

# Place value, ordering and rounding (whole numbers)

**Objectives**

- To read and write whole numbers to at least 10 000 in figures and words, and know what each digit represents.
- To add/subtract 1, 10, 100 or 1 000 to/from any integer, and count on or back in tens, hundreds or thousands from any whole number up to 10 000.

**Vocabulary** number; zero, one, two ... to hundred thousand; units; column; digit; figure; one- two- three- four- five-digit number; place; place value; worth; stands for; represents; count on; count back

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 Topic 1.1.

## Main teaching and pupil activities (about 30 to 40 min)

➡ Arrange the children so they can see the board.

Th H T U  
2 5 4 6

➡ Write the number **2546** on the board. Point to the 6 and ask: **What does this digit represent?** (6 units/ones) Write **U** above the 6. Repeat for the other digits. Ask: **Who can write 23 000 using words?**

Tth Th H T U  
8 2 5 4 6

➡ Point from one digit to the next, saying: **Ten times one (units) is ten. Ten times ten is a hundred. Ten times a hundred is a thousand. What is ten times a thousand?** (10 000) Write: **Tth** to the left of Th. Write: **8** below Tth and ask: **What does this 8 mean?** (80 000) **Eight tens are 80, so eight ten-thousands are 80 000.**

➡ Repeat for other three- or four-digit numbers, e.g. 509, 7204, 8090, 7002, 5600.



Point out to the children the space that is left between the hundreds and thousands digits.

➡ Write: **23 000** on the board. Point to the 3 and ask: **What does this digit represent?** (3000) **What does the 2 represent?** (20 000) **How many thousands altogether?** (23 000) **Who can write 23 000 using words?** Repeat for other five-digit numbers, e.g. 50 000, 23 000, 19 254, 40 003, 71 026.



Who can write 15 295, 20 509, 90 021 in words?

➡ Write: **6432** on the board. Ask: **How many tens are there?** (three) **If we add ten, how many will there be?** (four) Replace 3 by 4. Repeat up to 9 tens, inviting children to replace the digits. Ask: **If we add another ten, what happens?** (we get ten tens, a hundred) Rub out the 9. Ask: **How many hundreds are there now?** (five) Increase 4 to 5. Ask: **How many tens are there now?** (none) Write 0 in the tens place. Continue adding tens up to 6532.

➡ Continue adding hundreds up to 7432. Continue adding thousands up to 15 432.

➡ Subtract thousands to 7432, hundreds to 6532 and tens to 6432.

➡ Write the number **3614** at the top of the board. Say: **Who can say this number? Let's count on in tens.** Count around the class, occasionally stopping, rubbing out and replacing digits (a child could do this).

➡ Repeat, counting back in tens. Count on and back in hundreds and thousands.

➡ Repeat, starting with different numbers, e.g. counting back in thousands then hundreds then tens then ones from 10 000 to 0.

Pupil Book 3:  
Number tracks

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**Pupil consolidation****Refresher**

- 1 Children write the value of a digit in a number.
- 2 They add/subtract 10, 100 or 1000 from numbers, without crossing boundaries. They should record the row of answers.

**Practice**

- 1 Children add/subtract 10, 100 or 1000 from numbers, crossing boundaries.
- 2 They find whether 10, 100 or 1000 has been added or subtracted in a calculation, e.g.  $2345 + \square = 2445$ .
- 3 They write four- and five-digit numbers in words.
- 4 They count on in tens, hundreds or thousands.

**Extension**

**Resources** blank die labelled 1, 10, 100, 1000, 10000, 10000 (one per pair); paper; pencil (one per child)

Each child writes 49999 at the top of a sheet of paper. They take turns to roll the die, subtracting the numbers shown. The first to reach 0 is the winner. If it is impossible to subtract the number, they roll again.

**Variations**

- 1 Start with 55555. Add the numbers on the die.
- 2 The winner is the person with the highest/lowest number after 20 throws each.

**Plenary** (about 10 to 15 min)

- Arrange the children so they can see the board. Write a range of three- to five-digit numbers on the board, e.g. **289, 700, 806, 1724, 4000, 2013, 9991, 6008, 7748, 5407, 40000, 29000, 31500, 78230, 72619.**
- Point to a number, e.g. 1724 and ask: **How do you say this number? How many thousands/hundreds/tens/units does it have? Jason, come and write the number in words. What does the digit 7 represent/stand for? Tell me a number with 3 thousands? What is one/ten/hundred/thousand more/less than the number? Who can count on/back from 7748 in tens/ hundreds/ thousands? Which numbers have no units/tens/hundreds/thousands?**
- Count with the class from 0 to 5000 and back in thousands, hundreds, tens and ones. Write the number each time you change step, e.g. say: **Count in ones: 1, 2, 3, 4.** Write: **4.** Say: **Now in tens: 14, 24, 34, 45, 54.** Write: **54.** Say: **Now in hundreds: 154, 254 ... 654.** Write: **654.** Say: **Now in thousands: 1654, 2654 ... 4654.** Write: **4654.** Count to 4660 in ones, then to 4700 in tens, then to 5000 in hundreds.

# Place value, ordering and rounding (whole numbers)

**Objectives** ● To read and write the vocabulary of comparing and ordering numbers. ● To order a set of whole numbers less than 10 000. ● To begin to multiply by 100.

**Vocabulary** number; zero, one, two ... to thousand; units; digit; figure; column; place; place holder; place value; two- three- four- five-digit number; less than; greater than; order; smallest; largest

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 Topic 1.1.

## Main teaching and pupil activities (about 30 to 40 min)

**Resources** selection of two- three- and four-digit number cards; large place value chart; two sets of 0–9 digit cards; Blu-tack

Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Units

- ➞ Write: **37** above **51**. Ask: **Which number is larger?** (51) **Why?** (it has more tens) Repeat for 73 and 78.
- ➞ Write: **28**, **91** and **50** above one another. Ask: **Which is the largest number?** (91) Write the labels **Smallest** and **Largest** on a new line. Write: **91** above Largest. Ask: **Which is the next largest?** (50) Write it to the left of 91. Say: **28 is smallest. It has the least number of tens.** Write it above Smallest. Repeat for 57, 51 and 39.
- ➞ Write: **614** above **295**. Ask: **Which number is larger?** (614) **Why?** (it has more hundreds) Point to the 1 and 9 in the Tens column and say: **295 has more tens than 614. Why isn't it the bigger number?** (because 614 has more hundreds than 295; hundreds are more important/significant than tens) Repeat for 299, 956; 378, 387; 957, 952.
- ➞ Order these numbers from smallest to largest, as before: 658, 319, 465; 558, 397, 379; 641, 614, 604.
- ➞ Write: **4876** above **8234**. Ask: **Which is the larger number?** (8234) **Why?** (it has more thousands than 4876) Write: **5836** and **5863**. Say: **When you compare two numbers, compare the thousands first, then the hundreds, then the tens, then the units. Which number is larger?** (5863) **They have the same thousands and hundreds but 5863 has more tens than 5836.** Repeat for 2765, 2713; 7482, 7486.
- ➞ Blu-tack two four-digit, two three-digit and two two-digit number cards to the board. Ask: **Which are the largest two numbers? How can you tell?** Ask: **Which are the next largest numbers? What are the smallest two numbers?**
- ➞ Determine the largest of each pair of numbers, as before. Repeat above using other sets of number cards.
- ➞ Blu-tack the place value chart to the board. Place the '3' digit card in the Units column. On the board write: **3 × 100 = .** Ask: **What is 100 times three?** (300) Write: **3 × 100 = 300**. Place the digit card in the Hundreds column. As you move the 3 to the Hundreds column, say: **When you multiply a number by 100, it moves two places to the left.** Place zeros in the Tens and Units columns and say: **We need the two zeros to show that the 3 is in the Hundreds column.**
- ➞ Repeat above using other two- and three-digit numbers.

↑ Order a set of quantities, e.g. money (£534, £5342, £4352, £5403, £4053), lengths (1978m, 879m, 1978m, 7981m, 798m).

↑ Ask: **How many pence in £1?** (100p) **... in £2?** (200p) **... in £15?** (1500p) **... in £269?** (26 900p) Convert metres to centimetres in a similar way.

Pupil Book 3:  
All in order!

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**Pupil consolidation****Refresher**

- 1 Children order three- or four-digit numbers, smallest to largest, e.g. 2897, 4219, 7348, 5000.
- 2 They multiply numbers by 100.

**Practice**

- 1 Children order similar four-digit numbers, e.g. 7456, 7546, 7564, 6457.
- 2 They order a set of weights.
- 3 They convert £ to p.
- 4 They convert m to cm.

Support CM:  
Taking orders

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**Support**

- 1–3 Children tick the larger of two two-, three-, four- digit numbers.
- 4 Children write two numbers smaller than a given number.
- 5 Children write two numbers larger than a given number.
- 6 Children write numbers in order.

Extension CM:  
Calculate and order

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**Extension**

- 1 Children multiply or divide numbers by 10. They order the answers.
- 2 Children double numbers or multiply them by 20. They order the answers.
- 3 Children divide numbers by 10 or multiply them by 10 or 100. They order the answers.
- 4 Children perform calculations using a variety of operations. They order the answers.



Tell children to write their answers on scrap paper first, then order them.

**Plenary** (about 10 to 15 min)**Resources** selection of two- three- and four-digit number cards

- Arrange the children so they can see the board.
- Blu-tack three pairs of number cards to the board, e.g. 406, 7498; 39, 8500; 94, 490. Point to each pair and ask: **Which is the larger number? How do you know?**
- Ask: **Which are the largest two numbers?** (8500 and 7498) **How can you tell?** (they have four digits) Place them on the right. Ask: **Which are the next largest numbers?** (490 and 406) **What are the two smallest numbers?** (39 and 94) Order each pair and write labels **Smallest** and **Largest** underneath the row.
- Repeat for other sets of number cards, e.g. 923, 3290; 93, 3920; 932, 92.
- Write amounts of money (£) and lengths (m) on the board for children to convert to pence and centimetres, e.g. **£6, £43, £900, £305, £2859, £7090, 23m, 70m, 5000m, 2004m**. Ask: **How many pence in a pound? How many centimetres in a metre?**

Homework CM:  
Machine order

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**Homework** (about 20 min)**Refresher**

Children write numbers in order, smallest to largest. They then multiply some numbers by 100.

**Practice**

Children write numbers in order, smallest to largest. They then write weights in order and change some pounds to pence.

# Place value, ordering and rounding (whole numbers)/Measures: (capacity)

**Objectives** ● To make and justify estimates up to about 250, and estimate a proportion. ● To record estimates and readings from scales to a suitable degree of accuracy. ● To round any positive integer less than 10 000 to the nearest 10 or 100.

**Vocabulary** number; zero, one, two to thousand; tenth; half, quarter; three quarters; round; nearest; estimate; about; approximately; exact; container

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 Topic 1.1

## Main teaching and pupil activities (about 30 to 40 min)

**Resources** 0–100 and 0–1000 wall number lines; small cubes (arrange 5 rows of about 10 cubes); transparent container that will hold at least 100 cubes (draw a vertical line from top to bottom); other containers of various sizes; 0–500ml measuring jug labelled with multiples of 100; rice; mug; OHP

**i** If necessary, use the wall number lines to demonstrate rounding.

**i** Some children may not consider 0 and 100 to be multiples of ten.

**↓** If children require further work on rounding, repeat for 34, 234 and 7234. Repeat for 7, 27, 547 and 8547. Repeat for 3, 73, 473 and 8473. Repeat for 97, 397 and 4397.

**i** Some children may not consider 0 and 1000 to be multiples of 100.

**↓** If children require further work on rounding, repeat for 670, 672, 4672. Repeat for 350, 349. Repeat for 87, 287. Repeat for 32, 732. Repeat for 976.

**↑** Round 6050 to the nearest 100. Round 2005 to the nearest 10.

**↓** Write a range of numbers for children to round to the nearest 10 then the nearest 100, e.g. **76, 851, 28, 3928, 248, 972.**

Write: **38** on the board and ask: **What is 38 rounded to the nearest ten?** (40) Write: **2** to make 238 and ask: **What is 238 rounded to the nearest ten?** (240) Write: **7** to make 7238 and ask: **What is 7238 rounded to the nearest ten?** (7240)

Write: **35** on the board and say: **35 is exactly halfway between 30 and 40. How do we round it to the nearest ten?** (round up to 40) Round 235 and 7235 as before.

Write: **410** on the board and ask: **What is 410 rounded to the nearest 100?** (400) Replace 0 by 9 and repeat the question. Say: **When you round to the nearest 100, you only need to look at the tens.** Write 6 to make 6419 and round to 6400.

Round 9998 to the nearest 10 or 100.

Place the five rows of 10 cubes onto the OHP.

Ask: **How can we estimate the number of cubes? How many are in the top row?** Say: **That's about ten. How many rows are there?** (5) **There are five rows of about ten cubes. How many altogether?** (50) Mix up the cubes into a rough circle, touching each other.

Say: **Chin Lin, take about 50 more cubes.** Arrange the cubes in a similar way, next to the other 50. Ask: **Are there about the same number?** Adjust the second group until they look about the same. Ask: **Roughly how many cubes are there altogether?** (100)

Place the cubes into a container, levelling the surface. Mark the level and write 100 on the scale. Empty the container. Ask: **Who can show me where 50, 25, 75 cubes would come to?** Place about 50 cubes in the container and say: **Estimate the number of cubes.** Add 25 cubes and repeat. Pour out 50 cubes and repeat.

Place about 40 cubes in the container and ask for an estimate (probably about 50). Ask: **Can you think of a better/closer estimate?** (about 40) Mark tenths divisions and count in tens from 0 to the division nearest the level. Say: **Estimate the number of cubes to the nearest ten.**

Show a smaller container. Ask: **How can we estimate how many cubes will fit in this container?** Repeat using a larger container.

**Y4 Numbers and the number system/Measures, shape and space Suggested order: Summer Term, Week 1, Lesson 3**Pupil Book 3:  
Sweet estimates

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**Pupil consolidation****Refresher**

- 1 Children estimate the amount by reading labelled scales.
- 2 They round numbers to the nearest 10.
- 3 They round the same numbers to the nearest 100.

**Practice**

- 1 Children estimate the number of sweets in a container, given the number it contains when full.
- 2 Children estimate the amount of syrup to the nearest 10 ml.
- 3 They estimate the amount to the nearest 100 ml.
- 4 Children copy a blank number line and mark on it numbers from 0–100.

**Extension**

**Resources** three containers per pair; rice or other small objects for filling containers

Children have to work out the relative sizes of their containers, e.g.  $1\frac{1}{2}$  times bigger.



Game 33

**Games Pack 2****Tricky trail****Plenary** (about 10 to 15 min)

**Resources** reading books

- ➡ Write numbers on the board for children to round to the nearest 10 or 100, e.g. **25, 871, 249, 705, 6, 97, 591, 7745.**
- ➡ Show the class a 0–500 ml measuring jug. Pour in some rice and ask someone to estimate the amount to the nearest 100 ml. Pour in about 350 ml of rice. Ask: **Which number is halfway between 300 and 400?** Pour in about 270 ml of rice. Ask someone to read the scale accurately. Say: **There are ten divisions between 200 and 300. Each one is worth 10 ml.**
- ➡ Show the class the page of a reading book. Ask: **How can we estimate the number of words on this page? Roughly how many words are there on a line? How many lines are there? How many words altogether?**

# Mental calculation strategies (+ and -)/Rapid recall of addition and subtraction facts

**Objectives** ● To use known number facts and place value to add or subtract mentally: continue to add or subtract two-digit multiples of 10, add or subtract a pair of multiples of 100, crossing 1000. ● To consolidate knowing by heart addition and subtraction facts for all numbers to 20.

**Vocabulary** add; addition; more; plus; sum; total; and; altogether; equals; makes; is the same as; sign; take away; subtract; minus; fewer; less; difference; left; leaves; equals; multiple

↓ This calculation involves crossing the tens boundary and following calculations will involve crossing the hundreds and the thousands boundaries. Start with calculations that do not cross a boundary, e.g.  $5 + 3 = 8$  if you think the children are not confident crossing these boundaries.

↓ Demonstrate the link between the calculations using Dienes apparatus if the children are not sure.

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topic 2.1, 2.2 or 2.3.

## Main teaching and pupil activities (about 30 to 40 min)

- ➡ Begin by asking quickfire questions involving the addition and subtraction facts to 20. Ask: **What is 7 plus 9, 16 minus 7?** etc.
- ➡ Say: **It is really important that you know all the addition and subtraction facts to 20 as they can help you to work out answers to other calculations.**
- ➡ Write:  $5 + 7 = 12$  on the board. Say: **I know that 5 plus 7 equals 12 and I can use this to work out other calculations.**
- ➡ Write:  $50 + 70 =$  underneath. Say: **In this calculation instead of adding 5 units and 7 units I am adding 5 tens and 7 tens. So the answer will be 12 tens. 12 tens is 120.** Write: 120 on the board.
- ➡ Write:  $500 + 700$  on the board. Say: **In this calculation instead of adding 5 and 7 units I am adding 5 hundreds and 7 hundreds. So the answer will be 12 hundreds. 12 hundreds is 1200.** Write: 1200 on the board.
- ➡ Write:  $13 - 5 = 8$  on the board. Underneath write:  $130 - 50 =$ . Ask: **Who can work out the answer to this calculation using the subtraction fact to help them?**
- ➡ Invite a child to say the answer and explain how they worked it out.
- ➡ Write:  $1300 - 500 =$  on the board. Ask: **Who can work out the answer to this calculation using the subtraction fact to help them?**
- ➡ Invite a child to say the answer and explain how they worked it out.
- ➡ Write:  $90 + 60 =$  and  $900 + 600 =$  on the board. Ask: **What is the addition fact that can help us work these calculations out?** Record:  $9 + 6 = 15$  on the board.
- ➡ Invite the class to work out the answers to the calculations. Ask a child to explain how they worked out the answer.
- ➡ Repeat for other addition and subtraction calculations involving multiples of ten and a hundred, crossing the hundreds and thousands boundaries, e.g.  $1400 - 800$ ,  $120 - 30$ ,  $40 + 90$ ,  $700 + 900$ .

Pupil Book 3:  
Use your facts

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**Pupil consolidation****Refresher**

Children who are experiencing difficulty can first work through this section that starts with calculations that do not cross the hundreds boundary and only involves adding and subtracting multiples of ten. Children copy out the two calculations that go together and answer them.

**Practice**

Children copy out the three calculations that go together and answer them.

Extension CM:  
Find the missing multiples

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**Extension**

This involves missing number calculations. Children work out all the missing numbers and then choose one addition and one subtraction calculation. They explain in words how they worked it out.



Game 29

**Games Pack 2**

Patchwork quilt

**Plenary** (about 10 to 15 min)

- ⇒ Say: **Remember that knowing your addition and subtraction facts to 20 helps you add and subtract multiples of ten and a hundred.**
- ⇒ Invite three children to the front of the class. Tell the first child they are the addition and subtraction facts, the second child they are the multiples of ten and the third child they are the multiples of a hundred.
- ⇒ Say to the 'facts' child: **Say an addition or subtraction fact to 20, such as  $4 + 9 = 13$ .**
- ⇒ The other two children must say the corresponding multiple of ten and hundred calculations e.g.  $40 + 90 = 130$ ,  $400 + 900 = 1300$ .
- ⇒ Repeat with other children coming to the front.

**Software: Rapid Maths 4**

Crushers!



# Mental calculation strategies (+ and -)/Place value, ordering and rounding (whole numbers)

**Objectives** ● To use known number facts and place value to add or subtract mentally: revise adding/subtracting a multiple of 10 to/from a two- or three-digit number, without crossing the hundreds boundary. Revise adding a two- or three-digit number to a multiple of 10, 100 or 1000. ● To add/subtract 10, 100 or 1000 to/from any two-/three-digit number.

**Vocabulary** add; addition; more; plus; sum; total; and; altogether; equals; makes; is the same as; sign; take away; subtract; minus; fewer; less; difference; left; leaves; equals; multiple

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topics 2.1, 2.2 or 2.3.

## Main teaching and pupil activities (about 30 to 40 min)

➞ Write: **46** on the board. Ask: **What is 46 plus 10? 46 plus 100? 46 plus 1000?** Encourage quick responses from the class.

➞ Write: **1263** on the board. Ask: **What is 1263 minus 10? 1263 minus 100? 1263 minus 1000?** Encourage quick responses from the class.

➞ Say: **Adding and subtracting 10, 100 and 1000 is easy as only one of the digits changes.**

⬇ If children are not confident adding and subtracting multiples of 10 record the working out as  $50 + 30 = 80$ ,  $2 + 0 = 2$ ,  $80 + 2 = 82$ .

➞ Write: **52 + 30** on the board and ask the class to work out the answer. Ask: **Which digit changes in this calculation?** Only the tens digit changes. Say: **As we are adding a multiple of ten and not crossing the hundred boundary the units digit stays the same and the tens digit changes.**

➞ Write: **52 - 30** on the board and ask the class to work out the answer. Ask: **Which digit changes in this calculation?** (Only the tens digit).

➞ Write: **346 + 40** on the board and ask the class to work out the answer. Again establish that only the tens digit changes. Say: **Now we are adding a multiple of ten to a three-digit number. The hundreds and units digits stay the same as no hundreds or units are being added.**

➞ Repeat for  $356 - 40$ .

➞ Ask other questions involving adding and subtracting multiples of ten to or from two- or three-digit numbers without crossing the hundreds boundary e.g.  $39 + 40$ ,  $78 - 50$ ,  $618 + 60$ ,  $759 - 30$ .

⬇ Start adding three-digit multiples of ten to two-digit numbers e.g.  $350 + 24$ ,  $140 + 18$ .

➞ Write: **350 + 136** on the board. Say: **This calculation involves a three-digit multiple of ten.** Ask the class to work out the answer. Invite a child to explain how they worked it out. Repeat for  $220 + 457$ .

➞ Write: **237 + 500** on the board. Say: **As only hundreds are being added I only need to add 200 and 500 together. So the answer is 737.**

➞ Write: **237 + 5000** on the board. Say: **As thousands are being added and there are no thousands in 237 all the digits stay the same I just need to put them together. So the answer is 5237.**

➞ Ask the class to work out other addition calculations involving adding multiples of 100 and 1000 to two- or three-digit numbers.

➞ Invite some children to explain how they worked out the answer.

Pupil Book 3:  
Tortoise addition**Pupil consolidation***Refresher*

Children who are experiencing difficulty can first work through this section that involves adding multiples of ten and 100 or 1000 to two- or three-digit numbers. Children choose a number from each tortoise and make their own addition calculation.

*Practice*

Children choose a number from each tortoise and make their own addition calculation.

Support CM:  
Adding on**Support**

This involves adding 10 and 20 to two-digit numbers.

**Extension**

Write these calculations on the board and ask the children to work out the missing numbers.

$52 + \square = 82$ ;  $76 - \square = 36$ ;  $\square + 30 = 82$ ;  $\square - 40 = 36$ ;  $430 + \square = 484$ ;  
 $610 + \square = 687$ ;  $\square + 54 = 484$ ;  $\square + 27 = 637$ .

**Plenary** (about 10 to 15 min)

- Choose several of the calculations from the Extension work and ask some of the children who did them to explain how they worked out the missing numbers.
- Say: **Remember we can make adding and subtracting easier if we use our knowledge of the place value of the numbers. Then we can see which digits will change and which digits will not.**
- Finish by asking questions involving adding or subtracting 10, 100 or 1000.  
Ask: **What is  $65 + 10$ ,  $128 + 100$ ,  $348 + 1000$ ,  $657 - 10$ ,  $762 - 100$ ?**

**Software: Rapid Maths 4**

Crushers!

Homework CM:  
Sunny and star  
calculations**Homework** (about 20 min)

This provides further practice in adding multiples of 10, 100 and 1000.

# Mental calculation strategies (+ and -)/Rapid recall of addition and subtraction facts

**Objectives** ● To use known number facts and place value to add or subtract mentally: find what to add to a two- or three-digit number to make 100 or the next higher multiple of 100; find what to add to a four-digit multiple of 100 to make the next higher multiple of 1000. ● To derive quickly all pairs of numbers that total 100.

**Vocabulary** add; addition; more; plus; sum; total; and; altogether; equals; makes; is the same as; sign; multiple

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topics 2.1, 2.2 or 2.3.

## Main teaching and pupil activities (about 30 to 40 min)

⇒ Write:  $38 + \square = 100$  on the board.

⇒ Say: *To work out what needs to be added to 38 to equal 100 first I will jump to the next multiple of 10. 38 add 2 equals 40. Then use my knowledge of pairs of multiples of 10 that equal 100 and work out that I need to add 60 to equal 100. So 38 plus 62 equals 100.*

⇒ Write:  $53 + \square = 100$ . Ask the class to work out what needs to be added to 53 to equal 100. Invite a child to explain how they worked it out.

↓ If children are not confident working out number pairs that total 100 talk through some more examples.

⇒ Say: *You need to be able to work out quickly pairs of numbers that go together to equal 100.*

⇒ Write:  $268 + \square =$ . Ask: *What is the next multiple of 100?* (300) Write 300 as the answer i.e.  $268 + \square = 300$ .

⇒ Say: *I can work out what needs to be added to 268 to equal 300 in the same way that I worked out what needed to be added to a two-digit number to equal 100. 268 plus 2 is 270. 270 plus 30 is 300. So 32 needs to be added to 268 to make 300.*

⇒ Write:  $426 + \square =$  on the board. Ask: *What is the next multiple of 100?* Write 500 as the answer i.e.  $426 + \square = 500$ . Ask the class to work out the missing number. Invite a child to explain how they did it.

⇒ Repeat for  $514 + \square =$ .

↓ If children are not confident with pairs of multiples of 100 that equal 1000 begin with questions like  $200 + \square = 1000$ . Emphasise the link with addition facts for 10.

⇒ Write:  $3200 + \square =$  on the board. Ask: *What is the next multiple of 1000?* (4000) Write this in as the answer i.e.  $3200 + \square = 4000$ .

⇒ Say: *To work out what I need to add to 3200 to make 4000 I can use my knowledge of multiples of 100 that equal 1000. I know 200 plus 800 equals 1000 so 3200 plus 800 will equal 4000.*

⇒ Write:  $2500 + \square =$ . Ask: *What is the next multiple of 1000?* (3000) Write this in as the answer i.e.  $2500 + \square = 3000$ . Ask the class to work out the missing number. Invite a child to explain how they did it.

⇒ Repeat for  $5700 + \square =$ ,  $6100 + \square =$ .

Pupil Book 3:  
What's the jump?

10

**Pupil consolidation****Refresher**

Children who are experiencing difficulty can first work through this section that starts with working out what needs to be added to two-digit numbers to equal 100 and then what needs to be added to lower three-digit numbers to equal the next multiple of 100. Children record what each jump to the next number should be.

**Practice**

Children work out what each jump to the next number should be. They can record them as addition calculations.

**Extension**

Ask children to select five of their answers and explain using words or mathematical symbols how they worked them out.

Support CM:  
Jumping to 100

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**Support**

This provides practice in working out pairs of numbers that equal 100. The appropriate jumps on the number line are shown.



Game 30

**Games Pack 2**

Run the race

**Plenary** (about 10 to 15 min)

- ⇒ Say: **Remember to use your knowledge of pairs of multiples of 10 that equal 100 and pairs of multiples of 100 that equal 1000 to work out the next higher multiple of 100 or 1000.**
- ⇒ Write: **100** on the board. Say: **I am going to say a multiple of 10 and I want you to answer with the number that goes with it to make 100. So if I say 40 you say 60.**
- ⇒ Change 100 to 1000. Say: **I am going to say a multiple of 100 and I want you to answer with the number that goes with it to make 1000. So if I say 300 you say 700.**

**Software: Rapid Maths 4**

Crushers!

# Mental calculation strategies (+ and -)/Rapid recall of addition and subtraction facts

**Objectives** ● To use known number facts and place value to add or subtract mentally: add a single digit to any three- or four-digit number crossing the tens boundary; subtract a single digit from a multiple of 100 or 1000; subtract a single digit from a three- or four-digit number crossing the tens boundary. ● To consolidate knowing by heart addition and subtraction facts for all numbers to 20.

**Vocabulary** add; addition; more; plus; sum; total; and; altogether; equals; makes; is the same as; sign; take away; subtract; minus; fewer; less; difference; left; leaves; equals; multiple

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topics 2.1, 2.2 or 2.3.

## Main teaching and pupil activities (about 30 to 40 min)

➡ Begin by asking some quickfire questions involving the addition and subtraction facts to 20. Ask: **What is 7 plus 9? 16 minus 7?** etc.

➡ Say: **It is really important that you know all the addition and subtraction facts to 20 as they can help you to work out other calculations.**

↓ Begin with HTU + U calculations that do not cross the tens boundary.

➡ Write: **239 + 3** on the board. Say: **As only units are being added I can use my addition facts to work out this calculation.** Underline 9 + 3. Say: **I know 9 plus 3 is 12 so I know that in the answer the units will be 2.** **As the tens boundary has been crossed, the 30 in 239 will change to 40. So the answer will be 242.**

i Discuss other methods used, emphasising those methods that are effective and efficient.

➡ Write: **258 + 6** on the board. Ask the class to work out the answer. Invite a child to explain their method. Ask: **Did anyone work it out differently?**

➡ Write: **274 - 5** on the board. Say: **The subtraction fact that will help me work this out is 14 - 5 = 9.** Write: **14 - 5 = 9** on the board.

↓ Begin with HTU - U calculations that do not cross the tens boundary.

➡ Say: **I can see that when I subtract 5 from 274 I will cross the tens boundary. When 5 is subtracted from 14 the tens boundary is also crossed so the units in both calculations will be the same, 9. The 70 in 274 will become 60. So the answer will be 269.**

i Discuss other methods used, emphasising those methods that are effective and efficient.

➡ Write: **237 - 9** on the board. Ask the class to work out the answer. Invite a child to explain their method. Ask: **Did anyone work it out differently?**

➡ Say: **We can also use this method to add and subtract single digits to or from four-digit numbers.**

i Discuss other methods used, emphasising those methods that are effective and efficient.

➡ Write: **2376 + 9** on the board. Ask the class to work out the answer. Invite a child to explain their method. Ask: **Did anyone work it out differently?**

➡ Repeat for 2382 - 7.

➡ Write: **300 - 4** on the board. Say: **If I subtract a single-digit from a multiple of 100 or 1000 then I use my subtraction facts for 10 to help me work it out. I know 10 minus 4 is 6 so the units in 300 minus 4 will be 6. As the tens boundary is being crossed I know the rest of the answer needs to be 290. So the answer is 296.**

i Discuss other methods used, emphasising those methods that are effective and efficient.

➡ Write: **500 - 2** on the board. Ask the class to work out the answer. Invite a child to explain their method. Ask: **Did anyone work it out differently?**

➡ Repeat for 2000 - 5, 6000 - 7.

Pupil Book 3:  
Space calculations**Pupil consolidation****Refresher**

Children who are experiencing difficulty can first work through this section that starts with calculations that do not cross the tens boundary and only involves three-digit numbers. Children write out the four calculations for each robot and answer them.

**Practice**

Children write out the four calculations for each robot and answer them.

**Extension**

**Resources** paper and pencil

Each child writes and answers 10 calculations involving adding and subtracting single digits to three- and four-digit numbers e.g.  $754 + 9$ ,  $5821 - 5$ . They then take it in turns to read a calculation to each other and answer them mentally.



Game 29

**Games Pack 2**

Patchwork quilt

**Plenary** (about 10 to 15 min)

- ➡ Say: **Remember knowing your addition and subtraction facts to 20 helps you add and subtract single digits from other numbers.**
- ➡ Write: **265** on the board. Say: **I am going to say a single digit that I want you to add or subtract to or from 265.** Say, for example: **Plus 7, add 9, minus 6, subtract 8**, etc. Include numbers that will not involve crossing the tens boundary if children are not confident.
- ➡ Repeat for 2736.
- ➡ Write: **500** on the board. Call out single-digit numbers to subtract.
- ➡ Repeat for 7000.

**Software: Rapid Maths 4**

Crushers!

Homework CM:  
Sum games**Homework** (about 20 min)

This provides further practice in adding and subtracting single digits to or from three- and four-digit numbers.

# Mental calculation strategies (+ and -)


**Objectives** ● To use known number facts and place value to add or subtract mentally: add or subtract any pair of two-digit numbers, including crossing the tens boundary. ● To add or subtract the nearest multiple of ten and then adjust.


**Vocabulary** add; addition; more; plus; sum; total; and; altogether; equals; makes; is the same as; sign; take away; subtract; minus; fewer; less; difference; left; leaves; equals; partitioned

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topics 2.1, 2.2 or 2.3.

## Main teaching and pupil activities (about 30 to 40 min)

 Start with calculations that do not cross the tens boundary e.g.  $14 + 65$ .

 Some children may be using inefficient methods such as counting on in ones. Encourage them to use the method of partitioning the numbers and adding the tens and then the units.

- ➡ Write:  $19 + 65 =$  on the board.
- ➡ Ask the class to work out the answer. Ask: **Who can explain how they worked it out?** Record the method as a calculation on the board e.g.  $65 + 10 + 9$ .
- ➡ Ask: **Did anyone work it out in a different way?** Repeat this question until all the efficient methods used have been recorded on the board.
- ➡ If the method of rounding 19 up to 20, adding 20 and then subtracting 1 has not been used, put it forward as an efficient method you could use. If it has been suggested point to it.
- ➡ Say: **The method of rounding up or down to the nearest multiple of 10 and then adjusting by adding or subtracting the difference is a good method as adding multiples of 10 is easy. You cannot always use this method, you have to decide which calculations it can be used for.**
- ➡ Write:  $78 + 21$  on the board. Say: **Work this out using the method of rounding up or down to the nearest multiple of 10.**
- ➡ Write:  $83 - 47$  on the board. Ask the class to work out the answer. Ask: **Who can explain how they worked it out?** Record the method as a calculation on the board e.g.  $83 - 40 - 7$ .
- ➡ Ask: **Did anyone work it out in a different way?** Repeat this question until all the efficient methods used have been recorded on the board.
- ➡ Write:  $67 - 29$  on the board. Again ask the class to work out the answer and record their methods. If the method of rounding 29 up to 30 has not been suggested, suggest it yourself.
- ➡ Say: **The method of rounding up or down to the nearest multiple of 10 and then adjusting by adding or subtracting the difference is a good method, as subtracting multiples of 10 is easy. You cannot always use this method, you have to decide which calculations it can be used for.**

Pupil Book 3:  
Number facts

12

**Pupil consolidation****Refresher**

Children who are experiencing difficulty can first work through this section that starts with calculations that do not cross the tens boundary. Children copy out the calculations and answer them.

**Practice**

With a partner, children use the hundred square to make addition and subtraction calculations.

Extension CM:  
Complete the calculations

43

**Extension**

This involves missing number addition and subtraction calculations.

**Plenary** (about 10 to 15 min)

- ⇒ Write some of the calculations from the Extension work on the board. Invite children who worked on them to explain their methods.
- ⇒ Write a different calculation on the board and ask the rest of the class to work out the answer.
- ⇒ Say: **When adding or subtracting two two-digit numbers you need to choose the method that suits you best. You might use different methods for different kinds of calculations.**
- ⇒ Say: **Remember rounding numbers up or down to the nearest multiple of 10 can be a good method.**
- ⇒ Say: **I am going to say some numbers I want you to answer with the nearest multiple of 10.** Say, for example: **59, 41, 78, 42**, etc.




**Software: Rapid Maths 4**  
Crushers!





# Pencil and paper procedures (+)/Rapid recall of addition facts

**Objectives** ● To develop and refine written methods for column addition of two whole numbers less than 1000, and addition of more than two such numbers. ● To derive quickly all pairs of multiples of 50 with a total of 1000.


**Vocabulary** add; addition; more; plus; sum; total; and; altogether; equals; makes; is the same as; sign; hundreds; tens; units; ones; column


 Start with calculations that do not cross this boundary if children are not confident when adding using the standard written method.

 When the standard method for recording is introduced it is important that the children are clear that they are adding tens and hundreds and not single digits, e.g. 100 and 200 are being added together not 1 and 2.

 Remind the children to keep the hundreds, tens and units underneath each other in columns.

$$\begin{array}{r} 147 \\ 238 + \\ \hline 385 \\ \hline \end{array}$$

 Repeat with other HTU + HTU calculations that involve carrying the units only and where the thousand boundary will not be crossed e.g. 256 + 218, 345 + 237.

 Write the calculations out horizontally as well as vertically so children will not lose sense of the numbers they are adding together.

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topic 2.1

## Main teaching and pupil activities (about 30 to 40 min)

⇒ Write all the multiples of 50 to 1000 randomly on the board. Say: **I am going to point to the multiples of 50 and I want you to reply with the multiple of 50 that goes with it to make 1000.**

⇒ Write:  $147 + 238$  horizontally on the board. Say: **This is a difficult calculation to do mentally.** Write:  $147 + 238$  out vertically.

⇒ Say: **We add the units first. 8 plus 7 is 15. In this calculation the units come to more than 9 so the 5 goes in the units column. I cannot just write the ten from 15 into the tens column as there are still other tens to add. I need to carry the ten to the tens column.**

⇒ Say: **I am going to write the 1 in the tens column not in the answer line but underneath it. Although I have just written 1, I know it stands for 10 as it is in the tens column. Then I can add it to the other tens.**

⇒ Say: **Now we add the tens, 40 plus 30 is 70 plus the 10 from the 15. 70 plus 10 is 80. I can now write 8 in the tens column. I know it stands for 80 as I have written it in the tens column.**

⇒ Say: **Now we look at the hundreds. 100 plus 200 is 300. Instead of writing 300 I am going to write just the 3 in the hundreds column.**

⇒ Point and say: **The final answer is now written here, 385.**

⇒ Say: **When the units add up to more than 10, as they did here, and the ten has to be added in the tens column it is called carrying. We have 'carried' the ten from the units column to the tens column.**

⇒ Write:  $291 + 365$  on the board horizontally then vertically.

⇒ Say: **In this calculation it is the tens that need carrying. The units 1 plus 5 equal 6 so that answer can be written in the units column.**

⇒ Continue as above to complete the calculation.

⇒ Say: **The answer to the calculation is 656.**

⇒ Repeat with other HTU + HTU calculations that will involve carrying the tens only without crossing the thousands boundary e.g.  $342 + 271$ ,  $486 + 293$ .

⇒ Write  $246 + 138 + 214$  horizontally and vertically on the board. Say: **We can use the same method to add three numbers together.** Invite a child to carry out the calculation explaining what they are doing.

Pupil Book 3:  
Racing addition

13

**Pupil consolidation****Refresher**

Children who are experiencing difficulty can first work through this section that involves adding only carrying the units. Children copy out the calculations then work them out using the standard vertical method.

**Practice**

Children write out the calculations then work them out using the standard vertical method.

Support CM:  
Hundreds and hundreds

44

**Support**

This provides practice in recording addition calculations vertically but using an informal method.

Extension CM:  
Adding three numbers

44

**Extension**

This involves using the standard method to add three numbers together.



Game 39

**Games Pack 2**

Dotty dragon

**Plenary** (about 10 to 15 min)

- ⇒ Say: ***This method of working out addition calculations is useful for calculations that you cannot work out in your head.***
- ⇒ Say: ***When the units cross the tens boundary or the tens cross the hundreds boundary then you have to carry into the next column. It is very important to write down the ten or hundred that you carry otherwise you will forget to add it.***
- ⇒ Choose one of the calculations from the Extension work and ask a child who has completed it to work it out on the board.
- ⇒ Finish by discussing any problems that have arisen in the consolidation part of the lesson.

**Software: Rapid Maths 4**

Souperbowl

## Pencil and paper procedures (+)

**Objectives** ● To develop and refine written methods for column addition of two whole numbers less than 1000, and money calculations.

**Vocabulary** add; addition; more; plus; sum; total; and; altogether; equals; makes; is the same as; sign; hundreds; tens; units; ones; column

### Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topic 2.1.

### Main teaching and pupil activities (about 30 to 40 min)



This calculation involves the tens crossing the hundreds boundary. Start with calculations that do not cross the hundreds or tens boundaries if children are not confident at adding using the standard written method.

$$\begin{array}{r} 376 \\ 429+ \\ \hline 805 \\ 11 \end{array}$$

- ✎ Write:  $563 + 374$  horizontally on the board.
- ✎ Say: ***This is a difficult calculation to do mentally so we are going to add the numbers vertically.***
- ✎ Invite a child to write  $563 + 374$  out vertically on the board. Ask: ***Can you explain what you are doing?*** Encourage explanations that focus on the hundreds, tens and units being underneath each other in columns.
- ✎ Invite a different child to come and work out the calculation. Ask them to explain each step as they do it.
- ✎ Repeat for  $492 + 357$  and  $418 + 468$ .
- ✎ Write:  $376 + 429$  on the board horizontally then vertically.
- ✎ Say: ***In this calculation the tens and the units need carrying. 6 plus 9 equals 15. I can write the 5 in the units column and carry the ten to the tens column.*** Write the 5 and the 1 in the appropriate places.
- ✎ Say: ***Now I add 70 and 20. 70 plus 20 is 90. 90 plus the ten that I carried equals 100. 100 is one hundred and no tens. So I write 0 in the tens column and carry the 100 to the hundreds column.*** Write the 1 and 0 in the appropriate places.
- ✎ Say: ***Now I add the hundreds. 300 plus 400 is 700. Then I need to add the 100 that I carried. 700 plus 100 is 800. I write the 8 from 800 in the hundreds column. The answer to the calculation is 805.***
- ✎ Write:  $384 + 437$  horizontally on the board. Invite a child to write the calculation out vertically. Invite another child to work it out. Ask them to explain what they are doing. Repeat for  $218 + 694$ .
- ✎ Write:  $£3.63 + £4.58$  horizontally on the board. Then write it vertically. Say: ***It is important to make sure that you write the calculation out correctly. The decimal points that divide the pounds and pence must be underneath each other. Then all the numbers will be in the right columns.***
- ✎ Invite a child to work out the calculation explaining what they are doing.
- ✎ Repeat for  $£5.72 + £2.48$ .
- ✎ Write: ***I had saved £3.46 and then mum gave me £2.80 more. How much money do I have now?***
- ✎ Invite a child to write the calculation needed to answer the question, and another child to work out the answer.
- ✎ Ask other word problems involving “real life” or money if time allows.

Pupil Book 3:  
Shop calculations

14

**Pupil consolidation****Refresher**

Children who are experiencing difficulty can first work through this section that starts with calculations that involve carrying the units or the tens. Children copy out the calculations then work them out using the standard vertical method.

**Practice**

Children make up 10 money calculations using the prices on the objects. They write them out vertically and then work them out using the standard vertical method.

**Extension**

Each child writes ten HTU + HTU calculations making a note of the answers. They swap papers and work out the calculations their partner has written. Then they swap back and mark each other's work.

**Plenary** (about 10 to 15 min)

- ⇒ Choose one of the calculations from the practice section of the Pupil Book and work it out on the board emphasising how to carry and the importance of writing the 1 in the tens and hundreds column.
- ⇒ Write:  $246 + 137 + 402$  horizontally on the board. Say: **More than two numbers can be added using this method.** Invite a child who completed the extension work to write the calculation out vertically and explain how to work it out.
- ⇒ Say: **Knowing your addition facts makes using this method much easier as you know the answer to each step instead of having to work it out.**
- ⇒ Finish by asking quickfire addition facts to 20. Ask: **What is 7 add 8? 6 plus 9? 5 add 7? the total of 6 and 8?**

**Software: Rapid Maths 4**

Souperbowl

Homework CM:  
Column addition

46

**Homework** (about 20 min)

This provides further practice in using the standard method of addition.

## Pencil and paper procedures(-)/Making decisions

**Objectives** ● To develop and refine written methods for column subtraction of two whole numbers less than 1000, including money. ● To choose and use appropriate number operations and appropriate ways of calculating (mental, mental with jottings, pencil and paper) to solve problems.

**Vocabulary** subtract; subtraction; minus; take away; difference; equals; makes; is the same as; sign; column

**i** When working out these calculations vertically always refer to the digits by what they represent so that the children do not lose sight of what they are subtracting, e.g. say 50 not 5 in 354.

**↓** This calculation involves decomposing. Start with calculations that do require decomposition if children are not confident in subtracting using the standard method.

**↓** Label the columns HTU to remind children of the value of each digit.

$$\begin{array}{r} 4\text{ }1 \\ 354 \\ 138- \\ \hline 216 \end{array}$$

**i** Choose numbers that will involve decomposing the units, e.g.  $536 - 219$ ,  $672 - 345$ . Invite children to work out the calculation explaining what they are doing.

$$\begin{array}{r} 4\text{ }1 \\ 539 \\ 265- \\ \hline 274 \end{array}$$

**i** Choose numbers that will involve decomposing the tens, e.g.  $537 - 283$ ,  $826 - 571$ . Invite children to work out the calculations explaining what they are doing.

### Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topic 2.2.

### Main teaching and pupil activities (about 30 to 40 min)

➡ Write:  $354 - 138$  on the board horizontally and vertically. Remind the class of the vertical layout. Point and say: **Remember to write the hundreds, tens and units underneath each other in columns.**

➡ Say: **4 minus 8 cannot be done. So we need to increase 4 to 14 by borrowing 10 from the tens column.**

➡ Cross out the 50 and change it to 40. Say: **I have made 50 smaller by 10. I can put this 10 with the units.** Write a small **I** next to the 4. Say: **I have now made 4 into 14 by adding 10.** Say: **14 minus 8 is 6.**

➡ Say: **Now we can subtract the tens. The number in the tens column has changed to 40. 40 minus 30 is 10. I write 1 in the tens column. I know that it represents 10 as it is in the tens column.**

➡ Point to the hundreds column and say: **300 minus 100 is 200. I write the 2 from 200 in the hundreds column. So the answer is 216.**

➡ Repeat this method of recording with other HTU – HTU calculations.

➡ Write:  $539 - 265$  horizontally and vertically on the board. Say: **In this calculation it is the tens that will need to borrow from the hundreds column. First we subtract the units 9 minus 5 is 4.**

➡ Say: **Now the tens. 30 minus 60 cannot be done so I need to make 30 larger by borrowing one hundred from the hundreds. I am going to take 100 from 500 making it 400. Cross out 5 and write 4 next to it. I will now put that hundred into the tens column.** Write a small **I** next to 3. Say: **I have made 30 into 130 or 13 tens. Now I can do the subtraction. 130 minus 60 is 70. I will write 7 in the tens column of the answer.**

➡ Say: **500 has become 400, 400 minus 200 is 200.** Write **2** in the appropriate place. **The answer to 539 minus 265 is 274.**

➡ Repeat this method of recording with other HTU – HTU calculations.

➡ Write:  $£6.42 - £4.57$  horizontally then vertically on the board. Say: **It is important to make sure that you write the calculation out correctly. The decimal points that divide the pounds and pence must be underneath each other. Then all the numbers will be in the right columns.**

➡ Invite a child to work out the calculation explaining what they are doing.

➡ Repeat for  $£7.14 - £3.37$ .

Pupil Book 3:  
Boat calculations

15

**Pupil consolidation****Refresher**

Children who are experiencing difficulty can first work through this section that begins with calculations that do not involve decomposing, and then calculations where only the digits need decomposing. Children copy out each calculation and work it out vertically.

**Practice**

Children copy out each calculation and work it out vertically.

Support CM:  
Take it away

45

**Support**

This provides an opportunity for children who are unsure about decomposing to partition the numbers into hundreds, tens and units and then borrow from the tens column.

**Extension**

Each child writes ten HTU – HTU calculations and makes a note of the answers. They swap papers and work out the calculations their partner has written. Then they swap back and mark each other's work.

**Plenary** (about 10 to 15 min)

- ➡ Say: **We have been using a way to work out subtractions. This is a method that will be useful for calculations that you cannot work out in your head.**
- ➡ Say: **If either the units or the tens subtraction cannot be done because the first number is too small then you need to borrow from the next column.**
- ➡ Write: **I took £7.30 to the shop, I spent £2.56 in the supermarket and then £1.96 on a note book. How much will I have left?** Invite a child to use the standard method to work it out.
- ➡ Finish by discussing any problems that have arisen in the consolidation part of the lesson.

**Software: Rapid Maths 4**

Souperbowl

# Pencil and paper procedures(-)/Mental calculation strategies (-)


**Objectives** ● To develop and refine written methods for column subtraction of two whole numbers less than 1000. ● To use known number facts and place value to add or subtract mentally: find a small difference between a pair of numbers lying either side of a multiple of 1000.


**Vocabulary** add; addition; more; plus; sum; total; and; altogether; equals; makes; is the same as; sign; hundreds; tens; units; ones; column

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 2 Topic 2.2.

## Main teaching and pupil activities (about 30 to 40 min)

 This calculation involves decomposing the units. Start with calculations that do not need decomposing if children are not confident in subtracting using the standard written method.

 Encourage explanations that focus on the hundreds, tens and units being underneath each other in columns.

$$\begin{array}{r} 6\cancel{7}15\cancel{8}1\cancel{2} \\ 387- \\ \hline 375 \end{array}$$

- ➡ Write:  $571 - 348$  horizontally on the board. Say: ***This is difficult to do mentally so we are going to subtract the numbers vertically.***
- ➡ Invite a child to write  $571 - 348$  out vertically on the board. Ask: ***Can you explain what you are doing?***
- ➡ Invite a different child to come and work out the calculation. Ask them to explain each step as they do it. Repeat for  $629 - 254$  and  $744 - 427$ .
- ➡ Write:  $762 - 387$  on the board horizontally then vertically.
- ➡ Say: ***In this calculation it is the tens and the units that need to borrow from the next column. We start with the units. 2 minus 7 cannot be done. So I will borrow 10 from the tens column.*** Cross out the 6 in 762 and write 5 above it. Say: ***60 becomes 50 and I put the ten that I have borrowed in to the units column.*** Write a small *1* next to the 2. Say: ***2 now becomes 12. 12 subtract 7 is 5.***
- ➡ Say: ***Now I look at the tens. 50 minus 80 cannot be done. So I will borrow from the hundreds column.*** Cross out the 7 and write *6* above it. Say: ***700 becomes 600 and I put the 100 that I have borrowed into the tens column.*** Write a small *1* next to the 5. Say: ***50 now becomes 150 or 15 tens. 150 minus 80 is 70. I write 7 into the tens answer column.***
- ➡ Say: ***Now I subtract the hundreds. 600 minus 300 is 300. I write the 3 from 300 in the hundreds column. The answer to the calculation is 375.***
- ➡ Write:  $753 - 478$  horizontally on the board. Invite a child to write the calculation out vertically and another child to work it out. Ask them to explain what they are doing. Repeat for  $816 - 547$ .
- ➡ Say: ***This written method of subtraction is good for numbers that would be too difficult to subtract mentally. There are some calculations where it is much better to work out the answer in your head.***
- ➡ Write:  $503 - 495$  horizontally on the board. Say: ***In this calculation the two numbers are close together so the easiest method is to find the difference. 495 plus 5 equals 500 and 500 plus 3 is 503. So the answer is 8.***
- ➡ Say: ***Look at calculations and choose the best way to answer.***
- ➡ Write:  $806 - 792$  horizontally on the board. Say: ***Work this out in your head.*** Invite a child to explain how they worked out the answer.
- ➡ Repeat for  $2004 - 3998$  and  $4005 - 3997$ .

Pupil Book 3:  
Column subtraction

16

**Pupil consolidation****Refresher**

Children who are experiencing difficulty can first work through this section that involves calculations that involve decomposing the units or the tens. Children copy out the calculations then work them out using the standard vertical method for question 1. Question 2 involves working out the subtraction by finding the difference mentally.

**Practice**

Children write out the calculations then work them out using the standard vertical method for question 1. Question 2 involves working out the subtraction by finding the difference mentally.

**Extension**

Each child writes ten HTU – HTU calculations and makes a note of the answers. They then answer each other's calculations and mark each other's work.

**Plenary** (about 10 to 15 min)

- ➡ Choose one of the calculations from the practice section of the Pupil Book and work it out on the board emphasising how to borrow from the next column.
- ➡ Say: **Remember that knowing your subtraction facts makes using the written method easier as you know the answer to each step instead of having to work it out.**
- ➡ Say: **I am going to say a number and I want you to count forwards until I say stop.**
- ➡ Start counting at 4991, 6990, 7987. Children continue counting until the thousands boundary is crossed.

**Software: Rapid Maths 4**

Souperbowl

Homework CM:  
Subtraction problems

47

**Homework** (about 20 min)

This provides further practice in using the standard method of subtraction. There are also some word problems to work out using this method.



# Problems involving “real life” and money/Making decisions

**Objectives** ● To use addition and subtraction to solve word problems involving numbers in “real life” or money, using one or more steps. ● To choose and use appropriate number operations and appropriate ways of calculating (mental, mental with jottings, pencil and paper) to solve problems.

**Vocabulary** operation; calculation; answer; how did you work it out?; problem; explain

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 3 Topic 3.3 or 3.4, Strand 1 or Strand 2.

## Main teaching and pupil activities (about 30 to 40 min)



It is important to teach children an approach to solving word problems. This four-step model is used in lessons where word problems are presented: 1) read the problem and identify any important information; 2) identify the calculation needed; 3) find the answer to the calculation; 4) find the answer to the problem.

- ➡ Write on the board: **There are 92 children in Year 4 at Parkside School. Today 25 are out on a trip. How many Y4 children are in the school?**
- ➡ Ask: **What is the calculation that we need to work out to find the answer to this question?** Invite a child to write the calculation on the board.
- ➡ Say: **Decide how you are going to work out the answer. You might work it out in your head or you might want to make some jottings or you might want to use a more formal written method.**
- ➡ Ask: **Who would work out the answer in their head?** Repeat the question for the other two possible methods.
- ➡ Invite a child who said they would work it out in their head to explain their mental method. Then ask a child who said they would work it out making jottings to come out and work it out on the board. Then do the same with the formal written method.
- ➡ Establish that the answer to the calculation is 67. Say: **So the answer to the problem is 67 Y4 children are in school.**
- ➡ If the standard written method of subtraction is suggested explain that as the numbers involved are two-digit numbers the answer should be worked out mentally or with the help of jottings.
- ➡ Write on the board: **I have 90 postcards, my friend gave me 40 more. I sent 24 on Monday. How many do I have left?**
- ➡ Say: **For this problem we need to work out more than one calculation. What is the first thing we need to work out?** Invite a child to write the calculation on the board. ( $90 + 40$ )
- ➡ Say: **Decide how you are going to work out the answer. You might work it out in your head or you might want to make some jottings or you might want to use a formal written method.**
- ➡ Choose a method and invite a child who would work it out in this way to come to the board and explain to the class what they are doing.
- ➡ Ask: **What is the second calculation that we need to work out?** ( $130 - 24$ ) Choose a different method and ask a child who worked it out in this way to explain their method to the class.
- ➡ Repeat with other two-step problems. Each time choose a different way of working it out.



Spend more time on one step problems.

**Y4** Solving problemsSuggested order: **Summer Term, Week 3, Lesson 5**Pupil Book 3:  
Money problems

17

**Pupil consolidation****Refresher**

Children who are unsure should start with these one-step problems. Children should record first the calculation they used and then the answer to the question.

**Practice**

These problems require two steps to work out the answer. Children should record first the calculations they used and then the answer to the question.

Extension CM:  
Solving problems

45

**Extension**

Children use the information to make up problems for themselves. Encourage them to think of some two-step problems.

**Plenary** (about 10 to 15 min)

- ⇒ Discuss some of the word problems from the Pupil Book.
- ⇒ Invite children to explain their working. Ask: **Did anyone work it out in a different way?**
- ⇒ Say: **When you are working out word problems you need to decide if you can work out the answer in your head, if you need to make jottings on paper or if you need to use a standard written method.**

## Measures: (capacity)

**Objectives** ● To use, read and write standard metric units (l, ml) including their abbreviations, and imperial unit (pint). ● To know and use the relationships between familiar units of capacity. ● To know the equivalent of one half, one quarter, three quarters and one tenth of 1 litre in ml. ● To record estimates and readings from scales to a suitable degree of accuracy,

**Vocabulary** unit; standard unit; metric unit; imperial unit; litre; half-litre; millilitre; pint; measurement; container; measuring cylinder; measuring scale; division; capacity; contains; full; half-full; empty; compare; estimate; approximately

**i** Manufacturers are aware of the strong visual impact which the design of a container can make. Since appearances can be misleading, it is important that children develop an ability to estimate amounts held by containers in a range of shapes and sizes.

### Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

### Main teaching and pupil activities (about 30 to 40 min)

**Resources** 1 l measuring jug; 1 l measuring cylinder; 1 l detergent container; 1 l milk carton/container; 1 pint milk bottle; calibrated measures – two 500 ml, four 250 ml, one 100 ml; funnel

- ⇒ Display the four one litre containers. Compare their heights and establish that although they differ in shape/size, they all contain or measure the same amount, namely one litre.
- ⇒ Remind children of previous experiences in measuring capacity using the standard unit, the litre. Recall that 1 litre = 1000 ml.
- ⇒ Fill the measuring jug to the one litre mark. Ask two children to pour an equal amount of water into two identical containers (500 ml measurers).
- ⇒ Draw children's attention to the scale and ask: **How much water does each container hold?** ( $\frac{1}{2}$  litre/500 ml)
- ⇒ Refill the one litre measuring jug and ask two children to pour an equal amount of water into four identical containers (250 ml measurers). Say: **Reading from the scale, how much water is in each container?** ( $\frac{1}{4}$  litre/250 ml)
- ⇒ Empty two of the 250 ml measurers and say: **If you pour the water from the half litre container to the 250 ml mark in this smaller container, how much water will you have left in the half litre jug?** ( $\frac{1}{4}$  litre/250 ml)
- ⇒ Ask a child to check by pouring the remains of the  $\frac{1}{2}$  litre into a  $\frac{1}{4}$  litre container and reading the scale on the side. Establish that two  $\frac{1}{4}$  litre/250 ml containers hold the same as one  $\frac{1}{2}$  litre/500 ml container.
- ⇒ Pour the liquid from the  $\frac{1}{2}$  litre and  $\frac{1}{4}$  litre containers into the measuring cylinder and ask: **How many millilitres of water does the measuring cylinder now hold?** (750 ml) What is that in litres? ( $\frac{3}{4}$  litre) Say: **The cylinder is three quarters full. What fraction of it is empty?** ( $\frac{1}{4}$ )
- ⇒ Ask children to fill the measuring jug and cylinder to the 100 ml mark. Compare the water levels. Establish that each container is 100 ml/ $\frac{1}{10}$  litres full and 900 ml/ $\frac{9}{10}$  litres empty. Ask: **How full will the cylinder be if we add another 100/200/300 ml of water?** ( $\frac{2}{10}$ / $\frac{3}{10}$ / $\frac{4}{10}$  l or 200/300/400 ml)
- ⇒ Introduce the imperial measure, the pint. Place the pint bottle in the display and ask the children to estimate its capacity in millilitres. (about 500 ml) Check by filling and measuring.

Pupil Book 3:  
Fractions of a litre

18

**Pupil consolidation****Refresher**

Children copy and complete questions to establish the relationships between units.

**Practice**

- 1 Children complete true or false statements to consolidate their understanding of the relationships between units.
- 2 Children interpret the illustrations and copy the completed sentences.

Support CM:  
Measuring cylinders

46

**Support**

Children draw a line across each cylinder, and then colour to the line, to show how full or empty the cylinder is when water reaches the level shown by the label.

Extension CM:  
Measuring cylinders

46

**Extension**

Children complete the labels to show how full or empty each cylinder is when the water reaches the level shown by the arrow.



Game 48

**Games Pack 2**

Milk the cow

**Plenary** (about 10 to 15 min)

- Revise the relationships between units by asking children to complete these written statements in as many ways as they can:

1 litre = \_\_\_ measures of \_\_\_ ml (2/4/10 measures of 500/250/100 ml)

500 ml = \_\_\_ measures of \_\_\_ ml (2/5 measures of 250/100 ml)

- Ask children to write on the board the equivalent, in millilitres, of  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{3}{4}$  and  $\frac{1}{10}$  of 1 litre.
- Review the answers to the Support and Extension tasks.
- Discuss question 2 of the practice section in the Pupil Book. Ask questions such as: **If I have two cartons of juice, how many glasses can I fill?** (8) **How many beakers?** (10) **I open a fresh carton of juice and fill two glasses. How full is the carton after that? How empty?** ( $\frac{1}{2}$ )

# Measures: (capacity)

**Objectives** ● To suggest suitable units and measuring equipment to estimate or measure capacity. ● To record estimates and readings from scales to a suitable degree of accuracy.

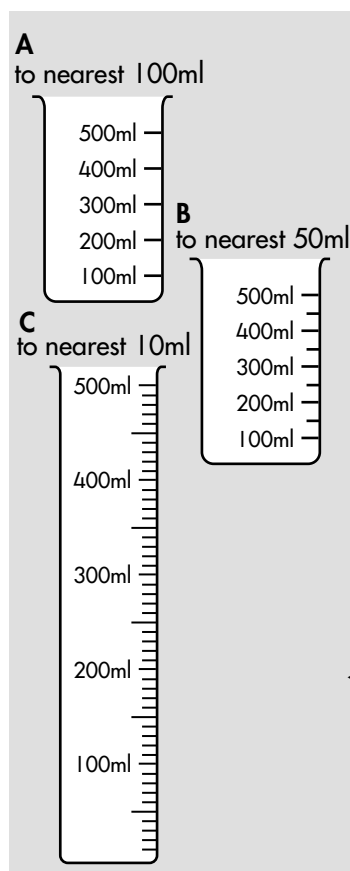
**Vocabulary** unit; standard unit; metric unit; litre; half-litre; millilitre; measurement; container; measuring cylinder; measuring scale; division; capacity; contains; full; half-full; empty; compare; estimate; approximately

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

## Main teaching and pupil activities (about 30 to 40 min)

**Resources** a selection of calibrated capacity measurers of different size and degree of calibration; small teacup; small unmarked plastic containers; funnels; water colouring



⇒ Display and compare the different calibrated measurers. Check that the children recognise the range of the graduated scale and the notional maximum capacity of each container, e.g. 0–100ml, 0–500ml, 0–1000ml

⇒ Ask: **Which measurers could we use to find the capacity of this teacup?** Pour a teacupful of coloured water into each selected measurer. Choose children to read the amount of water in each calibrated measurer.

⇒ Encourage language of approximation, e.g. just over/under 150 ml, between 100 and 200 ml, nearly 140 ml.

⇒ Discuss and compare results.

⇒ Ask: **What is the range of capacities found for the teacup?** (100–200 ml) **Which calibrated measurer is the easiest to read? Which gives us the most accurate result?** (measuring cylinder) **Who can explain why a tall narrow cylinder is more accurate than a short wide measurer?**

◀ ⇒ Select two differently calibrated containers and a measuring cylinder.

⇒ Label them A, B and C. Carefully measure and pour 250 ml of water into each. Focus children's attention on the need to read the scale at eye level.

⇒ Discuss the relative accuracy of each and the need to choose an appropriate measuring container.

⇒ Identify the sequence of numbers printed on the scale of the measuring cylinder and the length of line to mark each, e.g. important calibrations (100 ml, 200 ml ...), intermediate calibrations (50 ml, 150 ml ...) smaller calibrations of 10 ml.

**i** At this point you may wish to set half of the class to the Pupil Book task and half to the practical activity.

↓ to the nearest 50 ml.

↑ to the nearest 10 ml.

◀ ⇒ Recall that containers A, B and C all hold 250 ml. Fill them to different levels, e.g. 400 ml, 550 ml, 750 ml and ask the children to work out the amount added to each.

⇒ In small groups children estimate and record to the nearest 10/50 ml the capacities of three unmarked plastic containers. If resources permit, provide each group with two different measurers

Pupil Book 3:  
Millilitres more or less

19

**Pupil consolidation****Refresher and Practice**

Children write, to the nearest 10 ml, the amount held by each measuring cylinder.

**Practice**

1 Children copy and complete a table to show the sum of two amounts of liquid.

2–3 Children work out totals of and differences between soft drink containers.

**Extension**

**Resources** yoghurt pots; measuring cylinders; funnels

Provide each group with a measuring cylinder, a funnel and three identical yoghurt pots. Challenge the children to find a way to divide equally the capacity of one yoghurt pot among the three.

**Plenary** (about 10 to 15 min)

- Ask children to read their answers to question 1 of the Practice section in the Pupil Book. Taking each total amount in turn, ask supplementary questions such as: **How much would you need to add to 550 ml to make one litre? How many millilitres is double 550 ml? Half of 550 ml?**
- Fill the measuring cylinder to the 750 ml mark. Pour 400 ml into an unmarked container. Ask: **How much is left in the cylinder?** (350 ml)
- Say: **Imagine you have a plastic beaker and 500 ml of water in a measuring cylinder. How might you work out the capacity of the beaker?** (fill beaker, amount left in cylinder subtracted from 500 ml is the capacity of the beaker)

Homework CM:  
Filling cylinders

48

**Homework** (about 20 min)**Refresher and Practice**

Children cut out the labels at the foot of the page. They stick in the appropriate spaces the amounts that were used to fill the cylinder to the stated level. Then they draw a line across each cylinder to show the level reached by the water.

## Measures: capacity)/Problems involving measures (capacity)/Making decisions

**Objectives**

- To record estimates and readings from scales to a suitable degree of accuracy: record measurements using mixed units, or the nearest whole/half/quarter unit (e.g. 3.25 litres).
- To use all four operations to solve word problems involving numbers in measures (capacity) using one or more steps.
- To choose and use appropriate number operations and appropriate ways of calculating (mental, mental with jottings, pencil and paper) to solve problems.
- To explain and record methods.

**Vocabulary** unit; standard unit; metric unit; litre; half-litre; millilitre; measurement; container; measuring cylinder; measuring scale; division; capacity; contains; full; half-full; empty; compare; estimate; approximately

### Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2

### Main teaching and pupil activities (about 30 to 40 min)

**Resources** 3 containers with capacities less than 2 litres, e.g. electric kettle, teapot, water jug; mug; teacup; beaker; bottle of squash; funnel; Post-it notes; calibrated measuring cylinder; water

- ⇒ Display three containers: kettle, teapot and water jug. Ask the children to estimate the capacity of each in either millilitres or litres.
- ⇒ Consider estimates for each, e.g. the water jug holds about 1200 ml or  $1\frac{1}{2}$  litres.
- ⇒ Ask a child to write the most popular estimate on a Post-it note and stick it to the water jug.
- ⇒ Repeat, as above, for the kettle and teapot.
- ⇒ Elicit the most popular estimates for the teacup, beaker and mug, e.g. 125 ml, 150 ml, 200 ml, and label with Post-it notes
- ⇒ Say: **Look at your estimated capacities for the teacup and teapot.** (e.g. 125 ml and 1200 ml) **About how many cupfuls will fill the teapot?** (about 10)
- ⇒ Draw children's attention to the fact that, for safety reasons, the level of tea in a cupful stops short of the brim. Choose children to check the estimate by filling the teapot in cupfuls.
- ⇒ Fill the electric kettle to the 'full' mark and discuss the safety reason for this.
- ⇒ Refer to estimates and ask: **How many mugs of instant coffee can we get with one kettleful of water?** Again, choose children to check by successively filling the mug.
- ⇒ Ask: **How might we obtain a more accurate measure of the capacity of the teacup and hence, of the teapot?** (use a measuring cylinder to find the capacity of a cupful, then multiply by the number of cupfuls)
- ⇒ Ask a child to find the capacity of the beaker and say: **To make up an orange drink you need 50 ml of squash and 200 ml of water. We know that a beakerful is 200 ml. What is the most efficient way to make a jugful of squash?**
- ⇒ Discuss the children's ideas and try out several to check.

Pupil Book 3:  
Calculating capacities

20

### Pupil consolidation

#### Refresher

- 1 Children use the information given in the illustrations to calculate the number of cupfuls for each container.

#### Practice

- 1 Children interpret a block graph to answer questions about capacities.
- 2–4 Children choose and use appropriate operations to solve word problems including capacity.

#### Extension



**Resources** 1 cm squared grid paper

Children represent the information in question 4 in a block graph. They find a way to show how they might use a graph to calculate the number of 1 litre bottles for 20, 40, ... 200 drinks.

#### Plenary (about 10 to 15 min)

- Review the answers to the Refresher section.
- Revise halving and doubling litres and millilitres by asking, for example: **How much squash is in half of a jugful? You have two cups of tea. How many millilitres is that?**
- Referring to the practice section in the Pupil Book discuss the questions about the graph where children experienced difficulty.
- Choose children to explain, with jottings, how they solved the word problems. Ask if anyone had a different way.
- Ask the children who completed the Extension task to discuss their graph.



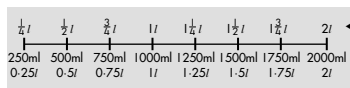
# Measures: (capacity)/Problems involving measures (capacity)/Making decisions

**Objectives**

- To record estimates and readings from scales to a suitable degree of accuracy: record measurements using mixed units, or the nearest whole/half/quarter unit (e.g. 3.25 litres).
- To use all four operations to solve word problems involving numbers in measures (capacity) using one or more steps.
- To choose and use appropriate number operations and appropriate ways of calculating (mental, mental with jottings, pencil and paper) to solve problems.
- To explain and record methods.

**Vocabulary** unit; standard unit; metric unit; litre; half-litre; millilitre; measurement; container; measuring cylinder; measuring scale; division; capacity; contains; full; half-full; empty; compare; estimate; approximately

**i** The engine capacity of cars is measured in cubic centimetres. For larger cars the capacities are often listed in litres, e.g. 2500cc = 2500ml or 2.5 l.



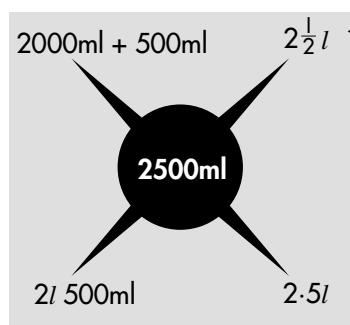
## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

## Main teaching and pupil activities (about 30 to 40 min)

**Resources** pictures of 5 cars from mini to 4 x 4; Post-it notes for the numbers 1043, 1275, 1391, 1598 and 2825

- ➡ Revise and record on the board, the millilitre equivalences of one half, one quarter, three quarters and one tenth of 1 litre.
- ➡ Draw an empty number line on the board. Beginning at zero, mark the divisions of the number line in multiples of 250 ml to 2000 ml. In a random way, elicit and write in fractional form, the litre equivalences for each division, e.g. 1500 ml /  $1\frac{1}{2}$  l, 750 ml /  $\frac{3}{4}$  l ...
- ➡ Recall from previous work in measure, the decimal equivalences of whole, half and quarter litres, e.g.  $1.25\text{ l} = 1\frac{1}{4}\text{ l}$  and complete the labelling of the number line.
- ➡ Write 2500 ml and say: **Tell me an equivalent way of writing 2500 ml.** Write on the board a diagram to show the four equivalent ways.
- ➡ Repeat, as above, for 3250 ml and 5750 ml, inviting children to write an equivalent form on the board using the diagram.
- ➡ Display the pictures of five cars and attach Post-it notes, e.g. Polo – 1043, Jeep – 2825.
- ➡ Invite suggestions about the numbers, e.g. price, mileage etc. Inform the children that the numbers refer to the capacity of the engine in millilitres.
- ➡ Write: **Polo – 1043 ml.** Recall the rules for rounding numbers to the nearest 10 and ask: **What is 1043 ml to the nearest 10 ml?** (1040 ml)
- ➡ Repeat, as above, making a table of all five cars, with capacities rounded to the nearest 10 ml.
- ➡ Recall the rule for rounding numbers to the nearest 100. Extend the table by adding the column, rounded to the nearest 100. Invite children to complete the table.
- ➡ Say: **My neighbour bought a two litre model. What might the engine capacity be in millilitres, rounded to the nearest 100 ml?** (1950 ml to 2049 ml)
- ➡ Say: **The engine capacity of a Formula 1 racing car is 5979 ml. What is that rounded to the nearest 100 ml?** (6000 ml / 6 l)



car	engine capacity rounded to nearest ml	10ml	100ml
Polo	1043	1040	1000
Jeep	2825	2830	2800

Pupil Book 3:  
Fill up in litres

21

**Pupil consolidation****Refresher**

Children express in a diagram four equivalences for each amount in millilitres.

**Practice**

- 1 Children convert petrol pump meter readings from millilitres to litres and millilitres and vice versa.
- 2 Children copy and complete the table of car engine sizes, rounding to the nearest 10 ml and to the nearest 100 ml.

**Extension**

**Resources** dictionaries, reference books



Say: ***At the end of a Formula 1 race the winning drivers celebrate with magnums of champagne. How many millilitres is that?***

Encourage children to find in a dictionary or reference book that 1 magnum = 2 quarts or 4 pints.

**Plenary** (about 10 to 15 min)

- Discuss what the children have learned in the lesson.
- Quickly revise the decimal equivalences of whole, half and quarter units, e.g.  $4\frac{3}{4}$  litres, 3 l 250 ml ...
- Write: **998 ml**. Discuss why rounding to 10 and to 100 gives the same answer, namely 1000 ml. Repeat for other 4-digit numbers, e.g. 1796 ml, 1803 ml.

Homework CM:  
Puzzling capacity

49

**Homework** (about 20 min)**Refresher and Practice**

Children investigate the statement, 'Liquids are sold by capacity (l, ml) and solid things are sold by mass (kg, g)' by finding 5 examples of bottles, packets etc in their kitchen and bathroom for each category.

**Practice**

**1–2** Children solve two “real life” problems.

## Measures: (capacity)

**Objectives** ● To suggest suitable units and measuring equipment to estimate or measure capacity. ● To record estimates and readings from scales to a suitable degree of accuracy: record measurements using mixed units, or the nearest whole/half/quarter unit (e.g. 3.25 litres). ● To explain and record methods.


**Vocabulary** unit; standard unit; metric unit; litre; half-litre; millilitre; pint; measurement; container; measuring cylinder; measuring scale; division; capacity; contains; full; half-full; empty; compare; estimate; approximately

### Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

### Main teaching and pupil activities (about 30 to 40 min)

**Resources** measuring cylinder; about 6 unmarked plastic containers in a range of sizes and shapes; funnel; water; small pebbles; 3 calibrated containers

- ➞ Invite children to measure 250 ml of water in the calibrated cylinder and then pour the liquid into a container of their choice.
- ➞ Discuss and compare the containers, establishing that all, regardless of shape or size, contain 250 ml of water. Say: **The amount of liquid is not changed by the shape of the container.**
- ➞ Ask the children to suggest things they would measure in litre, millilitres and pints.
- ➞ Write: **5 ml, 50 ml, 500 ml** and **5000 ml**. Ask the children to suggest things which may have these capacities, e.g. medicine spoon, egg cup, bottle of olive oil, bucket.
- ➞ Pour 500 ml into a 1 litre measuring cylinder and say: **Once upon a time there was a very thirsty crow. He came across this measuring cylinder. However, because it was tall and narrow, he could not reach the water to drink. Then the crow had an idea. It worked and he got his drink of water. How did the crow solve the problem?**
- ➞ Discuss the possible solutions but only accept the following solution. Ask the child who offered it to demonstrate that by dropping small pebbles, one by one, into the cylinder, the level of the water rises until it can be reached by the crow's beak.
- ➞ Discuss why the solution is correct. (water is displaced by the pebbles) If you wish, tell the children to look up the story in Aesop's Fables.
-  ➞ Give three pairs of children a calibrated container and some pebbles. Tell the children to fill their container with water to the 250 ml mark then give these instructions: **When I say 'Go', add enough pebbles to raise the level of water in your container from 250 ml to 500 ml. If you go over 500 ml you are out.**
- ➞ If time permits, repeat, as above, for other children.

Pupil Book 3:  
Estimating capacities

22

**Pupil consolidation****Refresher and Practice**

Children select from three the best estimate of the capacity of various objects and containers.

**Practice**

For each pair of containers, children work out how they could be used to measure a specific capacity.

Support CM:  
Measuring displacement

47

**Support**

**Resources** measuring jar calibrated in 10 ml divisions; coloured water; plasticine



Working with a partner, children make, in four tries, a ball of plasticine, as close to 100ml as they can. Using the plasticine ball from the fourth attempt, they reform it to make a cube and a cylinder. Having measured all three, they should discover that the water rises by the same amount each time.

Extension CM:  
Measuring displacement

47

**Extension**

**Resources** measuring jar calibrated in 10 ml divisions; coloured water; about 60 1 cm interlocking cubes



In pairs, the children investigate the relationship between the amount of water displaced in millilitres and the number of 1 cm cubes added to the water in the jar.

**Plenary** (about 10 to 15 min)

- ➡ Ask children to explain how they solved the container problems in the Practice section of the Pupil Book.
- ➡ Ask: **How might you use the containers in question d to measure out 500 ml?** (Fill B and pour into A. Refill B and top up A to 900 ml. 500 ml is left in B.)
- ➡ Ask the children who attempted the Support activity to say what they noticed about the water levels for the 4th try, the cube and the cylinder. Encourage fluent explanations as to why all three levels are the same.
- ➡ Refer to question 9 of the Extension task and discuss the predicted outcome, a rise of 100 ml, and why this is so.

# Shape and space: (reflective symmetry, reflection and translation)

**Objectives** ● To sketch the reflection of a simple shape in a mirror line parallel to one side (all sides parallel or perpendicular to the mirror line).

**Vocabulary** mirror line; line of symmetry; line symmetry; symmetrical; reflect; reflection; parallel; perpendicular

## **i** Background information

The idea of drawing lines which are parallel or perpendicular is introduced in Year 4.

### Parallel lines

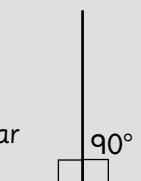
Lines which keep the same distance apart are called parallel.

We denote parallel lines by using arrows.



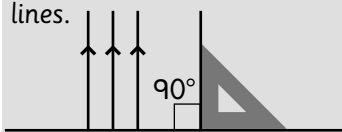
### Perpendicular

Lines which are at right angles are perpendicular to each other.



### Set square

Place the set square on a straight line to draw or measure perpendicular lines. Slide the set square along a straight line to rule parallel lines.



**i** Introduce the term 'perpendicular' meaning 'lines which are at right angles to each other'. Ask the children to use their set squares to check that the face of the mirror makes a right angle with the face of the cuboid.

**i** Introduce the term 'parallel' meaning 'lines which keep the same distance apart' and demonstrate that the edge of the cuboid is parallel to the edge of the mirror.

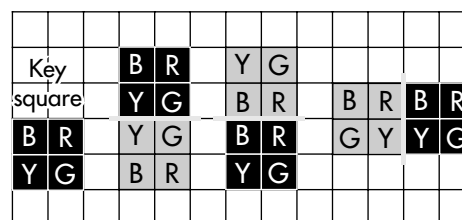
## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2

## Main teaching and pupil activities (about 30 to 40 min)

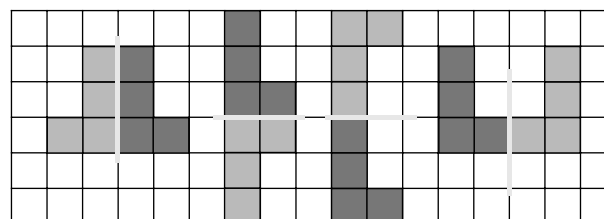
**Resources** 2.5 cm cubes; interlocking cubes; mirrors; set squares; large square grid, (use OHT grid if available); colouring materials

- ➞ Provide each table with a supply of cubes and mirrors.
- ➞ Say: **Take four cubes of the same colour. Make a cuboid 2 cubes long and two cubes wide. Place your mirror upright against one of the sides of your cuboid.**
- ➞ Point to the angle made by the mirror and the square face of the cuboid and ask: **What kind of angle does the upright mirror make with the face of the cuboid?** (right angle) **Which instrument can we use to test for a right angle?** (set square)
- ➞ On the large squared grid (or OHT grid) outline a square with sides of two units. Label the four small squares R, B, G, Y.
- ➞ Say: **Make a cuboid which has a square face like this. Place your mirror parallel to one edge of the cuboid and hold the mirror upright. What do you see reflected in your mirror? Place the mirror perpendicular to another edge. Is the mirror image the same or different?** (different)
- ➞ Say: **Let us suppose that our four unit square is a half shape. How many squares make the complete shape?** (8) **Where are these squares?** (4 actual + 4 image) **Can you name the shape?** (rectangle)



- ➞ Draw and label four identical squares as shown. Invite children to sketch the reflection for each mirror position and label/colour the eight small squares. Establish that the whole shape is a rectangle but there are four different colour patterns.

- ➞ Ask the children to form an L-shape with four cubes of the same colour and to reflect, in turn, the four sides in their mirror. On the squared grid build up the diagrams.



- ➞ Set up a paired activity where, in turn, one child makes a half shape with cubes and, using a mirror to check, the other child completes the shape.

Pupil Book 3:  
Puzzling reflections

23

**Pupil consolidation****Resources** mirrors*Refresher*

Children place their mirrors parallel to the edges of squares in the framed shape so that the revealed squares together with their images make the shapes a to e.

*Practice*

- 1 Children do the same task as above but for shapes a to g.
- 2 The children work out the positions of the mirror for shapes a to d. They should realise that the mirror must be placed perpendicular to the diagonals to reveal the shapes.

Support CM:  
Reflecting shapes

48

**Support****Resources** mirrors

- 1 Children place a mirror on the dotted line to reveal the whole shape. They complete each reflection on the opposite side of the dotted line.
- 2 Children draw a shape on one half of grid a. They draw the whole shape on grid b.

Extension CM:  
Reflecting shapes

48

**Extension****Resources** mirrors; colouring materials; set square

- 1 Children draw the reflection of shapes a to e on a dot lattice square grid.
- 2 They colour some of the triangles in the half shape. They reflect each half shape in a mirror, draw the completed shape and add the appropriate colour.

**Plenary** (about 10 to 15 min)

- ☞ Select some diagrams from the Pupil Book page and invite children to demonstrate and explain the positioning of the mirror.
- ☞ Ask: **Where must you place the mirror to find the shapes in question 2?** (on the diagonal line through the squares)
- ☞ Refer to the Extension task and ask: **Which half shapes were easy/tricky to sketch? Why was this so?** (c and e - mirror line runs diagonally)
- ☞ Ask the children who completed the Support task to show and describe their work for question 2.
- ☞ Ask the children to recall and define the terms 'parallel' and 'perpendicular' as applied in the lesson. Draw a straight line. Demonstrate the use of a set square to draw parallel lines - mark with arrows - and perpendicular lines - mark the right angle.

# Shape and space: (reflective symmetry, reflection and translation)

**Objectives** ● To sketch the reflection of a simple shape in a mirror line parallel to one side (all sides parallel or perpendicular to the mirror line): to know that equivalent points are the same (shortest) distance from the line of symmetry.

**Vocabulary** mirror line; line of symmetry; line symmetry; symmetrical; reflect; reflection; parallel; perpendicular; equivalent

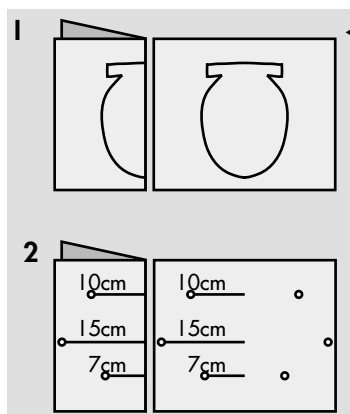
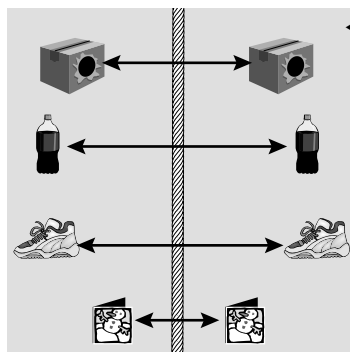
## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

## Main teaching and pupil activities (about 30 to 40 min)

**Resources** 4 pairs of identical objects, e.g. book, shoe, plastic bottle, box; 1 long and 4 shorter cords; pegboard; pegs; elastic band; 2 A3 sheets of paper; plain pin; rulers; set squares

- ➞ Lay a length of cord on the floor. Anchor the ends to keep the cord taut. Randomly place four objects, e.g. book, shoe, bottle, box, at different distances from the left hand side of the cord.
- ➞ Choose a child to place a matching shoe as far to the right of the cord as the other shoe is to the left. Repeat for the remaining 3 objects. Ask the children to explain how they estimated the position in which they placed their object.
- ➞ Ask the class to suggest a more accurate way to position the matching object each time. (measure the distance from the cord)
- ➞ Use the shorter cords to join matching objects and measure the distance of each object from the cord.
- ➞ Draw children's attention to pairs of corresponding objects to elicit these points:
  - the long cord acts as a line of symmetry or mirror line.
  - the cords which join pairs of objects are parallel and cut the long cord at right angles.
  - the pairs of objects lie:
    - on opposite sides of the line of symmetry
    - at equal distances from the mirror line
    - on a line at right angles/perpendicular to the line of symmetry.



- ➞ Fold a large sheet of paper and outline a half shape, e.g. a vase. Use a pin to make perforations along the shape outline. Hold the opened page to the light and ask children to describe what they see.
- ➞ Fold the second sheet in half. Measure 10cm from the fold line, mark the point with a pin prick. Repeat for other distances, e.g. 15cm, 7cm, 20cm.
- ➞ Open the paper and circle the pin holes with a felt tip pen. Rule straight lines along the line of symmetry and joining the first pair of pin holes.
- ➞ Ask a child to measure and record the length of the line from each pin hole to the line of symmetry. Repeat for the other pairs of pin holes.
- ➞ Discuss and compare lines. Establish that equivalent points are the same distance from the line of symmetry.
- ➞ Represent a line of symmetry on a peg board with an elastic band. Insert four pegs. Ask the class to give you precise instructions for positioning the corresponding points.

Pupil Book 3:  
Reflecting patterns

24

**Pupil consolidation****Resources** 1 cm squared grid paper; mirrors*Refresher*

Children copy and complete, in colour, the symmetrical patterns.

*Practice*

Children copy the dots and mirror lines on 1 cm squared paper. They mark the images of the dots after reflection.

**Extension****Resources** 1 cm squared grid paper; 3 small counters; mirror

Provide each child with a sheet of 1 cm squared paper, 3 small counters and a mirror. The children explore more challenging patterns. They mark the position of 3 counters on the grid. They investigate the patterns they can make after reflection where the mirror line passes diagonally through the squares or the counters.

**Plenary** (about 10 to 15 min)

- ➡ Ask the children to report on what they have learned in this lesson.
- ➡ Ask: **How does the grid of squares help you complete the shape patterns after reflection?** (e.g. in measuring from the mirror line)
- ➡ Discuss: **Why should the legs of a table, bed or bath be the same distance apart/equidistant?** (for balance) **Why must insects, birds, aeroplanes have reflective symmetry?** (to fly efficiently)

Homework CM:  
Pegboard puzzles

50

**Homework** (about 20 min)*Refresher and Practice*

Children use the mirror lines to find and draw the reflection of each pegboard.

*Practice*

The three black pegs mark the corners of a square.

- 1 The children colour the fourth peg to complete the square.
- 2 Using two adjacent pegs as one side of the square they find all the possible squares which have the same dimensions.
- 3 They use the diagonally opposite black pegs of the original square as the corners of a different square and complete the square.

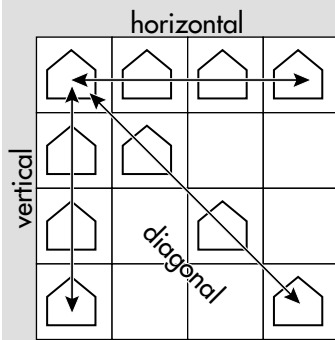


# Shape and space: (reflective symmetry, reflection and translation)

**Objectives** ● To make patterns by repeatedly translating a shape.

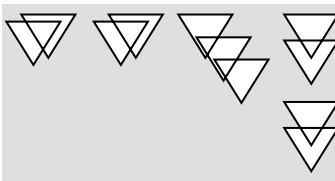
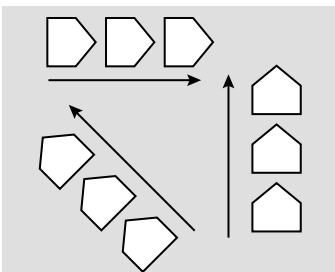
**Vocabulary** translation; horizontal; vertical; diagonal; fold; match; pattern; repeating pattern; motif

**i** Translation is a sliding or shifting movement. The translation of a shape requires a movement in a straight line so that the distance and direction of all the points of a shape are the same. The direction in which the shape is moved can be horizontal, vertical or diagonal.



**i** Introduce the term 'translation' and display samples of translations discussing the movement of key motifs.

**↓** Some children may find the task easier if their chosen shape has a right angle which they can align with the side and fold of each division.



## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

## Main teaching and pupil activities (about 30 to 40 min)

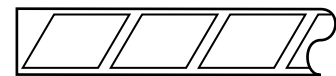
**Resources** samples of translation: wallpaper borders, wrapping paper, ribbons, braids, etc. sheet of A4 paper per child; large triangle; A4 paper cut into strips about 5-6 cm wide (allow at least two per child); pattern blocks or 2D shapes; plastic animal shapes; rulers

⇒ Elicit situations where children are involved in a sliding movement, e.g. on a slide in the park, a sliding tackle at football, sliding on an icy pavement. Draw their attention to the maintained 'pose' or 'static shape' they make as they move along for the duration of the slide.

⇒ Ask: **Can you suggest a board game where the pieces are slid?** Focus on 'Snakes and Ladders' and ask: **In which direction can the pieces move?** Use the answers 'left or right' to elicit 'horizontally' and 'up and down' to elicit 'vertically' and 'diagonally'.

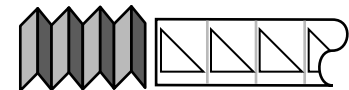
⇒ Distribute paper strips and pattern blocks or 2D shapes to each table.

⇒ Tell the children to choose a plastic shape and make a border pattern on a paper strip by drawing round the outline.



⇒ Discuss and compare results. Ask some children to hold up their strips, horizontally and vertically, to show the border pattern translations. Focus on the importance of regular spacing.

⇒ Demonstrate and discuss how a paper strip, made into 'concertina folds', produces equal divisions. Ask the children to use their second paper strip to make a pattern by drawing round their chosen shape one per division.



⇒ Compare and discuss the improved results.

⇒ Hold up a sheet of A4 paper. Elicit the need for a guideline.

⇒ Distribute the A4 paper, rulers and plastic animal shapes.

⇒ Say: **Rule three lines, about 10-15cm long. Mark with an arrow the direction of each line. Choose a shape to slide along each line. Draw round its outline three times.**

⇒ Ask: **How do you know where to place the shape to repeat the pattern? What clues do you use?**

⇒ Introduce the term 'motif' and demonstrate two ways of making a motif: by combining two pattern blocks, by overlapping one shape.

⇒ Children use the reverse of the A4 paper to experiment with repeating motifs.

Pupil Book 3:  
Sliding patterns

25

**Pupil consolidation****Resources** pattern blocks; 2D shapes; colouring materials*Refresher*

Using pattern blocks children make and translate single and composite 2D shapes horizontally and vertically to make repeating patterns. They colour the first two motifs of each pattern.

*Practice*

- 1 Children make composite shapes with two pattern blocks which they translate horizontally, vertically and diagonally. They colour the first two motifs.
- 2 Children copy and continue the translation of overlapping shapes. They use colour to highlight an element of the repetition.

*Extension***Resources** pattern blocks; colouring materials

The children experiment with shapes composed of three pattern blocks and translate them in a systematic way.

**Plenary** (about 10 to 15 min)

- ➡ Make a representative display of the children's work.
- ➡ Discuss and compare results. Ask: **What is the same about all of these patterns?** (same motif/shape is translated).
- ➡ Point to several examples of composite shapes and ask: **Where does this repeat begin and end?** For some of the examples, ask the children concerned to explain how they knew where to position each repeat.
- ➡ Use examples of overlaps to ask the class to identify the clues which might have been used in translating the motif. Then ask the child concerned: **Are they correct? Did you have a different way?**
- ➡ Ask the children to look for examples of strip patterns and repeating motifs in their homes.

# Shape and space: (reflective symmetry, reflection and translation)

**Objectives** ● To make patterns by repeatedly translating a shape.

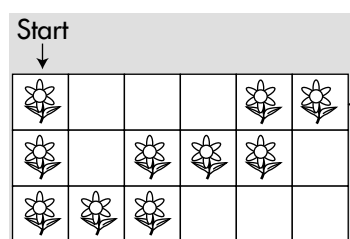
**Vocabulary** translation; horizontal; vertical; diagonal; pattern; repeating pattern; motif

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

## Main teaching and pupil activities (about 30 to 40 min)

**Resources** OHT or large squared grid; 2cm squared grids; gummed paper shapes; sticker shapes; stencils; rulers; Blu-tack; sheet of A4 paper per child

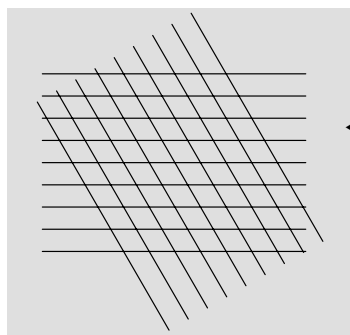


- ➞ Prepare a large squared grid (or OHT) and materials to demonstrate the translation of a single motif, e.g. flower, frog, crescent; lily pad etc.
- ➞ Place three motifs in a vertical translation on the grid. Mark the starting point.
- ➞ Establish that the motif can slide in any direction, horizontally, vertically or diagonally, from cell to cell on a grid. The motif itself cannot be turned round.

➞ Ask children to continue the pattern by placing shapes on the grid as instructed. For example, say: **Stick a flower in the next two squares in a horizontal direction ... up one square ... two squares horizontally ... one square up ...**



- ➞ Begin on a fresh grid. Invite pairs of children to give and respond to instructions and make single motif translations.

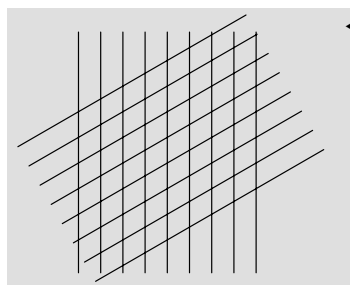


- ➞ Distribute rulers, blank paper and motif materials to each table.

➞ Demonstrate with a ruler, the preparation of the first grid.

➞ Say: **Draw one set of horizontal lines which are a ruler's width apart. Now draw a second set of diagonal lines, again the width of your ruler.**

- ➞ Tell the children to stick their chosen motif in the first cell and by sliding it to corresponding positions, fill a three by three block on their grid.

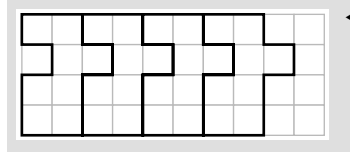


➞ Repeat, as above for the second grid where the first set of lines are vertical and the diagonal lines slope in the opposite direction.

- ➞ Compare and discuss results, highlighting the fact that both grids show a 3 x 3 block using the motif, however the orientation/slant is different.

➞ Prepare beforehand a partially completed strip pattern on grid paper.

➞ Ask: **Who can identify the motif in this border pattern? In which direction does it slide?** (horizontal) **Who can draw the next motif in the pattern?**



- ➞ Compare this grid pattern to earlier work, highlighting similarities.

Pupil Book 3:  
Grid patterns

26

**Pupil consolidation****Resources** 2 cm squared and triangular grids; gummed paper shapes or stencils*Refresher*

- 1 Children use stencils or gummed paper shapes to copy and continue translation patterns of asymmetric motifs on 2 cm squared grids.
- 2 Using gummed paper shapes or a stencil, children make a translation of their own choice on a 2 cm squared grid.

*Practice*

- 1–2 Children identify motifs and make simple translating patterns in 2 cm squared and 2 cm triangular grids.

**Extension****Resources** rulers with varying widths; paper shapes

Children experiment in preparing grids with pairs of rulers of different widths. They complete translating patterns in the resultant rectangles and parallelograms.

**Plenary** (about 10 to 15 min)

- Select examples of children's work for display and discussion.
- Ask some children who completed the Refresher task in the Pupil Book to describe their pattern to the class.
- Discuss where in the Practice tasks children met difficulties and how they were resolved.
- Ask: ***In what way does the colour in alternate motifs help you?*** (highlights the relationship between repeated motifs and whether or not they are translations)
- Say: ***Suppose you did not have a grid as a guide. How might you reproduce accurately the patterns which you attempted?*** (use tracing paper)
- Use the display of Extension work to discuss similarities and differences in the range of translation techniques which the children have met.

Homework CM:  
Grid patterns

51

**Homework** (about 20 min)*Refresher and Practice*

Children continue each pattern as far as they can go. By colouring alternate motifs, they are checking that the repeating motif is a pattern.

# Shape and space: (reflective symmetry, reflection and translation)

**Objectives** ● To make patterns by repeatedly translating a shape.

**Vocabulary** translation; horizontal; vertical; diagonal; match; pattern; repeating pattern; tile

**i** It is recorded that the Sumerians (4000 BC) used geometric mosaics in decorative work. Decorative patterns involving geometric translations can be found in many cultures, e.g. mosaic floors – Ancient Rome, lattice patterns – Medieval China, rangoli patterns – India, celtic knots – Scotland, Sioux and Cheyenne artefacts – USA. It is important that children know that within many artistic forms and structures there exists a mathematical precision.

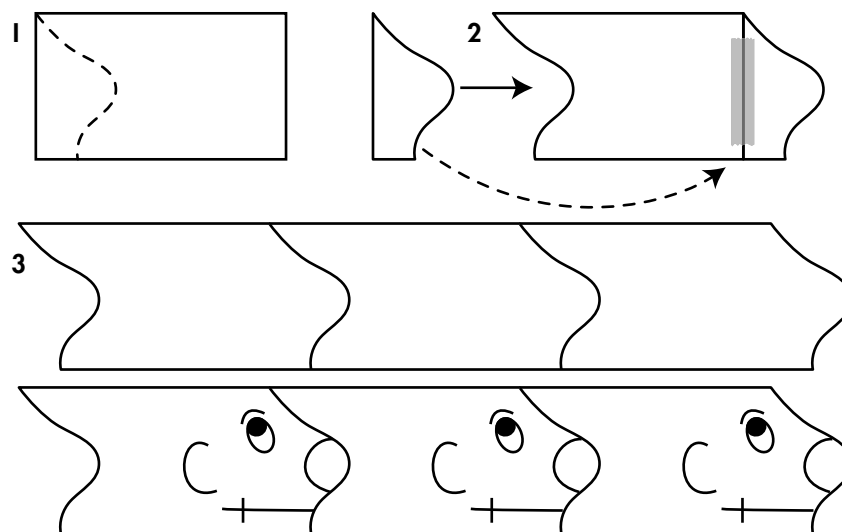
## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

## Main teaching and pupil activities (about 30 to 40 min)

**Resources** 6 cm by 4 cm rectangles of card; sticky tape; scissors; A3 paper cut into long strips about 6 cm wide; colouring materials

- Provide the children at each table with 6 cm by 4 cm rectangles of card, sticky tape, scissors, strips of A3 paper and colouring materials.
- Demonstrate the following steps in making a tile.



**Step 1.** Draw a curved line which begins at a corner of the rectangle and ends on the longer side. Cut out the shape.

**Step 2.** Slide the cut-out piece across the card until the opposite straight sides line up.

- Join the straight edges with sticky tape.
- The children copy and complete steps 1–2. Allow time for experimentation.
- **Step 3.** Show how to draw round the motif or tile and translate it several times on the strip of plain paper.
- Ask: **Who can explain why the tile makes a repeating pattern?** (the shape cut from the left-hand side is added to the right-hand side so the shapes fit together without gaps)
- Children complete step 3, drawing round their tile about six times. For some children a faint pencil guideline may be of help.
- **Step 4.** Show an example of how the identical decoration of some tiles highlights the translation.
- Discuss ideas for decoration, e.g. animal, clown faces.

Pupil Book 3: 27  
Cut and slide patterns

### Pupil consolidation

**Resources** squares of card with sides of 6 cm or 8 cm; plastic circles/semi-circles; ruler; sticky tape; scissors; A4 paper; colouring materials

#### Refresher and Practice

Children follow the steps for making a square into a new shape. They translate the shape several times and apply identical decoration to two of the tiles.

#### Practice

In this activity the children cut and slide two pieces to make their tile which they translate several times. Encourage decorative ideas by asking the children to turn their tile and view it from a different perspective.

#### Extension



**Resources** rectangles of card

Provide children with rectangles of card. The children make two modifications and translations to the rectangle to create a new tile. They translate the tile several times in all directions.

### Plenary (about 10 to 15 min)

**Resources** Blu-tack

- Make a display of the children's work. Choose several children who designed their own tile from a square to explain how they did it.
- Collect from the children several tile templates which show one modification. Blu-tack the blank face of the first tile to the board. Invite children to stick other tiles, one by one, to make a repeating pattern which interlocks in rows and columns.
- Repeat, as above, for the twice modified square.
- Discuss and compare the finished pattern blocks.

# Shape and space: (angle and rotation)

**Objectives** ● To begin to know that angles are measured in degrees and that: one whole turn is  $360^\circ$  or 4 right angles; a quarter turn is  $90^\circ$  or one right angle; half a right angle is  $45^\circ$ .

**Vocabulary** degree; ruler; set square; angle measurer; angle; right angle; straight angle; straight line

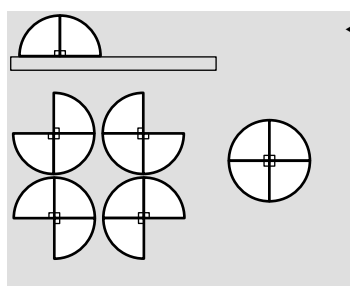
## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

## Main teaching and pupil activities (about 30 to 40 min)

**Resources** paper circles; rulers; large squares

➡ Distribute paper circles and rulers. Ask the children to fold the paper twice to make a right angle, then mark the right angle with a small square.



➡ In groups of four, the children use their paper right angles to demonstrate that:

2 right angles together make a straight angle or straight line

3 right angles can go together in four different ways

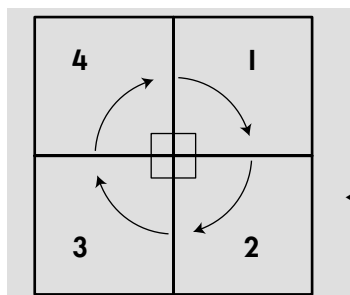
4 right angles make a complete circle or one whole turn.

➡ Ask: **Who can name the unit of measurement for angles?** (degree)

**What is the symbol for the degree?** (small circle) **Who can remember how the circle and the symbol for the degree came to be connected?**

(the cycle [or circle] of the Babylonian year was 360 and each degree represented one day)

➡ Write: **One whole turn = 4 right angles =  $360^\circ$**

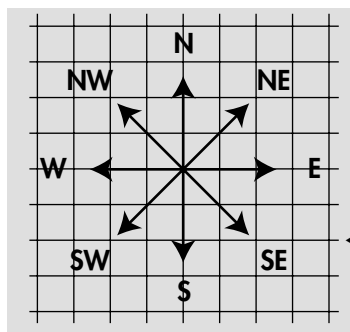


➡ Demonstrate that the right-angled corners of 4 large squares fit together round a point. Discuss and compare with the placing of the four paper right angles and with the folds of an opened-out paper circle.

➡ Ask: **How many degrees are the same as one right angle?** ( $90^\circ$ ) **How did you work it out?**

➡ Write: **One quarter turn = 1 right angle =  $90^\circ$**

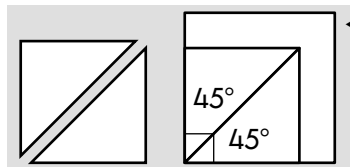
➡ Ask eight children to fold their right angle in half. They place them on top of the squares to fit round the same point.



➡ Elicit and write:  **$\frac{1}{2}$  of  $\frac{1}{4}$  turn =  $\frac{1}{2}$  of 1 right angle =  $45^\circ$**

➡ Sketch a compass rose and revise the amount of turn between directions.

➡ Fold two large squares along a diagonal. Demonstrate that the smaller angles, two half right angles, together make one right angle. Elicit the properties: equal sided, right-angled and base angles of  $45^\circ$ .



➡ Say: **We can describe this triangle in two ways; as an isosceles triangle which is also right-angled and as a right-angled triangle which is also isosceles.**

➡ Review the lesson by discussing its relevance to everyday life e.g. set squares, plumb lines, spirit levels, compass rose, directional compass.

Pupil Book 3:  
Fancy angles

28

**Pupil consolidation****Resources**  $45^\circ$ ,  $45^\circ$ ,  $90^\circ$  set squares or right and half right angle measurers; colouring materials**Refresher**

1–2 Children draw fans quarter and half open. They divide the fans into  $45^\circ$  parts which they colour.

**Practice**

1 Children work out the number of half right angles in each fan.

2–3 Children draw partly opened fans with angles of  $45^\circ$ . They explore ways to colour the fans using blue for  $90^\circ$  and gold for  $45^\circ$ .

Support CM:  
Right or half right  
angles

49

**Support****Resources**  $45^\circ$ ,  $45^\circ$ ,  $90^\circ$  set squares or right and half right angle measurers

Children use set squares to measure and mark angles of  $45^\circ$  and  $90^\circ$  in nine shapes. Then they draw two shapes having at least one  $90^\circ$  and one  $45^\circ$  angle.

**Extension**Extension CM:  
Stained glass fanlights

49

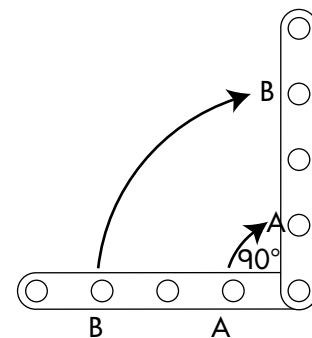
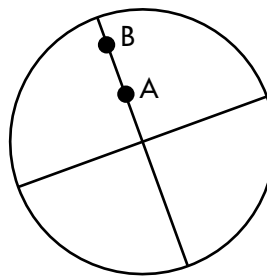
**Resources** blue, yellow and brown colouring materials

Children investigate the number of different ways to fit four panes of coloured glass into a fanlight, using two, then three colours of glass. (You may wish to substitute with your own school's colours.)

**Plenary** (about 10 to 15 min)**Resources** geostrips; fasteners; Blu-tack

⇒ Say: **Picture a bicycle wheel in your mind. Focus on the valve at the rim. Now turn the wheel. Through how many degrees has the valve turned in one quarter turn? ( $90^\circ$ ), one whole turn? ( $360^\circ$ ) How far has it turned in  $45^\circ$ ? (half a right angle)**

⇒ Draw a circle and mark two points within the circle.



Say: **A and B are two children on a roundabout. The roundabout makes a quarter turn. Through how many degrees has each child turned? ( $90^\circ$ ) How do you know this is so?** Demonstrate with geostrips.

⇒ Select from the consolidation activities and ask children to report on their work. Discuss quick ways to work out the answers to question 1 of the Practice section.



# Shape and space: (angle and rotation)/Reasoning about shapes

**Objectives** ● To begin to know that angles are measured in degrees and that: one whole turn is  $360^\circ$  or 4 right angles; a quarter turn is  $90^\circ$  or one right angle; half a right angle is  $45^\circ$ . ● To solve mathematical shape problems or puzzles, recognise and explain patterns and relationships, generalise and predict; suggest extensions by asking "What if ... ?" ● To explain methods and reasoning orally and in writing.

**Vocabulary** degree; ruler; set square; angle measurer; angle; right angle; straight angle; straight line

## Oral work and mental calculation (about 5 to 10 min)

Choose an activity from Strand 1 or Strand 2.

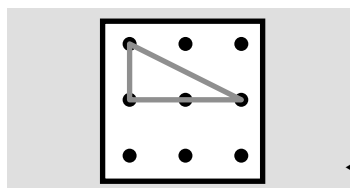
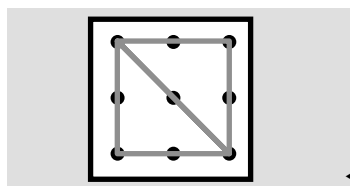
## Main teaching and pupil activities (about 30 to 40 min)

**Resources** pinboards; elastic bands; 45, 45, 90 set square; OHT (teacher) and 3 x 3 pinboards (pupils) see RCM 1.5, 3 x 3 Pinboards; OHT pen

- ➞ Provide each pair with a pinboard and an elastic band and each child with 3 x 3 pinboards. Prepare an OHT of the 3 x 3 pinboard or prepare about 6 pinboards on paper or on the board.
- ➞ Say: **Make a small square on your pinboard with an elastic band. Now stretch the band to make a rectangle, then another square.**
- ➞ Discuss similarities between squares and rectangles. Each corner of these polygons is a quarter turn or one right angle and measures  $90^\circ$ .
- ➞ Ask the children to make a square on their pinboard with sides of 3 pin units. Ask: **How many squares altogether can you see?** (5, 4 small and 1 large)
- ➞ Say: **In your head, draw diagonal lines through the large square on your pinboard. At what position will the lines intersect?** (centre pin)
- ➞ Draw two joined triangles on the OHT/board pinboard and ask: **How many facts do you know about these two triangles?** (identical in size, isosceles, right-angled, two half right angles, two angles of  $45^\circ$ ) Use the set square to check.
- ➞ Draw children's attention to the six pins on the perimeter of the triangle. Ask: **How many 6 pin right-angled triangles are there within the square?** (4) Children identify and copy all four triangles on to their recording sheet.
- ➞ Say: **In the square, find a right-angled triangle which has four pins on its perimeter.**
- ➞ Draw the four pin right-angled triangle on the OHT/board and say: **You have three minutes. Take it in turns to make on the pinboard as many different four pin right-angled triangles as you can. Draw each triangle you find on your recording sheet.**
- ➞ Discuss possible systematic approaches to finding all eight triangles.
- ➞ Write:

Number of pins on perimeter	6	4	3
Number of right-angled triangles	4	8	?

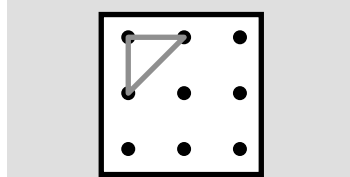
and say: **From this table, can you predict the number of right-angled triangles which have three pins on the perimeter? Why do you predict 12? (going up in fours) And 16? (doubling each time)**



**i** You may wish to set a time limit of, say, 10 minutes for children to investigate and record or you may wish to differentiate.

**↓** Find 6–8 different three pin triangles.

**↑** Find all 16 three pin triangles.



Pupil Book 3:  
Getting in shape

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**Pupil consolidation**

**Resources** 45°, 45°, 90° set square or half right angle measurer; congruent, isosceles right-angled triangles; straws

**Refresher**

1–2 Children write the letters of the shapes which contain angles of 90°, then of 45°.

**Practice**

- 1 Children test the generalisation that 'You can make 10 different shapes using 4 identical right-angled triangles' with the condition that equal sides are placed against each other.
- 2 Children attempt the puzzle of making five squares with 12 straws.

Support CM:  
New shapes from old

50

**Support**

**Resources** scissors; glue

Children cut out the 16 isosceles, right-angled triangles at the foot of the page. They use them to make squares, rectangles and right-angled triangles from 2, then 4, then 8 triangles. They choose an example from each question to paste into their exercise book. You may wish to reduce the task to the first two questions for some children.

Extension CM:  
New patterns from old

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**Extension**

**Resources** scissors; felt tip pens in two colours

Children explore the range of patterns which can be made in a 2 by 2 square with 4 square tiles.

**Plenary** (about 10 to 15 min)

- ☞ Refer to the Refresher task in the Pupil book. Ask those who attempted it: **What did you find out about shapes d, g and h?** (two angles of 45°) Ask the class: **Will shape h fit into shape g?** (yes) **How many times?** (twice) **Who can explain how this can be done?**
- ☞ Discuss and compare the work completed in the Support and Extension tasks.
- ☞ Ask: **Which statement is true? 'All rectangles are squares', or 'All squares are rectangles'?** (the latter) **How might you convince a friend?**