Number and measures 3

contents

objectives

The objectives covered in **Number 3A** are:

- Recall multiplication facts to 10 × 10 and derive associated division facts.
- Understand decimal notation and place value.
- Round positive whole numbers to the nearest 10 or 100, and decimals to the nearest whole number or one decimal place.
- Add and subtract mentally pairs of two-digit numbers, including decimals.
- Find two decimals with a sum of 1.
- Add and subtract decimals using written methods.
- Convert pounds to pence, and vice versa.
- Use a calculator effectively; enter numbers and interpret the display in different contexts.
- Check whether a result is the right order of magnitude.
- Solve word problems and investigate in number.

The objectives covered in **Number and measures 3B** are:

- Count on and back in steps of 0.1, 0.2, 0.25.
- Use names and abbreviations of units of length to measure, estimate, calculate and solve problems.
- Read and interpret scales on a range of measuring instruments.
- Convert one metric unit to another.
- Use a timetable and find intervals for 24-hour times.
- Solve word problems involving time.

Using the lesson plans in this unit

These lesson plans supplement the *Springboard 7* materials for Key Stage 3 pupils working toward level 4 in mathematics. All the lessons are examples only. There is no requirement to use them. If you decide to use the lessons, you will need to prepare overhead projector transparencies (OHTs) and occasional resource sheets for pupils to use.

The lessons consolidate work at level 3 and extend into level 4. They are suitable for a group of pupils or a whole class. Whatever the size of the group, the pupils are referred to as 'the class'.

Each lesson will support about 30 to 40 minutes of direct teaching. To help match the time to your timetable, each plan refers to 'other tasks' for pupils, based on *Springboard 7* resources. Select from these, textbook exercises or your own materials to provide practice and consolidation in the main part of a lesson and to set homework. Aim to choose tasks that vary in their level of demand, to suit pupils' knowledge, confidence and rate of progress.

Although the 'other tasks' are listed for convenience at the end of the main part of the lesson, they can be offered at any point, especially between the 'episodes' that form the main activity.

The lesson starters are of two kinds: practice starters and teaching starters. The former are opportunities to rehearse skills that will be needed later in the lesson. Teaching starters introduce an idea that is then developed in the main activity.

You will need to tell pupils what they will learn in the lesson, either in the starter or at the beginning of the main activity. Use the plenary to check pupils' learning against the lesson's objectives and to draw attention to the key points that pupils should remember.

Interactive teaching programs (ITPs)

Interactive teaching programs are interactive animated visual aids that can be used with a laptop and data projector, or with an interactive whiteboard. As extra support for this unit, you may find it useful to download and use these ITPs from the website www.standards.dfes.gov.uk/numeracy:

for lesson N3.7: *Measuring cylinder*

for lesson N3.8: *Tell time*

N3.1 Rounding decimals

objectives

- Round positive whole numbers to the nearest 10 or 100, and decimals to the nearest whole number or one decimal place.
- Check whether a result is the right order of magnitude.

starter

Vocabulary
estimate
approximately
halfway
multiple
lies between
less than (<)
round up or down

Resources
four cards, each with a four-digit number (e.g. 5236, 3621, 7060, 9874)

Ask the class to count up to 10 000 in thousands: one thousand, two thousand, three thousand, …, ten thousand. Remind them that the numbers they counted are multiples of 1000, numbers that divide exactly by 1000.

Give one of the cards to each of four pupils. Choose two of them to write their numbers on the board (e.g. 5236, 3621) to make a horizontal addition. Read this aloud together.

5236 + 3621

Ask pupils first to estimate the answer. Point to the first number, 5236.

Q Between which multiples of one thousand does this number lie?

Establish that it lies between 5000 and 6000.

Q Which number is exactly halfway between 5000 and 6000? (5500)
Q Is 5236 more or less than 5500? (less)
Q What is 5236 rounded to the nearest 1000? (5000)

Stress that 5236 is rounded *down* to 5000 because it is more than 5000 but less than 5500.

Repeat by rounding 3621 up to 4000.

Establish that 5236 + 3621 is approximately 5000 + 4000 = 9000. Then complete the addition, setting out the two numbers one below the other in columns, to find the total of 8857. Ask:

Q Is 9000 a good estimate of the total of 8857?

Establish that it is, because 8857 rounded to the nearest 1000 is 9000.

Repeat with the other pair of numbers, this time estimating the difference.

Now write each of the four numbers on the board:

5236, 3621, 7060, 9874

Explain how to round 5236 to the nearest 100 by looking at the tens digit. Ask:

Q Which multiples of one hundred does 5236 lie between?

Establish that it lies between 5200 and 5300.

Q Which number is exactly halfway between 5200 and 5300? (5250)
Q Is 5236 more or less than 5250? (less)
Q What is 5236 rounded to the nearest 1000? (5200)

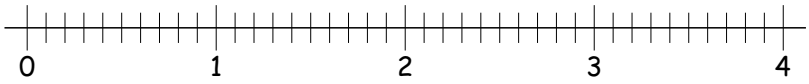
Repeat with the other three numbers.

main activity

Vocabulary
tenths
hundredths

Resources
OHT N3.1a
mini-whiteboards
dice
decimal cards (see Resources N2.8c and N2.8d)

Draw on the board a number line from 0 to 4, marked in tenths, or label the number line on **OHT N3.1a.**



Q How many spaces between nought and one? (ten)

Establish that there are ten equal spaces and that each is one tenth. Count along the line together, starting from nought: nought point one, nought point two, …, three point nine, four. Count back along the line in the same way. Explain that some people might say 'zero' rather than 'nought'.

Write 1.6 on the board. Choose a pupil to come and point to it on the line.

Q Which two whole numbers does it lie between? (1 and 2)

Q Which is the nearest whole number? (2)

Q How far away is 1.6 from 2? (four tenths, zero point four)

Q How far away is 1.6 from 1? (six tenths, zero point six)

Repeat with 2.3, 0.7, 3.1.

Tell the class that there are special arrangements for numbers like 0.5, 1.5, 2.5, 3.5, 4.5, …, which are exactly halfway between two whole numbers. These are always rounded up to the next whole number.

Erase the number line. Write a decimal number such as 26.2 on the board.

Q Does this number round up or round down to the nearest whole number?

Invite a pupil to come to the board, to draw the number line from 26 to 27, and the midpoint of 26.5.

Q Can you use this line to explain to the class how you know that 26.2 rounds down to 26?

Establish that 26.2 is more than 26 but less than 26.5, so it rounds down to 26.

Give out the decimal cards, one per pupil. Choose two pupils to hold up their cards and show the class. The first pupil has to round the second pupil's number to the nearest whole number, then vice versa. Other pupils check. Repeat as many times as possible.

Q Can you tell me a number with tenths and hundredths that lies between 1 and 6?

Establish that a number such as 6.15 would be too big, 0.87 would be too small, and that a number like 4.52 fits the conditions. Write on the board:

$1 < 4.52 < 6$

Play a game of rounding to the nearest whole number. Ask pupils, in pairs, to jot down on their whiteboards a decimal number with tenths and hundredths, lying between 1 and 6. Use a dice to generate a whole number. Any pair whose decimal number rounds to that whole number scores a point. Check pupils' numbers, then repeat. The first pair to score 5 points wins.

Explain that the same principles apply to rounding sums of money and measurements as they do to rounding numbers. Ask:

Q What is five metres forty-three centimetres to the nearest metre?

Q A line is measured as exactly nine millimetres to the nearest millimetre. What is the minimum length that the line could be? (8.5 mm)

Q What is four pounds sixty-one pence to the nearest pound?

Q How many books costing three pounds ninety-nine pence can you buy with twenty pounds?

Work through this problem with the whole class.

The lunches for four friends cost £10.76, £12.32, £8.50 and £11.05.
The friends had only £10 notes in cash.
What should they offer to pay in total for their four meals?

Establish an estimate for the cost of each meal (£11, £12, £9, £11). Encourage pupils to add these numbers up mentally, looking for pairs that are easy to combine, such as £9 and £11. Make sure that pupils recognise that the total of £43 gets rounded up to £50 in the context of the problem.

other tasks

Springboard 7
Unit 10

Unit 10 section 5: Rounding numbers

Unit 10 section 6: Money and 'real life' problems

plenary

Resources
decimal cards as in main activity
mini-whiteboards

Choose two pupils to hold up their decimal cards and show the class. This time ask the class to estimate mentally the sum of the two numbers and to write their estimates on their whiteboards. Choose a pupil to explain how they worked out the estimate. Repeat several times, alternating finding a sum, finding a difference, finding a product.

Remember

- Numbers that end in .5 lie exactly halfway between two whole numbers. It has been agreed that everyone will round up these 'halfway' numbers. For example, 42.5 rounds up to 43.
- It is useful to round decimal numbers to whole numbers in order to work out estimates for calculations with decimals. For example, to estimate 4.8×6.21, round each number to the nearest whole number; the answer is approximately $5 \times 6 = 30$.
- There are exceptions to the 'rules' about rounding up or down after division, depending on the context of a problem. Always think carefully before you decide on an answer.

N3.2 Decimals and money

objectives

- Use a calculator effectively; enter numbers and interpret the display in different contexts (decimals, money).
- Convert pounds to pence, and vice versa.
- Solve word problems.

starter

Vocabulary
convert
pounds
pence

Resources
mini-whiteboards

Start with some questions.

Q How many pence are equivalent to £1? (100p) **To £7?** (700p)
Q How many pounds are equivalent to 400p? (£4) **To 1200p?** (£12)

Ask pupils to include units in their answers, and not say merely 100 or 700.

Q What does 'converting' from pounds to pence mean?
Q How would you explain to a friend how to change pounds to pence?

Establish that you could tell the friend to multiply the number of pounds by 100 to obtain the number of pence, or to divide the number of pence by 100 to obtain the number of pounds.

Explain that each penny is one hundredth of a pound, so that 37p is 37 hundredths of a pound. Write on the board 37p = £0.37. Stress that, when we write amounts of money, either the pounds sign or p (for pence) is used, but not both.

Q What would 52p be in pounds? (£0.52)

Write on the board £0.49. Point to it and ask:

Q What would this be in pence? (49p)
Q What is 60 pence converted to pounds? (£0.60)
Q What would 3p be in pounds? (£0.03) **What about 8p?** (£0.08)

Draw attention to the noughts or zeros in the last example: no whole pounds, no tenths of a pound, but just eight hundredths of a pound, or 8 pence.

Discuss amounts of more than £1.

Q How would you change 467p to pounds?

Establish that 400p of the 467p converts to £4, and there is another 67p remaining, so that 467p = £4.67.

Write on the board one of the forms £6.32 and 632p. Ask pupils to provide the other form. Repeat with £14.60, 213p, 99p, £3.07, 1500p.

main activity

Vocabulary
estimate
approximate
round
check
inverse

Resources
OHP calculator
calculators

Tell the class that you want to do the calculation 24p + 47p on a calculator.

Q What should I key in?

Stress that, because both amounts are in pence, 24 + 47 = can be keyed in. Before pressing the equals sign, ask:

Q What answer will I get? How did you work that out? Could you have done it another way?

Acknowledge the mental methods used.

Write on the board £4.24 + £6.47 and ask pupils to use their calculators to work out the answer.

Q What is the answer? What does your display show? Is it a sensible answer? Why?

Now write on the board £5.43 + £8.27. Remind pupils to clear their display before entering their calculation.

Q What does the display show this time? Is the answer about right?

Establish that the display of 13.7 represents £13.70 in the context of money. Repeat with £2.51 + £8.19, then £3.72 + £17.28. In the latter case, make sure that pupils understand that the display of 21 means £21 in the context of money, and that there are no pence.

Q How would you key in four pounds and seven pence?

Use your OHP calculator to explain and illustrate the difference between £4.70 (4.7 on the display) and £4.07 (4.07 on the display).

Q What if you wanted to add 87p to £5.36 on your calculator?

Establish that amounts under £1 must be entered in the form of pounds and pence, so that both amounts are in the same units. So 87p would be entered as 0.87, since there are no pounds.

Remind pupils how to proceed if they think they have made a mistake entering a calculation. A safe way is to clear the display, and repeat the calculation over again.

Q How can you check your answer?

Establish that there are two ways to do this: by approximating the amounts to create an estimate, or by doing an inverse or 'opposite' calculation. Talk through a couple of examples of each.

Write £9.27 – £4.85 on the board.

Explain that when each amount is rounded to the nearest pound, the calculation would be £9 – £5 = £4. This is the estimated answer. Do the calculation on the OHP calculator, and say that the displayed answer of £4.42 can be assumed to be correct.

Clear the display and start again. Get pupils to do the calculation on their own calculators as you demonstrate on the OHP calculator. Key in £9.27 – £4.85, then press = to make £4.42 appear in the display. Now enter + £4.85 =, and check to make sure that the display shows the original £9.27.

Write £32.87 + £20.53, and repeat the two checks.

Q What is your estimate? Explain how you did it.

Establish an estimate of £33 + £21 = £54. Then do the calculation on the calculator, this time subtracting £20.53 to get back to the original £32.87.

other tasks

Springboard 7
Units 2 and 10

Unit 2 section 6: Calculating with money

Unit 10 section 6: Money and 'real life' problems

plenary

Vocabulary
show your working

Resources
mini-whiteboards

Write a problem on the board and work it through with the whole class.

Ali has already saved £83.06.
He was given a further £28.60 for his birthday.
How much money does he have now?

Q What calculation do you need to do? Explain why.

Q Can you do the calculation mentally, or would it be better to use a calculator?

Q What is your estimate of the calculation?

Q What keys on your calculator would you press to show the total of £83.06 and £28.60?

Q What does the answer in the display mean in the context of the question?

Q How can you check your answer?

Stress that there are two ways to check: by rounding each amount to create an estimate, or by carrying out the inverse calculation to 'undo' it, and so get back to the original amount.

Q What would you write down to 'show your working'?

Model for pupils how to 'show your working' by writing the calculation in horizontal form, with the answer:

83.06 + 28.60 = 111.66. Answer: £111.66

Remember

- If the answer to a question is a sum of money, remember to put the £ sign (if it is in pounds) or p (if it is in pence), but not both.
- Show your working by writing the calculation in horizontal form, with the answer.

N3.3 Making a decimal up to the next whole number

objectives

- Find two decimals with a sum of 1.
- Understand decimal notation and place value.
- Solve word problems and investigate in number.

starter

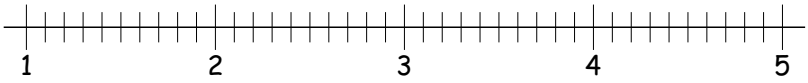
Vocabulary

what must be added to?
how much more?
whole number
tenths

Resources

OHT N3.1a

Draw on the board a number line from 1 to 5, marked in tenths, or label the number line on **OHT N3.1a**.



Count together along the line, pointing to each marker: 'one, one point one, one point two, …, four point nine, five'.

Point again to 1 on the line. Explain that it is a whole number, and that you can say either 'one' or 'one point nought', because a whole number has no tenths. Replace the whole numbers on the line with 1.0, 2.0, 3.0, 4.0, 5.0. Remind pupils that some people might say zero instead of nought.

Write 2.6 on the board. Choose a pupil to mark 2.6 on the line with an arrow, and then to point to the next whole number, 3 or 3.0.

Q What must be added to 2.6 to make 3?

Count on from 2.6: nought point one, nought point two, nought point three, nought point four. Repeat, this time saying: one tenth, two tenths, three tenths, four tenths. Write on the board 2.6 + 0.4 = 3.0. Read this aloud in two ways: two point six plus nought point four equals three; two and six tenths plus four tenths equals three.

Repeat with 1.8 and 4.5, then erase the number line.

Q What is the next whole number after 2.4? What do we need to add to 2.4 to make 3.0?

Repeat with other numbers, such as 3.1 and 4.9.

Finish by asking:

Q What must be added to four tenths to make one? (six tenths or nought point six)

Q What must be added to nought point nine to make one? (one tenth or nought point one)

Q What is one minus three tenths?

Q What is the difference between one and nought point two?

Q Tell me a pair of decimals with a total of one. Of two. Of three.

main activity

Vocabulary
equivalent
hundredths
digit

Resources
OHT N3.3a

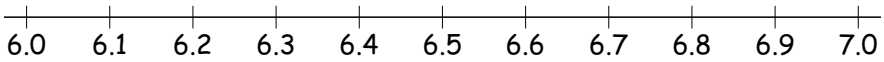
Ask pupils to suggest pairs of numbers that add together to make 100. After a few suggestions, write 63 on the board.

Q What do we need to add to 63 to make 100?

Use an empty number line, mark in 63 and 100, and demonstrate adding on 7 more to make 70, then 30 more to make 100.

Repeat with 48, and 82.

Draw on the board a long line numbered in tenths from 6 to 7, or use the upper of the two lines on **OHT N3.3a**.



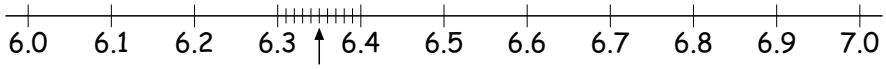
Write 6.35 on the board, away from the line.

Q How many units or ones in 6.35? How many tenths? How many hundredths?

Ask a pupil to point to where 6.35 would be on the line. Stress that 6.35 lies between 6.3, or six and three tenths, and 6.4, or six and four tenths.

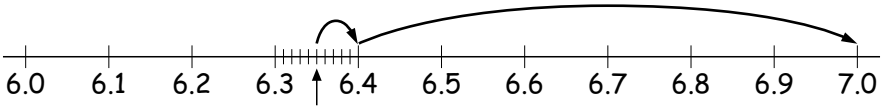
Q What is the next whole number?

Establish that this is 7, or 7.0. Draw nine markers on the line between 6.3 and 6.4, and an arrow pointing to 6.35, or use the lower of the two lines on **OHT N3.3a**. Emphasise that the new markers indicate hundredths.



Q What must be added to 6.35 to make 7?

Use the number line to demonstrate that five hundredths must be added, plus six tenths. Altogether this is equivalent to a total of 65 hundredths, or 0.65.



Write on the board 6.35 + 0.65 = 7.00. Point out that the decimal parts of each number, 35 hundredths and 65 hundredths, add together to make 100 hundredths, or one.

Erase the three arrows, and repeat with 6.18 and 6.72. After each, write the appropriate number sentence on the board: 6.18 + 0.82 = 7.00 and 6.72 + 0.28 = 7.00. Point out again that the decimal parts add together to make 100 hundredths, or one.

Now write 4.36 on the board.

Q What is the next whole number?

Choose a pupil to say what must be added to 4.36 to make 5, and to write it on the board in decimal form: 4.36 + 0.64 = 5.00. Repeat for different numbers, such as 1.57 and 14.21 Encourage pupils to do this without reference to the number line, reminding them that the decimal parts add together to make 100 hundredths.

Choose three different digits and write them on the board (e.g. 3, 5 and 9).

Q What decimal numbers with tenths and hundredths can you make with these digits?

Write them randomly on the board as pupils suggest them and establish that there are six altogether. Point to each of the numbers in turn.

Q What is the next whole number?

Ask pupils to list the numbers in order from largest to smallest (e.g. 9.53, 9.35, 5.93, 5.39, 3.95, 3.59).

They should then complete number sentences, making each of the numbers up to the next whole number (e.g. 9.53 + 0.47 = 10). Remind any pupils who need help that the tenths, when added, must make nine tenths, and that the hundredths, when added, must make ten hundredths, which is the same as one tenth. Repeat with three different digits.

other tasks

Springboard 7
Unit 6

Unit 6 section 4: Subtraction

Star challenge 6: Lengths of lines page 228
Star challenge 7: How much? page 228

plenary

Resources
OHP calculator

Write a problem on the board and work it through with the whole class.

Darren has saved £4.38 towards a CD that costs £5.
How much more must he save?

Q Will the answer be more or less than £1? Why?
Q What calculation do we need to do?
Q What is the answer? (£0.62 or 62p)

Say that you will use an OHP calculator to check the answer.

Q What shall I key in? (5 – 0.62 or 500 – 62)
Q What will you expect to see in the display? (4.38 or 438)
Q How will you interpret the answer? (as £4.38 or 438p)
Q How will you 'show your working'?

Stress that to 'show your working' you must write a complete calculation, with the answer. Model this on the board: 4.38 + 0.62 = 5. Answer: 62p.

If there is time, tackle this problem.

Wendy wants a skirting board that is 3.5 metres long.
She already has 2.25 metres of wood for the board.
How much more wood should she buy?

N3.4 Adding and subtracting decimals

objectives

- Add and subtract mentally pairs of two-digit numbers, including decimals.
- Understand decimal notation and place value.
- Add and subtract decimals using written methods.

starter

Vocabulary
add
plus
subtract
minus
what do I need to add to?
what do I need to subtract from?

Resources
mini-whiteboards

Start with some quick-response questions. Write 8 on the board.

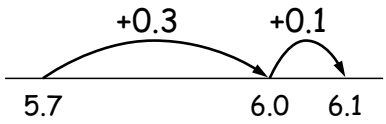
Q Can you tell me a pair of whole numbers with a total of 8? And another pair? And another?

Q What is 8 minus 0.4?

Remind pupils that there are ten tenths between 7 and 8 and that taking away four tenths will leave six tenths. Repeat with several similar questions, starting with a whole number and subtracting a number of tenths.

Show pupils how to add and subtract two-digit decimals in their heads by sketching a number line. Remind them that this is a 'jotting' and that it can be used in mental tests and in written tests. The diagram can be a useful way to show their working. For example:

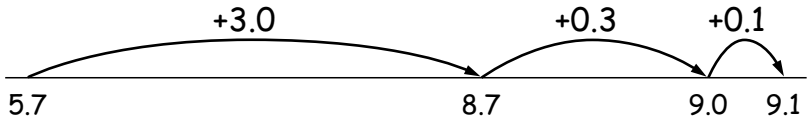
5.7 + 0.4



Start at 5.7. Ask yourself: 'What do I need to make the next whole number?' This is 0.3. Split the 0.4 into 0.3 and 0.1. Jump on 0.3 to reach 6, and then add on the remaining 0.1 to reach 6.1.

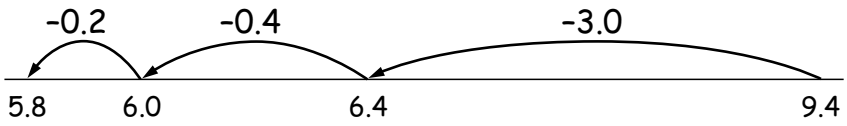
Show how to modify this for 5.7 + 3.4 by adding the whole number 3 first.

5.7 + 3.4



Repeat with subtraction.

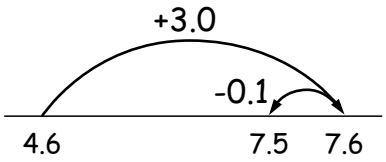
9.4 – 3.6



Start at 9.4. Jump back the whole number 3 to reach 6.4. Ask yourself: 'What do I need to get to the next whole number?' This is 0.4. Split the 0.6 into 0.4 and 0.2. Jump back 0.4 to reach 6, and then the remaining 0.2 to reach 5.8.

Remind the class that there are sometimes quicker ways to do these things. For example, to add 2.9, it could be easier to add 3, then subtract 0.1. To subtract 2.9, it could be easier to subtract 3, then add 0.1.

4.6 + 2.9



Now ask the class some mental addition and subtraction questions. Ask pupils to respond using their whiteboards. Check each answer as you go along, using an empty number line to correct errors.

Q What is nought point four plus nought point seven?
Q Add one point five to two point eight.
Q What is four point one minus nought point five?
Q Subtract six point seven from eight point four.
Q What must I add to four point six to make six point one?
Q What must I take from three point three to make nought point nine?

main activity

Vocabulary
total
difference

Say that it is sometimes necessary to add or subtract decimals using a written method setting out the numbers in columns: for example, when the calculation is too difficult to do in your head and a calculator is not available. Remind the class that the same principles apply to decimals as they do to whole numbers.

- If the numbers involve different units of measurement (e.g. £ and p, cm and m), they must be changed to the same unit.
- The numbers must be written in columns with the decimal points underneath each other, the tenths under the tenths and the hundredths under the hundredths.

Write on the board £3.65, 80p and £2.49. Say that these are the cost of three items for a take-away meal: a pizza, a drink and a salad. You want to know the total cost of the items. Set out the three items in columns, first changing the 80p to pounds.

3.65
0.80
<u>2.49</u>

Find the total, using your preferred method, paying attention to the 'carry' figures and where to write them. For example, you might say:

First add the hundredths: five hundredths and nine hundredths make fourteen hundredths, that's one tenth and four hundredths. Next add six tenths, eight tenths and four tenths, plus the extra one tenth, that's nineteen tenths, or one whole and nine tenths. Three and two make five, plus the extra one, make six altogether.

Repeat with numbers with a different number of decimal places, such as 18.7 and 5.63.

Now discuss a subtraction problem.

There are two snakes at the pet shop.
One is 84 cm long and the other is 2.32 metres long.
What is the difference in the lengths of the snakes?

Model a subtraction on the board in a similar way, using your preferred method. Stress the importance of both measurements being in the same units. Either change the 84 cm to 0.84 m, or change 2.32 metres to 232 centimetres, before carrying out the calculation.

other tasks

Springboard 7
Units 6 and 11

Unit 6 section 3: Addition

Unit 6 section 4: Subtraction

Unit 11 section 2: Units of mass

plenary

Resources
Resource N3.4a

Write on the board three calculations typical of those discussed in the lesson. For each calculation, ask:

Q Would you do that calculation mentally, in columns with pencil and paper, or with a calculator? Why?

Q How could you work it out?

Q Could you do it a different way?

Q How could you check your answer?

Check for errors or misconceptions and discuss how to rectify them.

Finish with a selection of mental arithmetic questions taken from National Curriculum tests, using **Resource N3.4a**.

Remember

- Look at the numbers carefully before deciding how to do a subtraction calculation.
- In word problems, make sure that measurements are in the same units before carrying out the calculation.

N3.5 Reviewing the use of a calculator

objectives

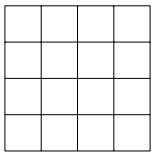
- Recall multiplication facts to 10 × 10 and derive associated division facts.
- Solve word problems and investigate in number.
- Use a calculator effectively.
- Check whether a result is the right order of magnitude.

starter

Vocabulary
operation

Resources
three dice
2 cm squared paper

Give out 2 cm squared paper and ask pupils to draw a 4 by 4 grid towards the top left of their paper.



Ask the class to fill their grid with the numbers 1 to 16, writing them at random, one in each box. Explain to the class that you are going to roll three dice and tell them the numbers. They can then use the numbers with any of the four operations to make a number on the grid. When they have made a number they should cross it out, and record how they have made it at the side of the grid. Show the class that, if the numbers rolled are 3, 4 and 6, they could make and record, for example:

$9 = 36 \div 4$ $\quad 7 = 4 + 6 - 3$ $\quad 14 = 6 \times 3 - 4$

Say that the first person to complete a line of four numbers in any direction (horizontal, vertical or diagonal) should call out 'Bingo!' and will win the game.

Play the game. When a pupil calls 'Bingo!' check the winning line by asking the pupil how they have recorded the numbers for that line. Repeat the game if you wish.

If time allows, ask pupils to turn over their paper and to write the numbers from 17 to 30 down one side. They should now make each number, using three of the digits 1, 2, 3, 4, 5, 6 (with no repeats), and any operation. Use the opportunity to check how quickly and accurately they can do the task.

main activity

Vocabulary
calculator

Resources
Resource N3.5a
OHP calculator
calculators

Tell the class that you will review with them what they know about using calculators.

Give out copies of **Resource N3.5a**, a set of problems. Ask pupils to work in pairs. Give them five to ten minutes to work on as many of the problems as they can, using their calculators. Tell them to use a piece of paper for any jottings.

Go through the questions one by one. Invite a pair to tell you exactly which buttons to press on the OHP calculator, including the on/off, clear and clear entry keys. Press only those keys that they ask for. Encourage other pupils to copy the instructions on their own calculators. Where appropriate, teach the class how to use the calculator facilities to make their calculations more efficient.

For each calculation, ask the class to estimate the answer by rounding the numbers. Write the estimate on the board before carrying out the calculation. Check each answer against its estimate, stressing that a good match does not necessarily

confirm that an answer is right but that a bad match indicates that an answer is probably wrong.

After every question, ask the pair who described the calculator method:

Q Did you jot anything down as part of your calculation? If so, what was it?

Invite a different pupil to the board to demonstrate how they would 'show their working' for that particular question.

1 2134 – 103.4

Q How do we key in a decimal number?

Q How can we check the answer by doing the reverse calculation? What keys do we press to get back to the starting number?

2 14.7 ÷ 1.3

Q How do we clear the display so that we can start on a new calculation?

Q Say you forgot to key in the decimal point. How do you clear the entry to go back a step?

3 2592 ÷ □ = 72

Q How can we rewrite this equation so that we can solve it with a calculator?

4 13 × (436 – 185)

Q What do the brackets mean? Which bit must we do first?

5 £2.37 + 86p

Q What do we need to do about the units?

Q How do we key in amounts of money?

Q What would 0.08 mean in the display if the answer were in pounds?

6 1 ÷ 8

Q How do we read the number in the display? What does it mean?

7 2 ÷ 3

Q What does 0.6666666 mean?

8 $^{2}/_{5}$ of 697

Q How do we key in this calculation?

As an extension for some pupils, you may want to show them how to use the calculator's memory, for example, to test whether particular numbers such as 22, 23, 24 are factors of 2352.

other tasks

Springboard 7
Unit 10

Unit 10 section 5: Rounding numbers

plenary

Resources
calculators
OHP calculator

Write on the board □ × □ × □ = 2197.

Explain that each box represents the same number.

Q Is the answer greater than 10? What is 10 × 10 × 10?

Get pupils to calculate 10 × 10 × 10 mentally. Agree with them that the answer of 1000 means the number in the box is greater than 10.

Q Is the number greater than 20? What is 20 × 20 × 20?

Get pupils to multiply mentally in two steps: 20 × 20 = 400, and 400 × 20 = 8000. Establish that the answer of 8000 means the number in the box is less than 20.

Q What would be a good number to try next?

Discuss their suggestions and reasons for them. Establish that trying 15 × 15 × 15 to see whether it is too big or too small would cut the possibilities by half. Clarify that the remaining possibilities are 11, 12, 13 and 14.

Q Can we eliminate any of these numbers? If the box represented an even number, would the answer be odd or even? (even)

Say that there are now two possibilities: 11 and 13.

Q Which of these two numbers is more likely?

Ask pupils to consider the last digit in each case.

Q If the number were 11, what would be the last digit of the answer? (1)

Say that 13 appears to be the most likely answer. Ask pupils to try 13 × 13 × 13 on their calculators and confirm that this is the correct answer.

Remember

- Whole numbers ending in 5 lie halfway between two multiples of 10. Round up these 'halfway' numbers. For example, 75 rounds up to 80.
- Round numbers to the nearest 10 or 100 in order to work out estimates for calculations.
- When you use your calculator in a test, remember to write down the calculation that you did. It may get you a mark even if you make a mistake with keying in.
- It is easy to make a mistake when keying numbers into a calculator. Always estimate the answer and check your answer against the estimate.

N3.6 Decimals and measures

objectives

- Use names and abbreviations of units of length to measure, estimate, calculate and solve problems.
- Convert one metric unit to another.

starter

Vocabulary
what fraction?
centimetre
metre
measure

Resources
two metre sticks, one marked in centimetres and one marked in decimetres
string
scissors

Show the class the metre stick marked in decimetres, saying: 'This is one whole metre.' Point out the decimetre spaces.

Q How many of these are there? (ten)

Q What fraction of the whole metre is one of these? (one tenth)

Show the class the metre stick marked in centimetres, saying: 'This is one whole metre.' Point out the centimetre spaces.

Q How many of these centimetres are there? (one hundred)

Q What fraction of the whole metre is one centimetre? (one hundredth)

Write 1.3 m on the board. Tell the class that you are going to measure a piece of string that is 1.3 metres long. Point to the 1, saying; 'This is one whole metre.' Point to the 3, saying: 'This is three tenths of a metre.'

Get two pupils to hold the two metre sticks to create a two-metre length. Point out the whole metre (on the left, as pupils look at it), and count three tenths along the metre marked in decimetres.

Stretch a length of string from the end of the first stick, across the 1 metre mark, to the third decimetre mark. Cut the string and hold it up, saying: 'This string is one and three tenths of a metre long.'

Repeat for strings that are 1.7 m, 0.6 m and 1.2 m long.

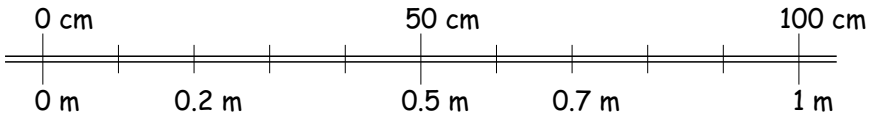
Q Which is the shortest string? Which is the longest string?

main activity

Vocabulary
convert
equivalent
estimate
range

Resources
OHT N3.6a
counting stick or paper strip

Make a paper strip one metre long and stick it to the board, or label a counting stick.



Count in 10 centimetres along the top of the stick from zero to 100 centimetres, and back again. Repeat by counting in decimal equivalents of 0.1 metre along the lower part of the stick.

Q What does 'converting' from one unit of measurement to another mean?

Q How many centimetres are equivalent to 1 metre? (100 cm) **To 9 metres?** (900 cm) **To half a metre?** (50 cm)

Stress that pupils should include the units in their answers, and not say merely 100, 900 or 50.

Refer to the paper strip.

Q What is 0.2 of a metre converted to centimetres? (20 cm)
What is 0.7 of a metre in centimetres? (70 cm)

Q What would 30 centimetres be in metres? (0.3 m)

Explain that each centimetre is one hundredth of a metre, so that 56 centimetres is 56 hundredths of a metre. Write on the board 56 cm = 0.56 m.

Q What would 27 centimetres be in metres? (0.27 m) **75 cm?** (0.75 m)

Q What would 0.42 of a metre be in centimetres? (42 cm)

Q What is 60 centimetres converted to metres? What about 10 centimetres? And 5 centimetres?

Remind pupils that 0.60 m is written as 0.6 m, and 0.10 m is written as 0.1 m, and that 5 cm is written as 0.05 m. Draw attention to the zeros in the last example.

Write on the board 4 m 23 cm. Point to the 4 metres.

Q How many centimetres are there in 4 metres? (400 cm)
How many centimetres are there in 4 metres 23 centimetres? (423 cm)

Q What would 23 centimetres be in metres? (0.23 m)
How many metres are there in 4 metres 23 centimetres? (4.23 m)

Write on the board 4 m 23 cm = 423 cm = 4.23 m.

Write on the board one of the forms 6 m 38 cm, 638 cm and 6.38 m. Ask pupils to provide the other two forms. Repeat with 2 m 8 cm.

Work through the problem on **OHT N3.6a**. Ask pupils to write down their reason why Sam is correct. Stress the need for a full explanation and a complete sentence.

Invite a pupil to put a cross on the line to mark Lynn's jump. Make sure that pupils understand that there is no division on the line that corresponds to 1.14 metres, and that it lies between 1.1 m and 1.2 m.

other tasks

Springboard 7
Units 3 and 10

Unit 3 section 3: Metres and centimetres

2 Measurement problems page 120
Star challenge 7: Trains and lorries page 122

Unit 10 section 2: Multiplication

Star challenge 5: 'Real life' problems page 336

plenary

Resources
metre stick
five pieces of string or ribbon, cut to varying lengths up to 1 metre (keep a note of the length of each one)
mini-whiteboards

Hold up a metre stick, saying: 'This is one metre.' Prop it up so that pupils can refer to it.

Q If you were estimating a length up to 1 metre, what would you regard as a good estimate? How close would it have to be?

Establish that an estimate within 5 centimetres either way could be regarded as a good one, a range of 10 cm. If appropriate, ask pupils what percentage 10 cm is of 1 metre (10%).

Q Would a range of 10 cm be the limits for a good estimate of a distance of 100 metres? (no – the range would be greater – perhaps 10% of 100 metres, or 10 metres)

One by one, hold up the five lengths of ribbon or string. Ask pupils to jot down an estimate of the length **in metres**. Stress that they should write the unit of measurement (metres) each time, not just the value. After each one, tell pupils the measured length.

Q Whose estimate was within 5 centimetres, either more or less?

Check pupils' estimates before holding up the next string or ribbon.

Remember

- When the answer to a question is a measurement, remember to include the units.
- Use the context of the question to decide whether you need to round up or round down.

N3.7 Reading numbers from scales

objectives

- Count on and back in steps of 0.1, 0.2 and 0.25.
- Read and interpret scales on a range of measuring instruments.

starter

Vocabulary
interval

Resources
counting stick
OHT N3.7a

Use a counting stick.

Tell the class that the end at the left is nought or zero, and the other end is 20. Point to the midpoint of the stick, and ask:

Q What number is this? How do you know? (10, because it is half of 20)

Now point to the end of the third interval, the marker for 6. Ask again:

Q What number is this? How do you know?

Remind pupils that the total length of the stick is 20, and there are 10 intervals. Each interval is 20 ÷ 10 = 2. Point to a few more numbers and ask pupils to identify them. If necessary, confirm by counting along the stick in twos.

Repeat with 50 at the right-hand end, then 5. Establish in the latter case that each interval is one half or nought point five. Confirm by counting along and back: nought, nought point five, one, one point five, … Point to the ends of the seventh and ninth intervals, in each case asking:

Q What number is this?

Change the end of the stick to 1000. Point to different markers on the stick and ask pupils to say what number you are pointing to.

Indicate positions between the markers.

Q Estimate this number. Give your reasons.

Show **OHT N3.7a**. Work through the questions on the slide.

main activity

Vocabulary
scale
reading

Resources
OHTs N3.7b, N3.7c, N3.7d
ITP *Measuring cylinder* (optional)

Show **OHT N3.7b**. Tell the class that this is a scale to measure the amount of water in litres in a cylindrical water tank. The lowest mark indicates empty and the highest mark indicates full. Write 4 in the lower box. Point to the intervals below 4.

Q What does each of these intervals represent?

Emphasise that the four main intervals each represent 1 litre. Erase 4, and replace it with 12. Ask:

Q What does each main interval represent now? Explain why.

Q What number should be written in the upper box? How much water does this represent?

Q How much water is in the tank when it is full? Give your reasons.

Stress that pupils should first work out what the intervals are worth and then work out the values of the readings.

Erase the numbers in the boxes and repeat with other numbers. Make sure that the number is divisible by 4 if it is the lower box, and by 7 if it is the upper box.

If you wish, you could extend the above by using the ITP *Measuring cylinder*, downloaded from www.standards.dfes.gov.uk/numeracy. Select options and ask questions to consolidate pupils' understanding.

Show **OHT N3.7c**. Tell the class that the arrow on the top scale shows the weight of a melon. They have to mark the weight of the same melon on a different scale. Point to the first scale. Ask:

Q What does the smallest interval represent? (one tenth of a kilogram, or 0.1 kg)

Q What is the weight of the melon? (1.4 kg) **How do you know?**

Point to the second scale.

Q What does the smallest interval represent? (one fifth of a kilogram, or 0.2 kg)

Q Where would 1.4 kg be on this scale? How do you know?

Show **OHT N3.7d**. Tell the class that the diagram represents a scale for weighing. The pointer rotates clockwise from the zero or nought position. Write 14 in the empty box. Ask:

Q What does the interval on the scale represent? (2 kg)

Q What interval does the pointer lie within? (between 8 kg and 10 kg)

Q Is the pointer nearer to 8 or nearer to 10?

Q Estimate the weight on the scale. (approximately 8.25 kg)

Erase 14. Repeat with 3.5 (estimated weight 2.1 kg).

other tasks

Springboard 7
Unit 11
Assess and review 3

Unit 11 section 2: Units of mass

1	Reading scales	page 369
2	More scales	page 370

Unit 11 section 3: Capacity

2	More metric units	page 376

Assess and review 3

	Question 7	page 414

plenary

Resources
OHT N3.7e

Show the class the first scale on **OHT N3.7e**. Tell them that it shows part of a number line. They have to write the number shown by the arrow. If necessary, prompt with questions such as:

Q What does each interval represent? (100)

Refer the class to the second scale. Again, they have to write the number shown by the arrow. Prompt with questions such as:

Q What numbers should we write on the two taller markers? (1000, 1001)

Q What do the smallest intervals represent? (one half or 0.5)

Q What number should go in the box? (1000.5) **Explain your thinking.**

Refer the class to the third scale. Invite a pupil to mark with an arrow the point 7500. Prompt if necessary with:

Q How many intervals are there between 0 and 10 000? (10)
What does each interval represent? (1000)

Q Between which two 'thousands' does 7500 lie? (7000 and 8000)

Refer the class to the fourth scale. Remind them that the number line extends to negative numbers and that negative numbers also appear on temperature scales and on the scales of graphs.

Q Where is the point –1.5 on the line? Where is 0.45?

Once again, if necessary, prompt with questions such as:

Q What numbers should we write on the medium sized markers?
(–1.5, –0.5, 0.5, 1.5)

Q What do the smallest intervals represent? (one tenth or 0.1)

Q Between which two 'tenths' does 0.45 lie? (0.4 and 0.5)

Remember

- When reading a scale, decide what each interval represents, and label the divisions or marks on the scale.
- When you estimate a reading, decide what two numbers (or measurements) the reading lies between. Then decide which of them it is nearer to.

N3.8 Problems involving time

objectives

- Use a timetable and find intervals for 24-hour times.
- Solve word problems involving time.

starter

Vocabulary
minutes
hours
am
pm

Resources
mini-whiteboards

Ask pupils for complements of numbers in 60. For example:

Q What should be added to 45 to make 60?

Check by counting up from 45 to 50, then 50 to 60. Repeat with 23 and 9. If necessary, use an empty number line to demonstrate.

Remind the class that there are 60 minutes in every hour. If the time is 10 minutes to 9 in the morning, it can be written as 8:50 am. Write this on the board. Stress that 50 minutes past the hour is the same as 10 minutes to the next hour, and that 50 + 10 = 60. Point out that a colon is used to separate the hours from the minutes.

Ask pupils to write these times on their whiteboards:

- 5 minutes to 3 in the afternoon;
- 20 minutes past 8 in the morning;
- 18 minutes to 5 in the afternoon.

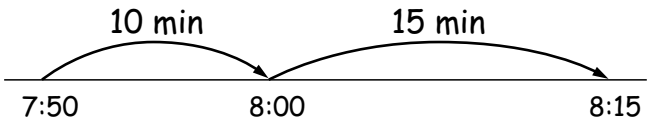
Say that, with time, there are three common types of calculation:

- you know a start time and the length of an event, and you want to know the end time (for example, when a TV programme will end if it starts at 7:45 pm and lasts 50 minutes);
- you know the length of an event and an end time, and want to know the start time (for example, when to start cooking a casserole that takes 90 minutes to cook, so that it is ready for lunch at 1:15 pm);
- you know the start time and end time, and want to know the length of an event (for example, how long a train journey will take if it starts at 4:35 and ends at 6:15).

Show pupils how to do each type of calculation. First, work out an end time.

> *A television programme starts at ten minutes to eight. It lasts twenty-five minutes. At what time does it finish?*

Explain how to add on the 25 minutes in two steps: the 10 minutes needed to reach the hour of 8 o'clock, then the remaining 15 minutes to reach 8:15. Use a time line to demonstrate bridging through the hour.



Ask one or two similar questions for pupils to answer on their whiteboards.

Next, work out a start time.

A forty-five minute lesson ended at ten twenty. What time did it start?

Explain how to subtract the 45 minutes in two steps: the 20 minutes needed to go back to the hour of 10 o'clock, and then the remaining 25 minutes to reach 25 minutes to 10, or 9:35.

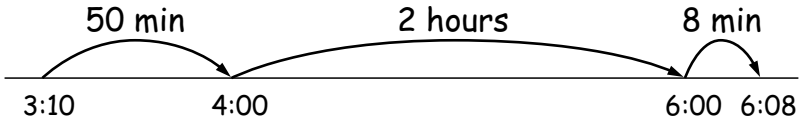
Ask a couple of similar questions for pupils to answer on their whiteboards.

Now show pupils how to calculate a time interval.

A bus leaves Hampton at 9:35 am and arrives at Croxton at 10:15 am. How long does the bus journey take?

Start with the earlier time. Count up to the hour from 35 minutes to 60 minutes. Jot down 25 minutes as a reminder. Then count from the hour to 15 minutes past the hour. Jot down 15 minutes. Add the two together mentally, then state the answer: 40 minutes.

Repeat by working out the difference between 3:10 pm and 6:08 pm. Stress to the class that first they should count on 50 minutes to 4:00 pm, then two hours to 6:00 pm, then the last 8 minutes to 6:08 pm.



main activity

Vocabulary
24-hour clock
digit

Resources
OHTs N3.8a, N3.8b
mini-whiteboards
ITP *Tell time* (optional)

Remind the class that on a digital clock or watch there are spaces for four digits: two for the number of hours past midnight and two for the number of minutes past the hour. Some clocks or watches may have spaces for two more digits for the number of seconds.

Write 7:35 am on the board. Say that on a 24-hour clock, it is conventional to fill all four of the spaces for digits for hours and minutes. 7:35 am is written as 07:35 hours. Ask pupils to write on their whiteboards in 24-hour clock time:

- 6:30 am (06:30);
- five past three in the morning (03:05).

Write 1:00 pm on the board. Explain that on a 24-hour clock this would be displayed as 13:00, or 13 hundred hours, because it is a total of 13 hours and no minutes past midnight. Repeat with 5:27 pm. Say that this would be written as 17:27 hours, and would usually be said as 'seventeen twenty-seven hours', not 'seventeen hundred and twenty-seven hours'.

Say that, with a 24-hour clock, it is possible to tell whether it is am (before midday or noon) or pm (after midday, or afternoon) by looking at the number of hours. If the number of hours is less than 12, it is am, before midday.

After midday, to convert a 12-hour clock time to a 24-hour clock time, we just add 12 to the number of hours. Ask pupils to convert these 12-hour clock times to 24-hour clock times, and to write them on their whiteboards:

- 4:15 pm;
- 10:45 pm;
- three minutes past six in the afternoon.

Ask:

Q The time is sixteen thirty-five. How many minutes is this before five o'clock in the afternoon?

You could, if you wish, support this section of the lesson by using the ITP *Tell time*, downloaded from www.standards.dfes.gove.uk/numeracy. Select options and ask questions to consolidate pupils' understanding.

Work through some questions with the whole class, using **OHTs N3.8a** and **N3.8b**. Use a timeline to demonstrate if any pupils have difficulty.

other tasks

Springboard 7
Unit 11

Unit 11 section 4: Time

plenary

Resources
Resource N3.8c

Check that pupils know the relationships between units of time by asking:

Q How many days in a week? Hours in a day? Minutes in an hour? Seconds in a minute?

Q Which operation do we use to convert weeks to days? (multiply by 7)

Q How do we convert a number of days to week? (divide by 7)

Q How do we change hours to minutes? (multiply by 60)
So how many minutes is 3 hours?

Q Which operation do we use to change minutes to hours? (divide by 60)
So how many hours is 300 minutes? 90 minutes? 105 minutes?

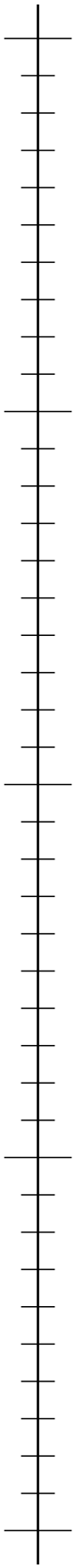
Finish the lesson by reminding the class that some of the ways that we talk about time are not very logical. For example, 2:00 am is described as 'two in the morning' although it is in the middle of the night!

Finish with a selection of mental arithmetic questions taken from National Curriculum tests, using **Resource N3.8c**.

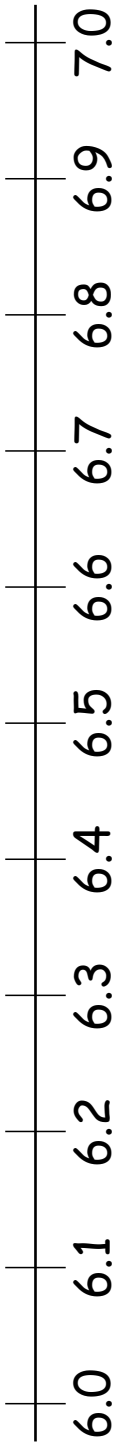
Remember

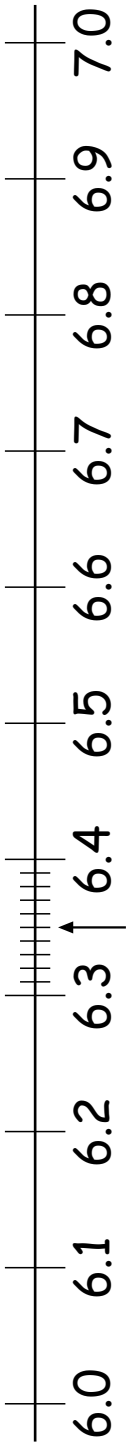
- A time line can help with time calculations.
- 00:00 is midnight and 12:00 is midday, or noon.
- 08:15 is before noon and is 8:15 am. 18:40 is after noon and is 6:40 pm.
- Some 24-hour clock timetables don't use a colon to separate the hours from the minutes.

OHT N3.1a



OHT N3.3a





Resource N3.4a

1 Multiply five by five, then add four.

2 How many degrees are there in two right angles?

3 What is the cost of four birthday cards at one pound and five pence each?

4 What is seven hundred and fifty-eight to the nearest ten?

5 The temperature in London was minus three degrees Celsius.
The temperature in Barcelona was twenty degrees warmer.
What was the temperature in Barcelona?

6 What is fifty-six divided by seven?

7 A jacket costs fifty-two pounds.
In a sale the price is nineteen pounds less.
What is the sale price?

8 Write eight tenths as a decimal number.

9 What is fifty-eight multiplied by ten?

10 Write nought point three as a fraction.

11 What is three quarters of sixty pounds?

12 Write another fraction that is equivalent to one fifth.

13 Add three point five to four point eight.

14 What is double fifteen point five?

15 A tape costs three pounds ninety-nine pence.
How much would five of these tapes cost?

Resource N3.5a

1 $2134 - 103.4$

2 $14.7 \div 1.3$

3 $2592 \div \square = 72$

4 $13 \times (436 - 185)$

5 £2.37 + 86p

6 $1 \div 8$

7 $2 \div 3$

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OHT N3.6a

On sports day pupils get points for how far they jump.

Standing long jump	
Over 80 cm	1 point
Over 100 cm	2 points
Over 120 cm	3 points
Over 140 cm	4 points
Over 160 cm	5 points
Over 180 cm	6 points

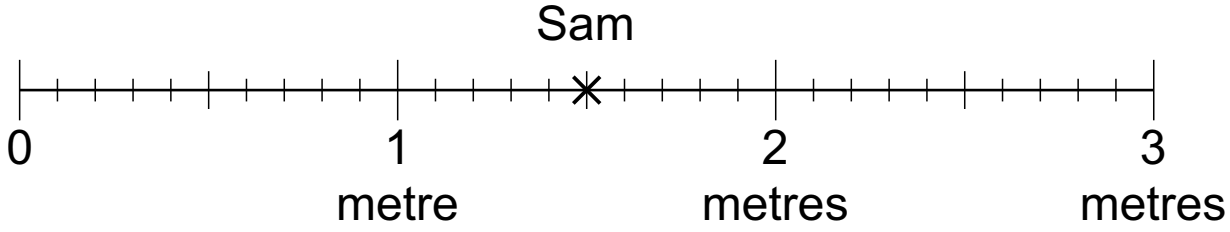
Sam said: 'I jumped 1.5 metres. I get 4 points.'
Give a reason why Sam is correct.

.....

.....

Each pupil put a cross on a line to show how far they jumped.

Sam put her cross at 1.5 metres.

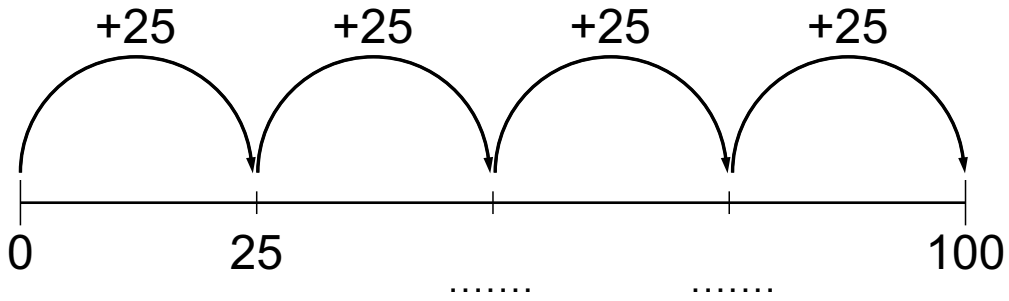


Lynn jumped 1.14 metres.
Put a cross on the line for Lynn's jump.

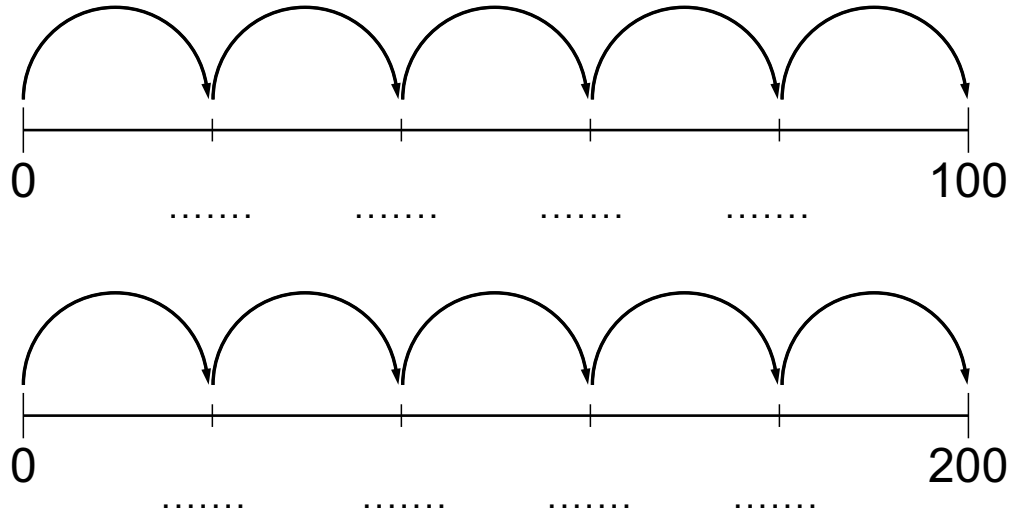
OHT N3.7a

The number line goes from 0 to 100 using 4 equal steps. The size of each step is 25.

Fill in the missing numbers on the line.

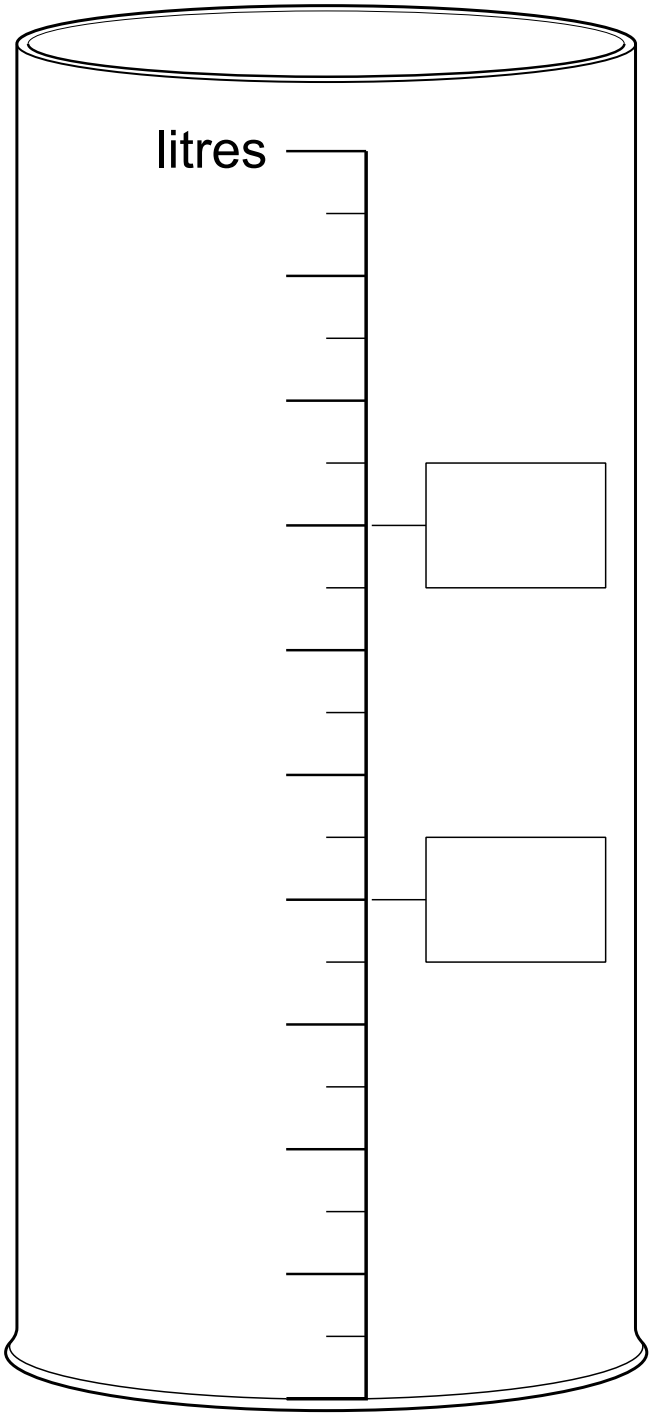


Fill in the missing numbers on these lines.

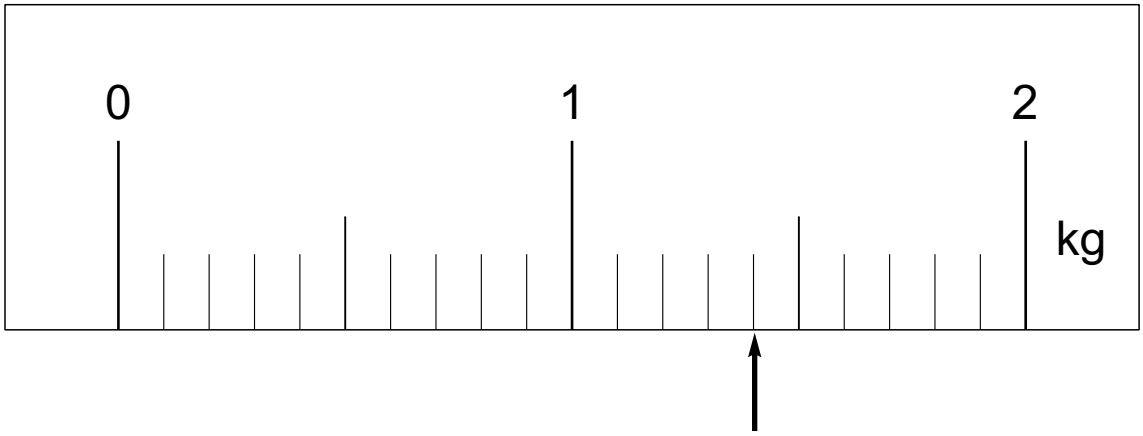


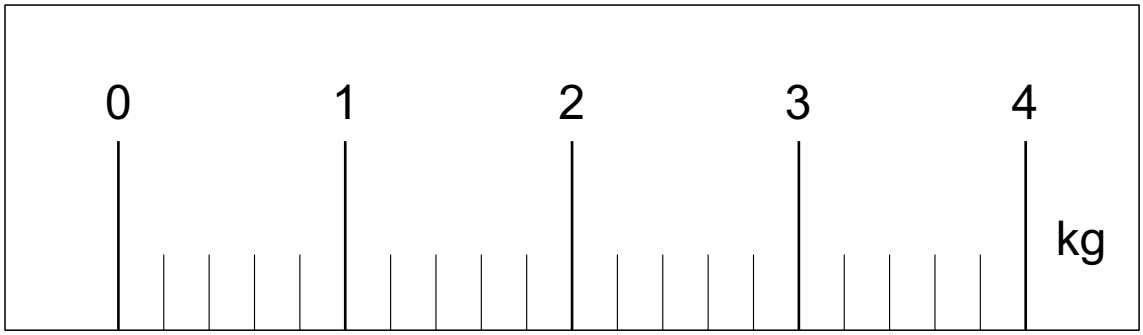
A number line goes up in steps of size 15.
How many steps will it take to get from 0 to 60?

OHT N3.7b

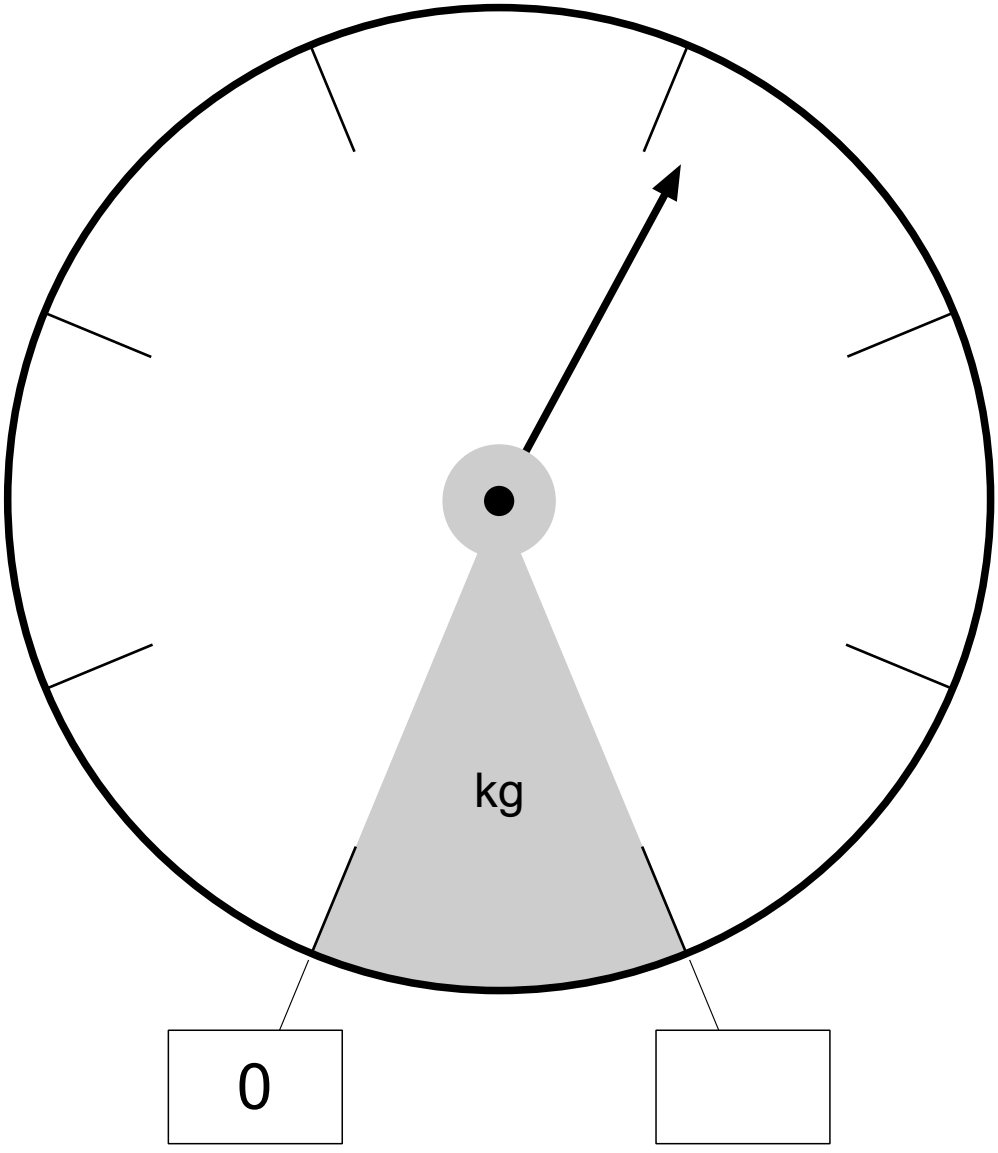


OHT N3.7c



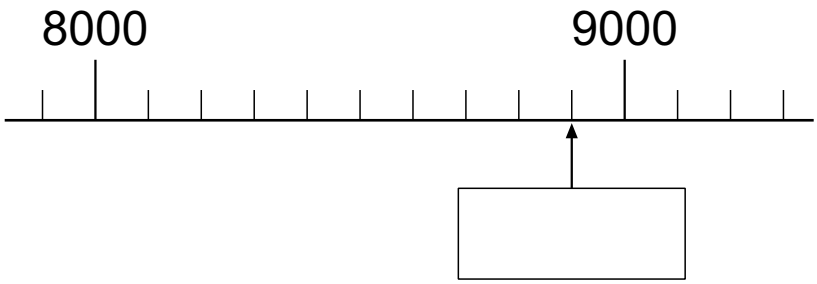


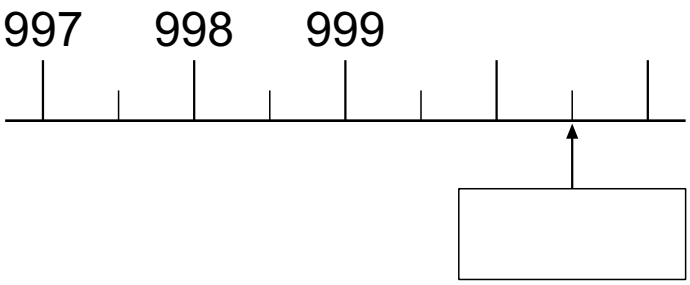
OHT N3.7d



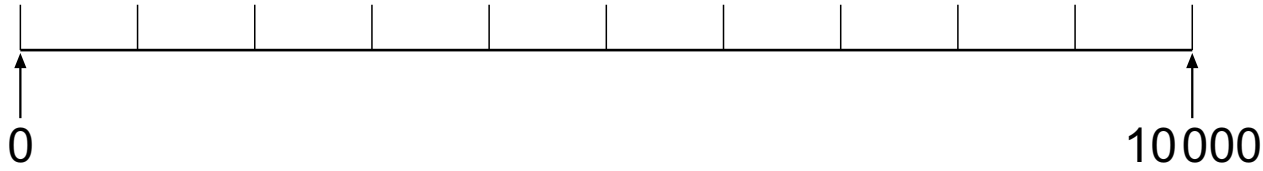
OHT N3.7e

Write the number shown by each arrow.

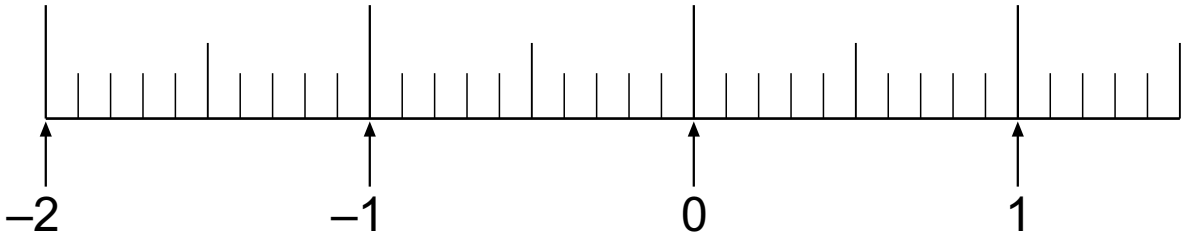




Draw an arrow to show the point 7500.



Draw arrows to show the points –1.5 and 0.45.



OHT N3.8a

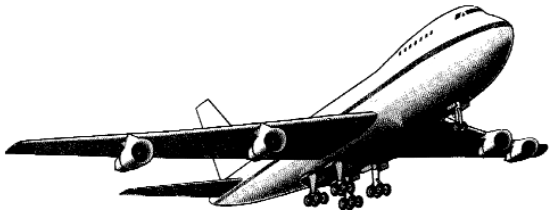
These are the start and finish times on a video cassette recorder.

START 14:45
FINISH 17:25

For how long was the video recording?

hours	minutes

An aeroplane takes off on Tuesday at 22:47
It lands on Wednesday at 07:05



How long in hours and minutes is the flight?

hours	minutes

OHT N3.8b

Bus timetable Croxton to Braytown					
Croxton *depart*	11:30	11:45	12:20	12:45	13:30
Braytown *arrive*	12:15	12:30	13:05	13:30	14:15

Derek caught the 11:45 bus from Croxton.
What time did he arrive in Braytown?
How long did the bus journey take?

Derek took 15 minutes to get from his house to the bus stop.
He waited 5 minutes for the bus to come.
What time did Derek leave his house?

Ruth must get to Braytown by 13:20.
Which buses could she catch?

Ruth is 15 minutes too late for the 12:20 from Croxton.
She catches the next bus instead.
How long does Ruth wait for the next bus?

Resource N3.8c

1 How many centimetres are in one metre?

2 Write a number that is bigger than twenty-eight and a half but less than twenty-nine.

3 Gary collects ten-pence coins. Altogether he has twelve. How much money is that?

4 What is nine multiplied by seven?

5 What number is one hundred less than eight thousand? Write your answer in figures.

6 A television programme starts at ten minutes to seven. It lasts twenty-five minutes. At what time does the programme finish?

7 How many hours is three hundred minutes?

8 Subtract twenty from eight.

9 The perimeter of an equilateral triangle is thirty centimetres. What is the length of each side?

10 What is twenty-one multiplied by nine?

11 What is the next prime number after twenty-three?

12 The time is sixteen thirty-five. How many minutes is this before five o'clock in the afternoon?

13 What is one quarter of two hundred thousand? Write your answer in figures.

14 Add together two point two and one point nine.

15 What is two thirds of sixty minutes?