the *Number, Pattern and Calculating 3 Teaching Resource Handbook.*



Going deeper

1 5 apples; 4 bananas; 2 apples and 2 pears; apple, pear, 2 bananas

2 Any two of the answers to question **1** combined or 6 pears plus an apple.

3 £8·55

GMS Milestone 4

- Use a dial weighing scale to measure individual amounts in 100 g increments, up to 5 kg.
- Recognize equivalences between g and kg, e.g. 1000 g = 1 kg, 500 g = $\frac{1}{2}$ kg, 250 g = $\frac{1}{4}$ kg.
- Find the total mass of two or more items and the difference in mass between items.
- Interpret word problems involving mass, modelling with weights or other apparatus, as appropriate.

Page 138: Reading a scale in millilitres (Mea 6·1)

Practice

1 **a** 200 ml **b** 850 ml **c** 50 ml

2 **a** $\frac{1}{4}$ litre **b** $\frac{3}{4}$ litre **c** $\frac{1}{2}$ litre

Going deeper

1 **a** 300 ml **b** 450 ml **c** 175 ml

Page 139: Changing fractions of a litre to millilitres (Mea 6·2)

Practice

1 0 ml, 200 ml, 250 ml and $\frac{1}{4}$ litre, 300 ml, 350 ml, $\frac{1}{2}$ ℓ, 600 ml, $\frac{3}{4}$ litre, 999 ml, 1000 ml and 1 litre

Going deeper

1 6

2 1

3 Answers will vary.

Page 140: Adding and subtracting volumes of liquid (Mea 6·3)

Practice

1 420 ml

2 600 ml

3 60 ml

4 750 ml

5 700 ml

Going deeper

1 Fill 5 litres, pour into 3 litre jug and 2 litres are left in large jug.

Page 141: Mixed units of litres and millilitres (Mea 6·4)

Practice

1 2400 ml

2 2100 ml

3 1500 ml

4 2400 ml

Going deeper

1 They can do it 4 times (this uses up 900 ml of the 1000 ml of squash and there is only enough left for one more full 75 ml glass).

2 30 ml, for 8 days plus a bit left for day 9. Helen will use 30 ml of medicine each day. After 8 days she will have used 240 ml, so there will only be 10 ml left in the bottle, which is not enough for another day.

GMS Milestone $\boxed{4}$

- Recall that there are 1000 ml in 1 ℓ and know, or work out, the volume of $\frac{1}{2}$ ℓ, $\frac{1}{4}$ ℓ and $\frac{3}{4}$ ℓ in ml.
- Understand the term 'capacity' and make sensible estimates of volumes of liquid held in different containers.
- Measure out a precise volume of liquid using the scale on a jug or other scaled vessel.
- Solve capacity word problems, e.g. 'What is the total volume of…?', and 'How much is left if I pour out…?'

Page 142: Comparing parts with wholes (NNS 7·1 & 7·2)

Practice

1 $\frac{1}{4}$

2 $\frac{1}{2}$ is yellow, $\frac{1}{2}$ is green

3 2 children

Going deeper

1 Ben, Molly and Tia

2 Ben, as the others have 9 between them and the 3 blues are $\frac{1}{3}$ of 9.

Page 143: Using fractions to compare parts (NNS 7·3 & 7·4)

Practice

1 £8 (half of 16)

2 Tia

3 $\frac{1}{4}$, this is £2.

Going deeper

1 $\frac{1}{99}$ because it has fewer shares.

2 $\frac{2}{50}$ fiftieths are bigger than sixtieths.

3 Answers will vary.

Page 144: Exploring fractions as numbers on a number line (NNS 7·5)

Practice

1 **a** $\frac{1}{4}$ **b** $\frac{1}{6}$ **c** $\frac{5}{6}$ **d** $\frac{2}{8}$ **e** $\frac{3}{8}$ **f** $\frac{6}{8}$

Going deeper

1 **a** $\frac{1}{2}$ **b** $1\frac{1}{2}$ or $\frac{3}{2}$ **c** $\frac{1}{3}$ **d** $1\frac{2}{3}$ or $\frac{5}{3}$ **e** $2\frac{1}{2}$ **f** $3\frac{1}{2}$

Page 145: Exploring equivalence (NNS 7·6 & 7·7)

Practice

1 **a** $\frac{2}{4}, \frac{3}{6}$ **b** $\frac{2}{6}$ **c** $\frac{4}{6}$ **d** $\frac{2}{2}, \frac{3}{3}, \frac{4}{4}, \frac{5}{5}, \frac{6}{6}$

Going deeper

1 5 combinations

$\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}$

$\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{8}+\frac{1}{8}$

$\frac{1}{4}+\frac{1}{4}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}$

$\frac{1}{4}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}$

$\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}$

2 7 combinations

$\frac{1}{2}+\frac{1}{2}$

$\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$

$\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}$

$\frac{1}{2}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}$

$\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{3}$

$\frac{1}{6}+\frac{1}{6}+\frac{1}{3}+\frac{1}{3}$

$\frac{1}{2}+\frac{1}{6}+\frac{1}{3}$

3 3 combinations. There is no way to combine different denominators.

$\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$

$\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}$

$\frac{1}{5}+\frac{1}{5}+\frac{1}{5}+\frac{1}{5}+\frac{1}{5}$

NPC Milestone 6

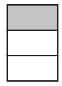
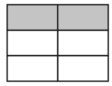
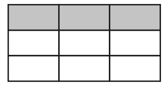
- Connect ordinal number names with names for fractions and understand that the denominator (i.e. the name of the fraction) tells us how many parts a whole has been divided into and the numerator tells us how many of those parts are represented.
- Know that fractions have places on the number line between whole numbers (integers).
- Know that the greater the number of parts a number is divided into, the smaller each of the parts becomes.

Page 146: Fractions of a set (NNS 8·1 & 8·2)

Practice

1 **a** $\frac{3}{4}$ **b** $\frac{3}{4}$ **c** $\frac{1}{4}$ **d** $\frac{1}{4}$

2 Answers will vary, e.g.

a  **b**  **c** 

Going deeper

1 **a** $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}, \frac{2}{3}, \frac{2}{5}, \frac{3}{5}$

b As above and then: one-half, one-third, one-fifth, two-thirds, two-fifths, three-fifths.

Page 147: Recognizing fractions (NNS 8·3 & 8·4)

Practice

1 **a** $\frac{3}{4}$ **b** $\frac{3}{5}$ **c** $\frac{3}{6}$ or $\frac{1}{2}$ **d** $\frac{4}{7}$ **e** $\frac{3}{9}$ or $\frac{1}{3}$ **f** 1

2 Fraction **c**

3 Fraction **e**

4 **a** $\frac{1}{4}$ **b** $\frac{2}{5}$ **c** $\frac{3}{6}$ or $\frac{1}{2}$ **d** $\frac{3}{7}$ **e** $\frac{6}{9}$ or $\frac{2}{3}$ **f** 0

Going deeper

1 **a** $\frac{2}{3}$ **b** $\frac{2}{4}$ **c** $\frac{1}{3}$ **d** $\frac{2}{5}$ **e** $\frac{2}{8}$ **f** $\frac{2}{6}$

Page 148: Adding, subtracting and finding equivalent fractions (NNS 8·5 & 8·6)

Practice

1 **a** **a** $\frac{4}{7}$ **b** $\frac{3}{9}$ **c** $\frac{4}{8}$ **d** $\frac{2}{6}$

b **a** $\frac{2}{7}$ **b** $\frac{3}{9}$ **c** $\frac{3}{8}$ **d** $\frac{2}{6}$

2 **a** $\frac{2}{7}+\frac{4}{7}=\frac{6}{7}$ **b** $\frac{3}{9}+\frac{3}{9}=\frac{6}{9}$

c $\frac{3}{8}+\frac{4}{8}=\frac{7}{8}$ **d** $\frac{2}{6}+\frac{2}{6}+\frac{2}{6}=\frac{6}{6}$

Going deeper

1 **a** $1-\frac{6}{7}=\frac{1}{7}$ **b** $1-\frac{6}{9}=\frac{3}{9}$

c $1-\frac{7}{8}=\frac{1}{8}$ **d** $1-\frac{6}{6}=0$

2 $\frac{2}{4}, \frac{5}{10}, \frac{17}{34}, \frac{34}{68}, \frac{60}{120}, \frac{20}{40}, \frac{15}{30}, \frac{10}{20}, \frac{30}{60}$

Page 149: Making links between finding fractions of a set and dividing (NNS 8·7 & 8·8)

Practice

1 **a** $12 \div 3 = 4$ **b** $12 \div 4 = 3$

2 **a** $\frac{1}{3}$ of $12 = 4$ **b** $\frac{2}{3}$ of $12 = 8$

Going deeper

1 **a** $9 \div 3 = 3$, $\frac{1}{3}$ of $9 = 3$ **b** $12 \div 3 = 4$, $\frac{1}{3}$ of $12 = 4$

c $6 \div 3 = 2$, $\frac{1}{3}$ of $6 = 2$

NPC Milestone 6

- Know that half can be represented by different equivalent fractions.
- Illustrate written fractions with apparatus and can write a fraction in response to seeing it built with apparatus.
- Add and subtract fractions with the same denominator within one whole Shape and within one set.

Page 150: Finding all possibilities (P&A 5·1)

Practice

1 8 different combinations

RRR	YRR
RRY	YYR
RYY	RYR
YYY	YRY

Any systematic recording acceptable, e.g. Cuisenaire/number rods, counters, written form.

2 Any answer that refers to the combinations in order or being systematic.

Going deeper

1 **a** 27 combinations

b Any systematic recording using resources or pencil and paper acceptable.

RRR	BBB	YYY
RRY	BBY	YYR
RYY	BYY	YRR
RRB	BBR	YYB
RBB	BRR	YBB
RBY	BRY	YRB
RYB	BYR	YBR
RBR	BRB	YRY
RYR	BYB	YBY

3 cubed = 27

2 Explanations here should refer to being systematic, e.g. starting with all of the red permutations or grouping the permutations into three, e.g. all the same RRR, BBB, YYY or beginning with all the ones starting with two reds RRR, RRB, RRY. Hints for those struggling should centre on being systematic and finding a way to check, perhaps with counters or number rods.

Page 151: Finding all possibilities with coins (P&A 5·3)

Practice

1 41 ways. Any recording that is systematic, e.g. beginning with 20p coin and then working through to 20 × 1p coins

20
10 : 10
10 : 5 : 5
10 : 5 : 2 : 2 : 1
10 : 5 : 2 : 1 : 1 : 1
10 : 5 : 1 : 1 : 1 : 1 : 1
10 : 2 : 2 : 2 : 2 : 2
10 : 2 : 2 : 2 : 2 : 1 : 1
10 : 2 : 2 : 2 : 1 : 1 : 1 : 1
10 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1
10 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
10 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
5 : 5 : 5 : 5
5 : 5 : 5 : 2 : 2 : 1
5 : 5 : 5 : 2 : 1 : 1 : 1
5 : 5 : 5 : 1 : 1 : 1 : 1 : 1
5 : 5 : 2 : 2 : 2 : 2 : 2
5 : 5 : 2 : 2 : 2 : 2 : 1 : 1
5 : 5 : 2 : 2 : 2 : 1 : 1 : 1 : 1
5 : 5 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1
5 : 5 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
5 : 5 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
5 : 2 : 2 : 2 : 2 : 2 : 2 : 2 : 1
5 : 2 : 2 : 2 : 2 : 2 : 2 : 1 : 1 : 1
5 : 2 : 2 : 2 : 2 : 2 : 1 : 1 : 1 : 1 : 1
5 : 2 : 2 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1
5 : 2 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
5 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
5 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
5 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
2 : 2 : 2 : 2 : 2 : 2 : 2 : 2 : 2 : 2
2 : 2 : 2 : 2 : 2 : 2 : 2 : 2 : 2 : 1 : 1
2 : 2 : 2 : 2 : 2 : 2 : 2 : 2 : 1 : 1 : 1 : 1
2 : 2 : 2 : 2 : 2 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1
2 : 2 : 2 : 2 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
2 : 2 : 2 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
2 : 2 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
2 : 2 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
2 : 2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
2 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1

2 20p coin

3 20 × 1p coins

4 Children's explanation here should link to their method of working and be systematic. They may have recorded this using coins or pencil and paper.

Going deeper

1 Fewest coins to make 26p is 3 (20p + 5p + 1p). Most number of coins is 26 (26 × 1p).

2 Answer will vary, depending on the chosen amounts. Explanations that use what they found out in Practice question **1**, working logically and systematically, are valid here.

3 This is not true as they can use the 1p coin to make any amount, odd or even. This is an open investigation; children should be recording logically and systematically as they have in Practice question **1**.

Page 152: Investigating consecutive numbers (P&A 5·5)

Practice

1 6 and 7

2 Any odd, even, odd combination of three consecutive numbers such as 5, 6, 7 or 57, 58, 59.

3 2 × 3 × 4. Yes, this is the only answer. If they try smaller numbers the product will not be big enough; if they try larger numbers, the product will be too big.

Going deeper

1 **a** 45 **b** 36 **c** 75

2 **a** 6, 7, 8 **b** 4, 5, 6 **c** 2, 3, 4 **d** 8, 9, 10 **e** 5, 6, 7

3 The answer is always three times the middle number ($3n$).

4 No, the answer will always be odd because when adding two consecutive numbers you are always adding odd + even, and odd + even always equals odd.

Page 153: Investigating odd and even numbers (P&A 5·6)

Practice

1 Yes. Proof could be explaining that the sum of any two even numbers can be divided by 2, therefore are even. This could be proved with Numicon Shapes.

2 **a** An odd number is always left. Explanations could again be proved with Numicon Shapes. Taking away an even number (a multiple of 2) from an odd number will always be odd because an odd number is 1 away from being even. Or subtracting an even number takes away groups of 2, therefore the odd pattern remains.

b It will always be even. The difference between two odd numbers can be investigated with Numicon Shapes.

3 No, this will be odd because the first two odd numbers will combine to make an even number – both these numbers are 1 away from being even, therefore combining them makes a pair. The third odd is 1 away from an even number again.

Going deeper

1 **a** True because four odd numbers are each 1 away from being even and these add to make 4; an even number. This can be proved with Numicon Shapes

b True because each odd number is 1 away from an even so if we subtract any odd number this 1 is always taken leaving an even number. Proving with Numicon Shapes allows the pattern to be seen.

NPC Milestone 6

- Investigate suitable problems and work systematically to show that they have tried and tested all possibilities.
- Choose efficient recording systems.
- Express a general statement and explain their reasoning.

Page 154: Using position and direction instructions (Geo 4.1 and 4.4)

Practice

1 Across 3 and up 4

2 Down 2, left 4

3 **a** 7 shape: right 4 and up 3

b 4 shape: right 5 and down 5

c left 4, down 3; left 5, up 5. The directions are the exact opposite.

Going deeper

1 Instructions will vary.

Example:

Right 8, down 1 – collect yellow

Down 2, left 4 – collect green

Down 2, left 1 – collect red

Down 4, left 3 – collect blue

2 Answers will vary.

Page 155: Using compass directions (Geo 4.2)

Practice

1 West

2 **a** Boot

b Bucket and scroll

c Crown

3 It is to the west of the shield.

It is north of the crown, boot and shield.

It is to the east of all the objects except the shield.

It is south of the scroll, bucket and helmet.

It is directly east of the apple.

Going deeper

1 Forward 2 and then turn to face north – then forward 3.

2 Answers will vary.

Page 156: Using grid references (Geo 4.3)

Practice

1 **a** D7

b City Park, which covers several grid references so any of these answers are acceptable: G7, H7, I7, J7, I8, J8.

2 A6, J3

3 Hospital

4 Green Park

Going deeper

1 and **2** Answers will vary.

Page 157: Making shapes and patterns using instructions (Geo 4.5)

Practice

1 Instructions will vary.

Example:

east 5 – collect strawberry

west 2, north 4, west 2, south 1 – collect strawberry

north 2 – collect strawberry

2 Instructions will vary.

Example:

east 2, north 2, east 1 – collect blackberry

east 3, south 3 – collect blackberry

3 Instructions will vary.

Example:

east 1, north 4 – collect cherry

south 3, west 4 – collect cherry

west 4, north 4 – collect cherry

Going deeper

1 Face west and move forward 2 - collect strawberry

Continue west for 5 then turn to face north and move forward 3.

Turn to face east and move forward 1 - collect strawberry

Turn to face north and move forward 2 - collect strawberry

Turn to face west and move forward 1

Turn to face north and move forward 4 - collect cherries

Turn to face east and move forward 3.

Turn to face south and move forward 2.

Turn to face east and move forward 1 - collect blackberry

Turn to face east and move forward 4.

Turn to face north and move forward 1 - collect cherries

Turn to face south and move forward 4.

Turn to face west and move forward 1 - collect blackberry

Turn to face north, move forward 1.

Turn to face west, move forward 3 - collect cherries.

2 Answers will vary.

GMS Milestone 4

- Present data that they have collected in tables and scaled bar charts.
- Notice patterns in tables and bar charts, e.g. 'the difference between the most and least popular is … '
- Identify positions on a grid, using letter/number grid references e.g. D6.
- Describe movements on a grid with increasing accuracy, e.g. forward 2, left 1, down 3.

Notes

Notes

Notes

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- A guide to the other Numicon 3 resources and how to use these alongside Pupil Book 3
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This answer booklet is also available as part of the *Numicon Online* Planning and Assessment Support on Oxford Owl.

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