Unit 5A1 2 weeks

Counting, partitioning and calculating

Objectives End-of-year expectations (key objectives) are highlighted
• Explain reasoning using diagrams, graphs and text; refine ways of recording using images and symbols
• Count from any given number in whole-number and decimal steps, extending beyond zero when counting backwards; relate the numbers to their position on a number line
• Explain what each digit represents in whole numbers and decimals with up to two places, and partition, round and order these numbers
• Use knowledge of place value and addition and subtraction of two-digit numbers to derive sums and differences and doubles and halves of decimals (e.g. 6.5 ± 2.7, half of 5.6, double 0.34)
• Use efficient written methods to add and subtract whole numbers and decimals with up to two places
• Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts
• Identify pairs of factors of two-digit whole numbers and find common multiples (e.g. for 6 and 9)
• Use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 or 1000
• Extend mental methods for whole-number calculations, for example to multiply a two-digit by a one-digit number (e.g. 12 × 9), to multiply by 25 (e.g. 16 × 25), to subtract one near multiple of 1000 from another (e.g. 6070 – 4097)
• Use knowledge of rounding, place value, number facts and inverse operations to estimate and check calculations

Starters

1	**Place value in whole numbers**	Refine
	Objective: Explain what each digit represents in whole numbers and decimals with up to two places, and partition, round and order these numbers	
	Write 87 063 on the board. Ask the class to read the number aloud in words. Discuss the value of different digits. • What is the value of the digit 6? Of the 8? • Why is there a zero or nought in the hundreds column? • What number is 100 more than 87 063? 100 less than 87 063? • Is 87 063 nearer to 87 000 or to 87 100? How do you know? Talk through writing 86 963 in an expanded form. 86 963 = 80 000 + 6000 + 900 + 60 + 3 Now ask children to write these numbers in figures on their whiteboards: – nine thousand three hundred; – fourteen thousand and six; – one hundred and twenty thousand and thirty. Check and correct errors by writing numbers in an expanded form.	

2	**Counting in ones, tens, hundreds and thousands** Rehearse **Objective:** Count from any given number in whole-number and decimal steps, extending beyond zero when counting backwards; relate the numbers to their position on a number line Use the cards from Resource 5A1.1. Choose a starting number (e.g. 656) and shuffle the cards. Choose a card, using steps of 1, 10, 100 or 1000. Get children to count in steps of the size shown on the card. If the number is +, then count forwards; if it is –, count backwards. Call 'Stop!', select another card and carry on counting using the step shown. Repeat a few times, making sure that children get the opportunity to cross the tens, hundreds and thousands boundaries. Move from the whole class counting to choosing individual children to say the next number to check their understanding. Include counting back below zero. For example, start with 456 and count back in steps of 100. Stop at 56, and ask: • What type of number will the next number be? How will you work it out? If necessary use a calculator to demonstrate what happens, or an empty number line with 0 in the middle.
3	**Multiplying numbers by 10, 100 and 1000** Refine and rehearse **Objective:** Use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 or 1000 Discuss the movement of the digits in a number when it is multiplied by 10, 100 or 1000, using the ITP 'Moving digits'. Use Resource 5A1.2 to make up packs of cards for children to play a 'domino' card game. Ask children to work in groups of four and to make a circle of linked domino cards. Shuffle the cards and repeat. Set the groups a time target using an egg timer or stopwatch.

Main activities

1	**Place value in numbers with two decimal places** **Objective:** Explain what each digit represents in whole numbers and decimals with up to two places, and partition, round and order these numbers Write 63.47 on the board. Ask children to read the number aloud ('sixty-three point four seven'). Remind them that the first place after the decimal point is called the first decimal place and is for tenths; the second decimal place is for hundredths. Ask: • What is the value of the digit 3? Of the 6? Of the 4? Of the 7? Stress that the part of the number before the decimal point is the whole-number part and is read in the same way as a whole number. The part after the decimal point is the decimal fraction, and is read digit by digit. • How would we write 63.47 in expanded form? (63.47 = 60 + 3 + 0.4 + 0.07) Read this aloud together, pointing as you go: 'sixty-three point four seven equals sixty plus three plus four tenths plus seven hundredths'. Write 46.05 on the board. Ask children to read the number aloud ('forty-six point nought five'). Say that some people might say 'forty-six point zero five'. Discuss the value of different digits. • What is the value of the digit 6? Of the 4? Of the 5? • Why is there a zero in the tenths column?

- How would we write and read 46.05 in expanded form? (46.05 = 40 + 6 + 0.05)

Write on the board a target number such as 68.47 and these numbers: 10, 1, 0.1, 0.01. (Alternatively use the cards from Resource 5A1.1.)

Point to one of them (e.g. 10). Start the class counting in multiples of that number: for example, 'ten, twenty, thirty, forty, …'. Call 'Stop!', point to one of the other numbers (e.g. 0.1, one tenth), and continue counting: 'forty point one, forty point two, forty point three, …'. Call 'Stop!', point to one of the other numbers (e.g. 0.01, one hundredth), and continue counting: 'forty point three one, forty point three two, forty point three three, …'. Call 'Stop!', point to the last of the four numbers (1), and continue counting: 'forty-one point three three, forty-two point three three', and so on. Call 'Stop!' again, and remind children of the target number.

- What shall we count in to reach the target number: tens, units or ones, tenths or hundredths?

Choose a child to call 'Stop!', and continue counting as suggested by the class. Repeat the question above each time 'Stop!' is called until the target number is reached. If appropriate, extend to thousandths.

Repeat the activity by counting down from a target number to zero.

Ask children to enter three point seven two into their calculators. Check that all children have entered the correct number by demonstrating on the OHP calculator. Then ask:

- What is one tenth more than the number in your display? What do you think the display will show? What keys should you press?
- What is one hundredth less than the number that is now in your display?

Make sure that children know that to add one tenth they key in + 0.1, and to add one hundredth they key in + 0.01. Read aloud the new number. Then ask:

- What is three tenths more than the number now in your display? What will the display next show? What is one and two tenths more? Four hundredths more?

Ask children to clear the display and enter twenty point nought six. This time ask:

- What is one tenth less than the number in your display? What do you think the display will show? What keys should you press?
- What is one hundredth less than the number that is now in your display? Two tenths less? Three hundredths less? One and four tenths less?

Repeat with:

– nought point nine;

– one point nought eight.

Review

Write on the board: 14.99, 7.01, 13.9.

Point to one of the numbers and ask children to read it aloud (e.g. 'fourteen point nine nine'). Point to particular digits.

- What is the value of this digit?

Invite a child to the board to write the number in expanded form. Ask the class to read it aloud (e.g. 'ten plus four plus nine tenths plus nine hundredths'). Then ask them to write on their whiteboards the number that is one tenth more, one tenth less, one hundredth more, one hundredth less.

Repeat with the other two numbers.

2

Positioning decimals on a number line

Objective: Explain what each digit represents in whole numbers and decimals with up to two places, and partition, round and order these numbers

Explain that the class is going to identify decimal numbers 'hidden between' whole numbers on a number line. Draw this line on the board.

Point about halfway between 0 and 10.

- What number am I pointing at? How do you know?

Draw in the markers for the whole numbers, without numbering them.

Point first to where 7 would go, and then where 8 would go. Each time ask:

- What number goes here? Explain why.

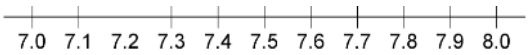
Write in the numbers 7 and 8, then point somewhere between them and repeat the question. Establish that it is difficult to say exactly what number you are pointing at, but that it is a number more than 7 and less than 8.

- What number is halfway between 7 and 8? Where is it on the line?

Establish the approximate position of 7.5 on the line. Say that you will now zoom in on the part of the line from 7 to 8, as though you were looking at it under a microscope. Show an OHT made from Resource 5A1.3, an enlarged segment of the number line from 7 to 8.

- What numbers do the marks on this line show? (tenths from 7 to 8)
- What number is the arrow pointing to? (7.4) How did you work it out?

Invite a child to write in the decimal number at each marker.



Explain that the markers at 7 and 8 can be written as 7.0 and 8.0, because the line is marked in intervals of one tenth, or 0.1. Count together forwards and backwards along the line, saying: 'seven and one tenth, seven and two tenths, seven and three tenths, …', then saying: 'seven point one, seven point two, seven point three, …'.

- What number is one tenth more than 7.3? Three tenths less than 7.8 ?
- What number is two tenths more than 7.9? Three tenths less than 7.1?

Write the following on the board. Point to each in turn and ask for the answer, encouraging children to count on or back in tenths.

7.5 + 0.3 7.8 + 0.5 7.6 + 0.4

7.9 – 0.4 7.4 – 0.6 7.3 – 0.3

Say that you will zoom in again, this time between the 7 and the 7.1. Show an OHT made from Resource 5A1.4, the segment of the line from 7.0 to 7.1, with ten intervals. Explain that the new line is marked in intervals of one tenth of one tenth, or one hundredth. Point to different markers.

- What number am I pointing to?

Get children to call out the number at each marker as you write them in. Count on and back along the line from 7 to 7.1, in hundredths: 'seven point nought one, seven point nought two, …, seven point nought nine, seven point one'.

- What number is one hundredth more than 7.04? Two hundredths less than 7.05?

	Write on the board: 7.07 + 0.02. • What is the answer? Repeat with 7.08 – 0.04. **Review** Write on the board a mixed set of four or five numbers with one or two decimal places. Ask children to write the numbers on their whiteboards starting with the smallest.
3	**Investigating factors** **Objective:** Identify pairs of factors of two-digit whole numbers and find common multiples (e.g. for 6 and 9) Tell children that they are going to explore the question: *Do all numbers have an even number of factors?* Make sure that children understand that the factors of a number are all the numbers that divide it exactly giving no remainder. For example, 4 is a factor of 12 because 12 can be divided by 4 with no remainder. The other factors of 12 are 1, 2, 3, 6 and 12. Display the number 60. Give children 2 to 3 minutes to work with a partner and find all the pairs of numbers that give the product 60. Take feedback. Establish that 60 has 12 factors:  • 60 has an even number of factors. Does this prove that all numbers have an even number of factors? Discuss the need to test more numbers. Divide children into small groups and give each group a set of five numbers using copies of Resources 5A1.5 and 5A1.6. Each set includes a square number. Ask children to find all the factors of each number and agree their answers as a group. They have 10 minutes. Circulate around the groups. Make sure that children record the factors of a square number such as 25 as 1, 5 and 25, not 1, 5, 5, and 25. Bring the groups back together and display a 100-square, for example on an interactive whiteboard. Take feedback from each group. Circle or shade the number on the square if it has an even number of factors. Each time a number is found that does not have an even number of factors circle or shade it in a different colour. Ask children to look at the numbers that do not have an even number of factors and to discuss in their groups what they can say about these numbers. Take feedback. Establish that the numbers are square numbers. **Review** Refer back to the original question: *Do all numbers have an even number of factors?* Ask children to work back in their groups for 2 to 3 minutes to draft their answer to this question. Take feedback. Establish that most numbers have an even number of factors, but that square numbers have an odd number of factors.

Seven more lessons consolidating the above and extending to:

a	**Deriving sums and differences, doubles and halves of decimals; using written methods for adding and subtracting whole numbers and decimals with up to two places; estimating and checking calculations**
b	**Recalling multiplication and division facts; multiplying and dividing pairs of multiples of 10 and 100 (e.g. 3600 ÷ 900)**
c	**Extending mental methods for whole-number calculations**
d	**Explaining reasoning using diagrams, graphs and text and refining ways of recording using images and symbols**

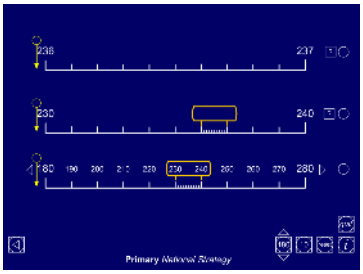
Unit 5A2 — 2 weeks

Counting, partitioning and calculating

Objectives
End-of-year expectations (key objectives) are highlighted
• Explain reasoning using diagrams, graphs and text; refine ways of recording using images and symbols
• Solve one-step and two-step problems involving whole numbers and decimals and all four operations, choosing and using appropriate calculation strategies, including calculator use
• Count from any given number in whole-number and decimal steps, extending beyond zero when counting backwards; relate the numbers to their position on a number line
• Explain what each digit represents in whole numbers and decimals with up to two places, and partition, round and order these numbers
• Use knowledge of place value and addition and subtraction of two-digit numbers to derive sums and differences and doubles and halves of decimals (e.g. 6.5 ± 2.7, half of 5.6, double 0.34)
• Use efficient written methods to add and subtract whole numbers and decimals with up to two places
• Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts
• Identify pairs of factors of two-digit whole numbers and find common multiples (e.g. for 6 and 9)
• Use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 or 1000
• Extend mental methods for whole-number calculations, for example to multiply a two-digit by a one-digit number (e.g. 12 × 9), to multiply by 25 (e.g. 16 × 25), to subtract one near multiple of 1000 from another (e.g. 6070 – 4097)
• Use a calculator to solve problems, including those involving decimals or fractions (e.g. to find $\frac{3}{4}$ of 150 g); interpret the display correctly in the context of measurement
• Use knowledge of rounding, place value, number facts and inverse operations to estimate and check calculations

Starters

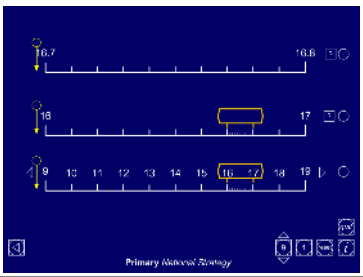
1	**Counting in tens, ones, tenths and hundredths**	Rehearse
	Objective: Count from any given number in whole-number and decimal steps, extending beyond zero when counting backwards; relate the numbers to their position on a number line	
	Display a number line using the ITP 'Decimal number line'. This allows you to select an interval from a number line and show that interval as a second number line divided into ten equal parts but on a bigger scale. This can be repeated to create a third number line that represents an interval on the second number line. Initially the ITP shows the number line 0 to 100, which can be adjusted for intervals of different lengths with different starting numbers.	
	Begin with a number line from 180 to 280 with divisions in tens. Ask children to count up together from 180 to 280. Explain that we know the divisions are in tens because there are ten steps and the difference between the two numbers is 100.	



Take a section of the line and drag it up to show 230 to 240. Discuss what each division represents. Count on together from 230 to 240.

Repeat by selecting 236 to 237. Discuss what each division represents now (one tenth or 0.1). Count together forwards and backwards.

Repeat, this time starting with 9 to 19, counting on in ones, then to 16 to 17, counting on in tenths, and then to 16.7 to 16.8, counting on in hundredths.



2 **Finding factors** Refresh

Objective: Identify pairs of factors of two-digit whole numbers and find common multiples (e.g. for 6 and 9)

Display the number 12 on the board.

- Find as many pairs of numbers as you can with a product of 12.

Take feedback: 3 and 4, 6 and 2, 1 and 12, so the factors of 12 are 1, 2, 3, 4, 6 and 12.

Ask children to choose numbers and list all their factors. They should find: a number that has two factors, a number that has four factors and a number that has six factors. Discuss solutions.

3 **Using multiplication and division facts** Recall and reason

Objective: Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts

Remind children that for each multiplication fact there are three associated facts. Give children 6 × 7. Ask them for the other three facts and write them on the board.

42 ÷ 7 = 6 42 ÷ 6 = 7 7 × 6 = 42

Repeat to generate further examples.

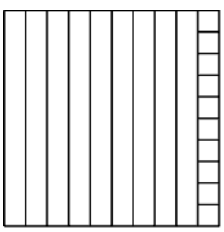
Display an OHT of the partially completed multiplication table on Resource 5A2.1 and give a copy of the resource sheet to each pair.

×	3		
	27		54
7		56	
	12		

- Suggest one of the missing numbers that you can fill in straight away. How did you work

	out this missing number? What multiplication/division fact did you use? Ask children, working in pairs, to discuss and find the missing numbers, filling the table with these. Take feedback, asking children to explain the multiplication or division fact that they used to find each number.

Main activities

1	**Equivalence of tenths and hundredths as fractions and decimals** **Objective:** Explain what each digit represents in whole numbers and decimals with up to two places, and partition, round and order these numbers Draw on the board a number line from 0 to 4, marked in tenths.  Hold up a stick of ten cubes. Together, count the cubes. Hold up one cube. • What fraction – what part – of the whole stick is this? (one tenth) Write $\frac{1}{10}$ on the board. Remind the class that the fraction can also be written as a decimal number, and write 0.1 on the board. Then hold up seven cubes. • What part of the whole stick is this? (seven tenths) Write $\frac{7}{10}$ on the board. • How else could you write this? (0.7) Hold up two whole sticks of ten cubes, and four single cubes. • How many whole sticks? (two) How many parts of a whole stick? (four tenths) Write $2\frac{4}{10}$ on the board. • Where is two and four tenths on the line? Point to 2, saying: 'Two whole ones'. Count on four tenths from 2: 'one tenth, two tenths, three tenths, four tenths'. Mark it with an arrow.  Repeat by holding up whole sticks of cubes and single cubes for 1.7, 3.6 and 0.9. --- Prepare several large paper squares, all the same size. Mark one in ten equal strips, with one strip marked in ten equal small squares. Make another copy of this square, and cut it into nine strips and ten small squares.  Hold up the whole square marked in strips. Tell the class that this is one whole square, which you have cut into ten equal strips. Hold up one of the prepared strips, matching it to a strip on the whole square. • What fraction – or part – of the whole square is this? How do you write one tenth as a decimal number? Write $\frac{1}{10}$ and 0.1 on the board. Point to each in turn, saying: 'one tenth, nought point one'.

	Choose seven children to help you. Give four of them a large paper square, and three of them a paper strip. • How many whole squares? (four) How many tenths? (three) How many tenths altogether? (forty-three) Write $^{43}/_{10}$, $4^{3}/_{10}$ and 4.3 on the board. Point to each in turn, saying: 'forty-three tenths, four and three tenths, four point three'. Repeat with 6.2. Hold up the strip marked in ten small squares. Hold up one of the small squares, matching it to a small square on the strip. • How many of these small squares are in a whole square? How did you work that out? Establish that there are 100 small squares in the large square, because there are ten small squares in a strip, and ten strips in the whole square. Ten lots of ten make one hundred. Point again to the small square. • What fraction – or part – of the whole square is this? (one hundredth) How do you write one hundredth as a decimal number? (0.01) Write 0.01 next to $^{1}/_{100}$ on the board, saying: 'one hundredth, nought point nought one'. Choose six children to help you: two to hold up two large squares each, one to hold up two strips and three to hold up two small squares each. • How many squares can you see? Establish that this is four and two tenths and six hundredths. Write 4.26 on the board. Point to each digit in turn, saying 'four, the whole number; two, the number of tenths; six, the number of hundredths'. Ask the class to think about two tenths and six hundredths. Write 0.26 on the board. Refer again to the child holding the two strips and say 'two tenths', and to the children holding the six small squares, saying 'six hundredths'. • How many hundredths are equivalent to or the same as two tenths and six hundredths? Establish that there are ten hundredths in every tenth, so there are twenty hundredths in two tenths. Altogether, there are twenty-six hundredths. Write on the board: 0.26 = $^{26}/_{100}$. Repeat with other decimals. **Review** Write on the board 8.1 and 8.01. Ask the class: • Which of the two numbers do you think is the larger? Why? • What number is one tenth more than 8.1? Than 8.01? Repeat with one tenth less, one hundredth more and one hundredth less.
2	**Developing an efficient written method for addition** **Objective:** Use efficient written methods to add and subtract whole numbers and decimals with up to two places Write 468 + 276 on the board. • Is this easy to work out mentally? Establish that it would be difficult to hold the numbers in your head. Show children how to set out the calculation in columns. Show first an expanded method, adding the units first, and then a compact method.

```
  468
+276
  14
 130
 600
 744
```

```
  468
+276
  744
  11
```

Ask children to use the compact method to add 487 + 356.

Now write on the board 645 – 276. Show children how to set out the calculation in columns. Show first an expanded method, subtracting the units first, and then a compact method.

```
  645
−276
    4  → 280
   20  → 300
  300  → 600
   45  → 645
  369
```

```
  645
−276
   24  → 300
  345  → 645
  369
```

Ask children to use the compact method to subtract 625 – 368.

Show children how the same methods can be used to add and subtract decimals. Stress the importance of aligning the decimal points.

```
  38.5
+18.6
  57.1
  11
```

```
  3.82
−1.23
  0.77  → 2.00
+1.82   → 3.82
  2.59
  1
```

Ask children to use the same methods to add 4.76 + 3.53 and to subtract 91.4 – 24.6.

Review

Show the calculation:

```
  3□7
+ 4 3 6
  8 2 3
```

- What do you think the missing digit is in this calculation?

Ask children to discuss in pairs. Take feedback from children to explain their reasoni ng. Check the solution by putting in the suggested digit and then asking children to work through the calculation. Establish that a carry of one must be involved in both the tens and hundreds columns.

Now show the calculation:

```
  1 □ 9
+ □ □ 8
  8 2 □
```

- What is the missing digit in the units column? What could the digits in the tens column be? What could the empty digit in the hundreds column be?

Take feedback. Establish that there is more than one digit possible for the two empty boxes in the tens column (e.g. any pair of numbers that total 11), but that the digit in the hundreds column must be a 6 or a 7.

3	**Solving money problems using a calculator** **Objective:** Use a calculator to solve problems, including those involving decimals or fractions (e.g. to find $\frac{3}{4}$ of 150 g); interpret the display correctly in the context of measurement Display an OHT made from Resource 5A2.2. Give each child a copy. Explain that the table gives the costs of pizzas from a take-away restaurant. Discuss the table with the class. Ask children in pairs to find out the cost of a large mushroom pizza with an extra topping of cheese. Take feedback and correct any misunderstandings. Ensure that children can interpret the data in the table. Ask children to work individually to find the cost of the pizzas in part A of the sheet using a calculator. Review answers together. • For question 1, what calculation(s) did you key into the calculator? Did anyone work this out differently? Why is it incorrect to key in 3.60 + 40 + 60? • For question 2, what calculation(s) did you key into the calculator? Did anyone work this out differently? What answer did the calculator give? What does this mean in this case? Discuss part B. Ask children to work out what pizzas Sue and Ravi could buy. **Review** Take feedback on children's responses to the question in part B. • How did you start to solve the problem? Discuss strategies such as taking away the value of the extra toppings first to establish that the pizzas must cost £9 or less. Discuss the extent the calculator was needed for this problem and if it would have been just as easy to solve without the calculator. • What do you need to remember when using a calculator to solve problems involving money?

Seven more lessons consolidating the above and extending to:

a	**Multiplying and dividing by 10 and 100 and 1000; multiplying and dividing multiples of 10 and 100; multiplying by 25**
b	**Deriving sums and differences and doubles and halves of decimals (e.g. 6.5 ± 2.7, half of 5.6, double 0.34)**
c	**Written methods for adding and subtracting decimals with a different number of decimal places**
d	**Solving problems, explaining reasoning and checking results using knowledge of rounding, place value, number facts and inverse operations**

Counting, partitioning and calculating

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• Solve one-step and two-step problems involving whole numbers and decimals and all four operations, choosing and using appropriate calculation strategies, including calculator use
• Count from any given number in whole-number and decimal steps, extending beyond zero when counting backwards; relate the numbers to their position on a number line
• Explain what each digit represents in whole numbers and decimals with up to two places, and partition, round and order these numbers
• Use knowledge of place value and addition and subtraction of two-digit numbers to derive sums and differences and doubles and halves of decimals (e.g. 6.5 ± 2.7, half of 5.6, double 0.34)
• Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts
• Refine and use efficient written methods to multiply and divide HTU × U, TU × TU, U.t × U and HTU ÷ U
• Extend mental methods for whole-number calculations, for example to multiply a two-digit by a one-digit number (e.g. 12 × 9), to multiply by 25 (e.g. 16 × 25), to subtract one near multiple of 1000 from another (e.g. 6070 – 4097)
• Use a calculator to solve problems, including those involving decimals or fractions (e.g. to find $\frac{3}{4}$ of 150 g); interpret the display correctly in the context of measurement
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Starters

1

Ordering decimal numbers Reason

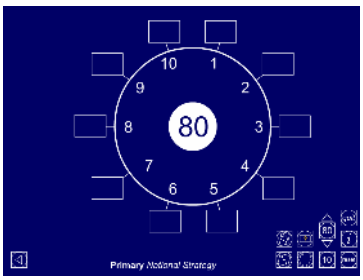
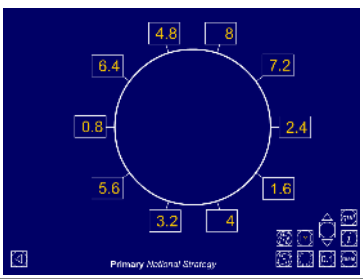
Objective: Explain what each digit represents in whole numbers and decimals with up to two places, and partition, round and order these numbers

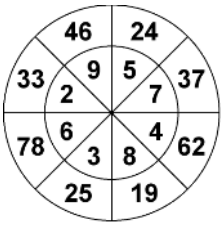
Display three number cards such as:

- What three-digit numbers can you make using these three digits once each? Write down all possible numbers in order of size.
- How did you ensure that you found all possible numbers?

Confirm that there are six possible numbers: 237, 273, 327, 372, 723, 732. Ask children who recorded them in a methodical order to explain their reasoning.

Add another card containing a decimal point. Repeat the activity, explaining that children should make as many possible numbers as they can using each digit once. The numbers should have one digit after the decimal point (23.7, 27.3, 32.7, 37.2, 72.3, 73.2).

	• How many possible numbers are there? Why are there the same number of possible answers as before? Now ask children to make as many numbers as they can with one or two places of decimals. They should record all possible numbers in order (2.37, 2.73, 3.27, 3.72, 7.23, 7.32, 23.7, 27.3, 32.7, 37.2, 72.3, 73.2). • Will there be the same number of possible answers as for the last activity? Ask children to explain their reasoning. Discuss why there are twice as many.
2	**Recalling multiplication and division facts using the ITP 'Number dials'** Recall **Objective:** Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts Display the ITP 'Number dials'. The empty boxes around the outside of the dial contain multiples, the number in the centre multiplied by the corresponding multipliers around the inside edge of the dial. You can change the centre number to a single digit in the range 2 to 9, a multiple of 10 from 10 to 90, and to a decimal from 0.1 to 0.9. To reveal and hide the number at the centre, click on it or the box with the two pointers. To reveal and hide each multiple, click on the box. To reveal and hide all multiples, click on the box with ? in it. To reveal and hide all multipliers, click on the box with the dial. Begin by showing a dial with 8 in the centre. Show 2 × 8. Ask children which facts they can derive quickly from this fact (4 × 8, 8 × 8) and reveal them. Build up the table together using known facts (e.g. 5 × 8 is half of 10 × 8, 6 × 8 is 8 more than 5 × 8, 3 × 8 is half of 6 × 8, and so on). Now show another dial with 80 in the centre. Discuss with children the relationship with the 8 times-table. Reveal 80 × 2, then build up the table in the same way as before.  Repeat, this time just showing random answers for multiples of 0.8. Ask children to talk to their partner to identify the number in the centre of the dial. Take feedback and establish that it is 0.8. Ask children to talk to their partner and decide what the multipliers are around the inside of the dial and to write on their whiteboards which multiplier each answer is; for example, 8 is 10 × 0.8. Take feedback and then reveal the answers. 

3	**Multiplying two-digit by one-digit numbers** Rehearse and reason **Objective:** Extend mental methods for whole-number calculations, for example to multiply a two-digit by a one-digit number (e.g. 12 × 9), to multiply by 25 (e.g. 16 × 25), to subtract one near multiple of 1000 from another (e.g. 6070 – 4097) Display the dartboard on an OHT made from Resource 5A3.1.  Tell children that they are to work in pairs to find the product of one number from the outer ring and one from the inner ring. Get children to choose a pair of numbers. Then all the pairs write the corresponding number sentence on their whiteboards, estimate the size o f the answer, work out the answer and show it. Discuss the methods used, for example partitioning the two-digit number, multiplying each part and then combining the products to find the answer. Repeat several times. • Which two numbers on the board will give the product closest to 300? Give children a minute or two to think about this and to try out a few ideas. Take feedback. • How did you choose the numbers?

Main activities

1	**Identifying the operation(s) needed to solve word problems** **Objective:** Solve one-step and two-step problems involving whole numbers and decimals and all four operations, choosing and using appropriate calculation strategies, including calculator use Make and show an OHT of Resource 5A3.2. Make one copy for each pair of children. Ask children to work in pairs, to cut up the problems and sort them into four groups: those that they would solve using addition, subtraction, multiplication and division. Take feedback. Discuss where children have suggested different operations to solve particular problems. For example, some children may suggest that they would solve question 2 by working out 52 – 17 while others may suggest they would work out 17 + □ = 52 by counting on from 17 to 52. Establish that these are equivalent calculations. Now ask children to work in pairs to answer each problem. They should consider which method to use for each problem: mental method, mental with jottings, written method or calculator method. Give out copies of Resource 5A3.3, which contains multi-step problems. • In what way are the problems on this sheet different from the first set? Establish that the problems on this sheet require more than one calculation to solve each one. These problems have to be solved in two or more steps. Select a problem from the sheet. • What is the first calculation you need to do? What does the answer to this calculation tell you?

	• What is the next step? What calculation will you do? Take feedback and correct any mistakes. Ask children to work individually and to solve four of this set of problems, recording the steps involved in solving each problem clearly. **Review** Take a past question from Paper A of the Key Stage 2 national tests. Choose a question that involves two steps. Give children a copy each. Ask children to discuss in pairs how they could solve it and to agree how to record their working. Take feedback. Include a discussion on: the key vocabulary that helped them to identify which operations they would need to use and in what order; whether they chose to use mental methods, jottings or a written method. Ask one or two children to show the class how they recorded their working.
2	**Rounding up or down to solve division word problems** **Objective:** Use a calculator to solve problems, including those involving decimals or fractions (e.g. to find $^3/_4$ of 150 g); interpret the display correctly in the context of measurement Give out calculators. Write this problem on the board. *I have saved £240. A computer game costs £34.75. How many games can I buy?* • What calculation do we need to do to solve the problem? Ask children to talk to their partner and explain how they think they could solve the problem. Take feedback. Establish that the calculation will be 240 ÷ 34.75 and write this on the board. Use an OHP or interactive whiteboard calculator. Enter the calculation into the calculator and ask children to do the same on their calculators. Ask children to write on their whiteboards their answer and show you. If necessary repeat to ensure that all children have input the calculation correctly. • What does 6.906 474 8 mean in the context of the question? Establish that there are nearly (but not quite) 7 lots of £34.75 in £240. You would be able to take away 6 lots of £34.75 but there would be a remainder. Go back to the original question. Get children to write on their whiteboards a sentence to answer the original question. Discuss some of children's responses. • Why did you decide to round the answer down to 6 rather than up to 7? • How much money would I have left after I bought the games? Ask children to work in pairs and answer this question using their calculators. Give children about 5 minutes to work together on whiteboards while you circulate to establish what strategies they were using. Ask one pair to demonstrate to the other children how they worked out the answer to the question. • Did anyone solve this another way? • What do you think is the best way? Ask children to use their calculators to find out how much 7 computer games would cost. Take feedback and check answers. • How much more money would I need to buy a seventh game? Explain that the answer 6.906 474 8 means that £240 is more than enough to buy six games but not enough to buy seven games. This is an example of having to round an

answer down.

Give out copies of Resource 5A3.4 and ask children to solve the problems.

Review

Discuss answers to one or two of the questions. For each problem, discuss how children interpreted the decimal remainder in the calculator display. Ask children why they chose to round up or down in that particular context.

Ask children to read out some of the answers they have written. Everyone else should decide whether the problem involves rounding up or down.

3

Using systematic recording to solve a problem

Objective: Explain reasoning using diagrams, graphs and text; refine ways of recording using images and symbols

Write this information on the board:

Large batteries cost £1.60 each.
Medium batteries cost £1.10 each.

- What would 10 large batteries cost? (£16)
- What would 6 medium batteries cost? (£6.60)

Ask children to work out answers to these questions on their whiteboards. Take feedback after each question. Ask one or two children to explain how they worked out the answer.

- How many medium batteries could you buy for £10? How much chang e would you get? (9 batteries with 10p change)
- How many large batteries could you buy for £10? (6 batteries with 40p change).
- I need to buy some batteries for a science lesson. I have a £20 note. How many of each size of battery could I buy with £20?

Discuss children's suggestions. Establish that you could buy up to 12 large batteries or up to 18 medium batteries, but that you might buy some of each size.

- I spend exactly £20. How many large and how many medium batteries do I buy?

Give children 5 minutes in pairs thinking about how they might begin to solve the problem. Take suggestions and establish that a list or table would be helpful. Display this table.

Medium	1	2	3	4	5	6	7	8	9	10
Cost	£1.10									
Large	1	2	3	4	5	6	7	8	9	10
Cost	£1.60									

Start completing the table with children, then get them to work in pairs to copy and complete the table and use it to answer the problem.

Review

Take feedback on the last problem. Confirm that 8 medium batteries and 7 large batteries is an answer, by completing the table with children. Ask children to tell you how they used the table to work out their answer.

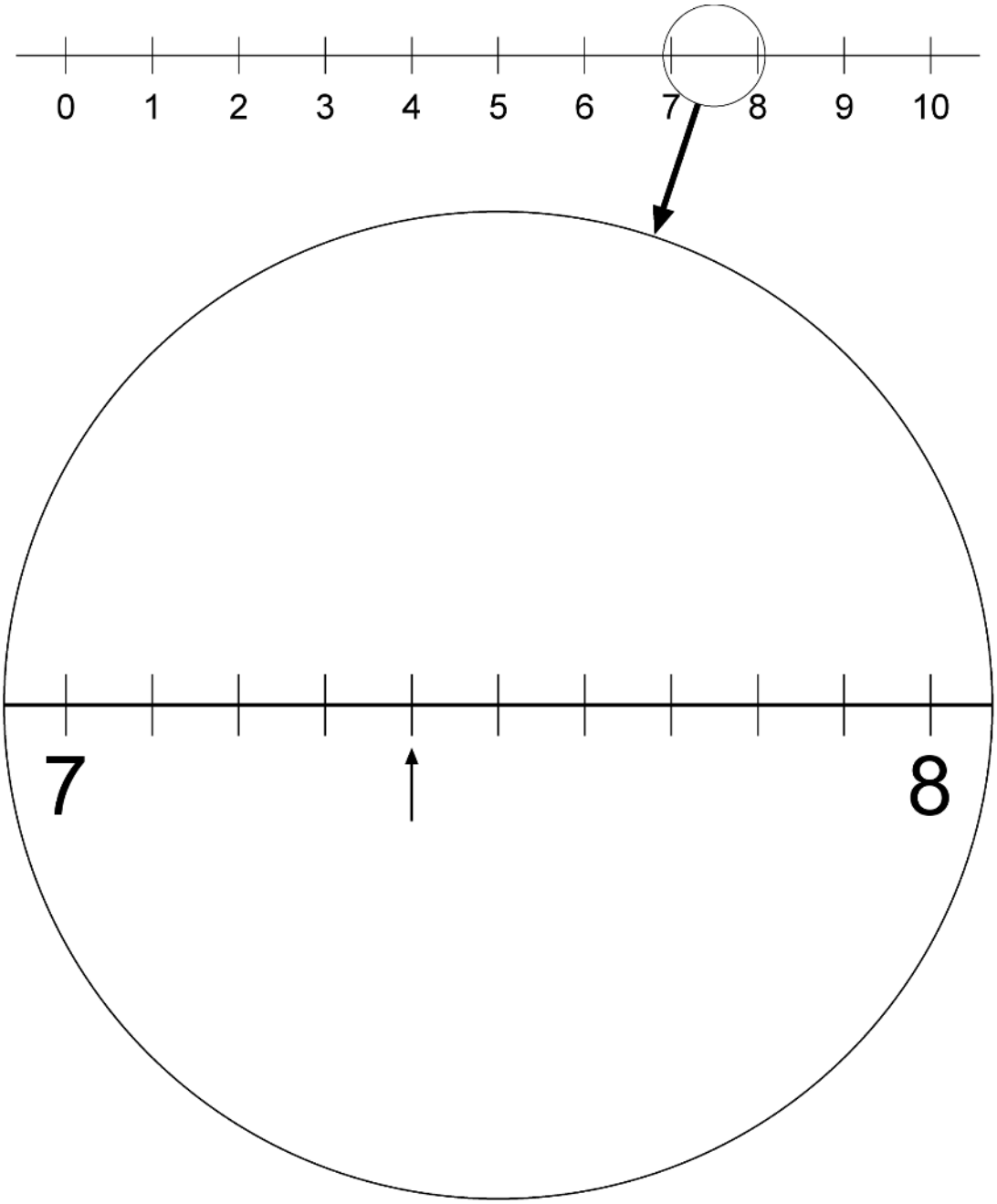
- Are there any other ways of spending £20 exactly?

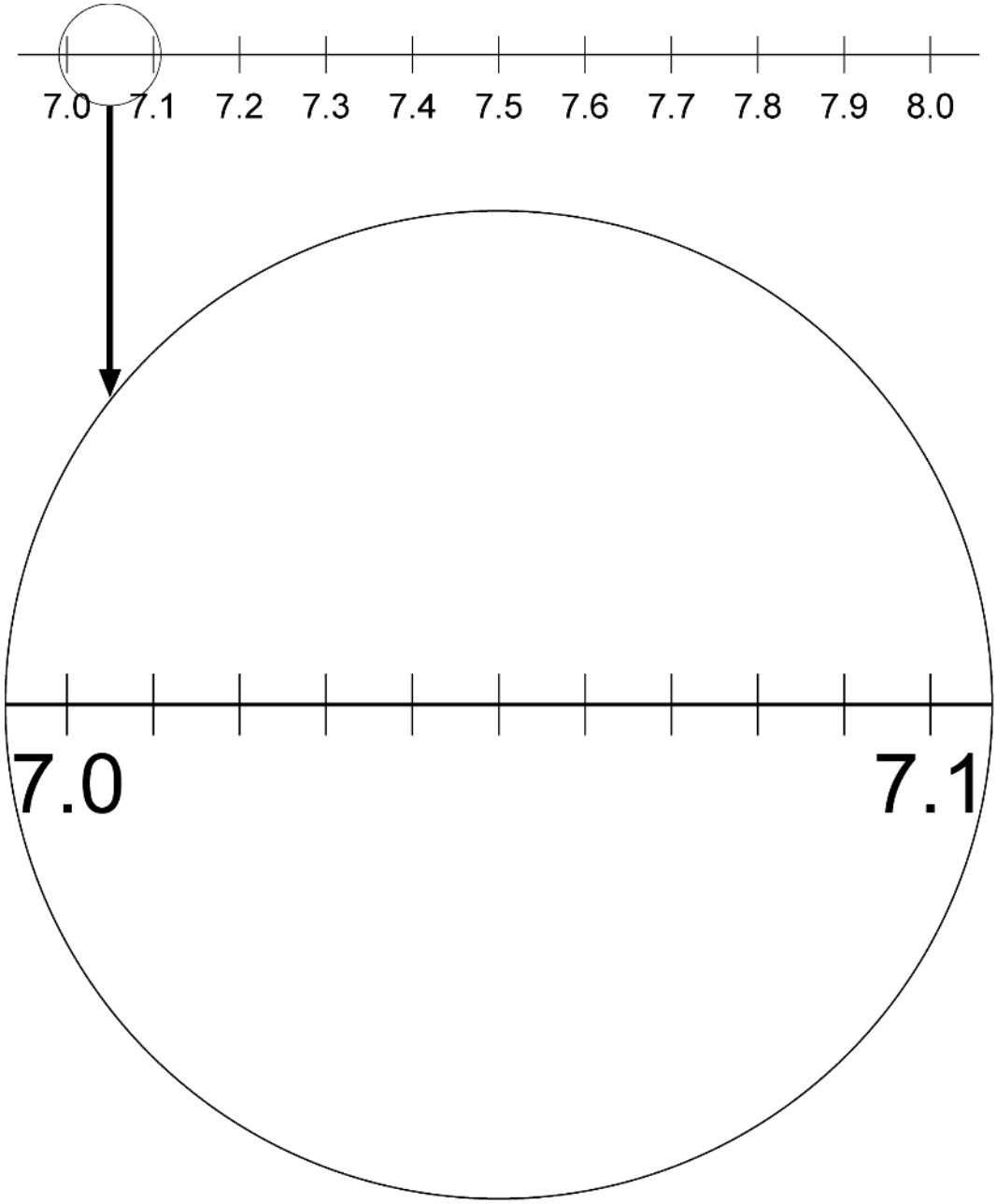
Seven more lessons consolidating the above and extending to:

a	**Using efficient written methods to multiply HTU × U, TU × TU, U.t × U; solving problems and checking answers**
b	**Using efficient written methods to divide HTU ÷ U; solving problems and checking answers**
c	**Solving problems involving inverse operations; explaining reasoning**

+0.01	+0.1	+1
+10	+100	+1000
–0.01	–0.1	–1
–10	–1000	–0.1

19500	7×1000	7000	65×1000
65000	25×100	2500	834×100
83400	250×100	25000	65×100
6500	56×10	560	482×10
4820	25×10	250	450×100
4000	1400×10	14000	195×100





Number	Factors	Total number of factors
15		
40		
23		
36		
70		

Number	Factors	Total number of factors
14		
28		
17		
49		
80		

Number	Factors	Total number of factors
12		
35		
19		
64		
50		

Number	Factors	Total number of factors
18		
42		
13		
81		
40		

×	3		
	27		54
7		56	
	12		

Cost of Take-Away Pizzas		
Pizza Toppings	**Small**	**Large**
Ham	£3.80	£5.40
Barbecue Chicken	£4.50	£6.00
Cheese	£3.50	£4.65
Salami	£3.90	£5.10
Mushroom	£3.60	£4.75
Tuna	£4.40	£5.80
Extra cheese 60p		
Extra tomato 40p		

Part A

Find the cost of:

1 One small mushroom pizza with extra cheese and tomato.

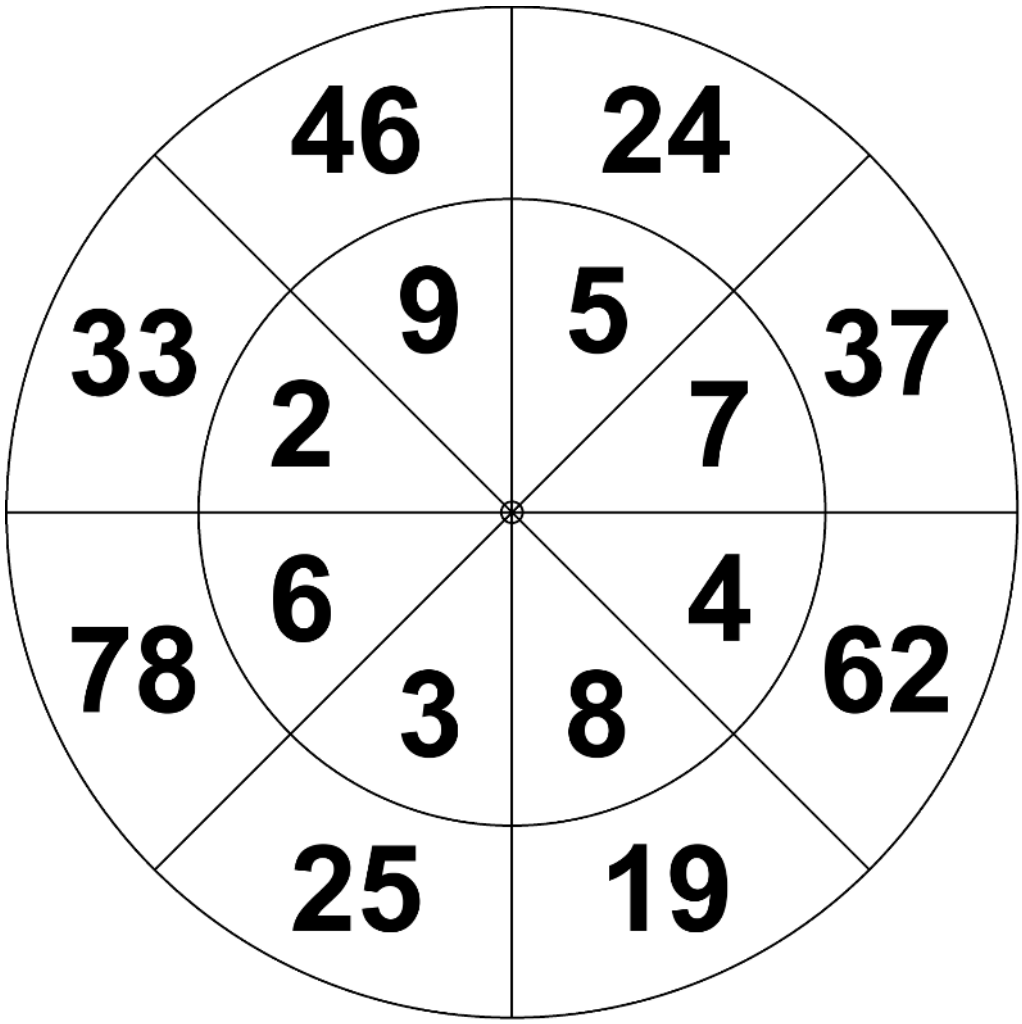
2 Two large cheese pizzas and one small chicken pizza.

3 A small ham pizza with extra cheese and a large tuna pizza with extra tomato.

4 A large salami pizza with extra cheese and two small cheese pizzas, one with extra tomato.

Part B

Sue and Ravi want to buy one large pizza with extra cheese and one small pizza with extra tomato. They have £10 between them. Which pizzas can they buy?



1	I think of a number and divide it by 15. The answer is 20. What is my number?
2	A bus seats 52 people. No standing is allowed. 17 people get off a full bus. How many people are left on the bus?
3	Kobi saved 15p a week for one year. How much money did he save?
4	Four people paid £72 for tickets to a football match. What was the cost of each ticket? How much change did they get from £100?
5	Petrol costs 101.2p per litre. How much do you pay to fill a 7.5-litre can?
6	There is 365 ml of milk in a jug. Another 450 ml is added. How much milk is there in the jug now?
7	A football club has 400 litres of soup for its fans. One cup holds 250 ml of soup. How many fans can have a cup of soup?
8	A full bucket holds 5 $\frac{1}{2}$ litres of water. A full jug holds $\frac{1}{2}$ litre of water. How many jugs of water will it take to fill the bucket?
9	Dad bought a 2 kg bag of carrots. He used 400 g to make a carrot cake. How many kilograms of carrots were left?

1 I have read 134 of the 512 pages of my book. How many more pages must I read to reach the middle of the book?

2 There are 8 shelves of books. Six of the shelves hold 25 books each. Two of the shelves hold 35 books each. How many books are there altogether on the shelves?

3 I think of a number, subtract 17 and divide by 6. The answer is 20. What is my number?

4 John started to read a book on Thursday. On Friday he read 10 more pages than on Thursday to reach page 60. How many pages did John read on Thursday?

5 Ravi bought a pack of 30 biscuits. He ate one fifth of them on Thursday. He ate one eighth of the remaining biscuits on Friday. How many biscuits did he then have left?

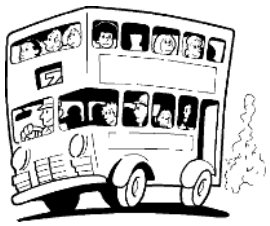
6 There are 10 floors in a multi-storey car park. There is space for 8 rows of 15 cars on each floor. How many cars can the car park hold when it is full?

7 I think of a number, subtract 11 and divide by 2. The answer is 20. What is my number?

8 There are 12 sweets in a packet. Joan bought 6 packets. How many sweets can Joan and her 3 friends have each if they share the sweets equally?

9 Sue bought some CD racks at £19.98 each. Each rack holds 35 CDs. Sue has 87 CDs. How much did it cost Sue to buy enough racks for all her CDs?

10 Of 96 children in Year 6, three quarters have one pet and the rest have no pets. 45 children have a dog. 21 children have a cat. How many children have other kinds of pets?

 A baker has 340 cakes. One box holds 24 cakes. How many boxes can the baker fill with cakes? How many boxes are needed to hold all the cakes?	 325 children and 15 teachers are going to Alton Towers. A bus can hold 52 people. How many buses are needed?
 I have 5 metres of ribbon. I need lengths of 85 cm for the balloons at the Summer Fair. How many lengths can I cut from my ribbon?	 5251 football fans are at a match. Programmes are in boxes of 600. Each person gets a free programme. How many boxes need to be opened?
Make up your own division problem here where the answer would be rounded up.	Make up your own division problem here where the answer would be rounded down.