Unit 6A1 2 weeks

Counting, partitioning and calculating

Objectives
End-of-year expectations (key objectives) are highlighted
• Explain reasoning and conclusions, using words, symbols or diagrams as appropriate
• Find the difference between a positive and a negative integer, or two negative integers, in context
• Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line
• Use knowledge of place value and multiplication facts to 10 × 10 to derive related multiplication and division facts involving decimals (e.g. 0.8 × 7, 4.8 ÷ 6)
• Calculate mentally with integers and decimals: U.t ± U.t, TU × U, TU ÷ U, U.t × U, U.t ÷ U
• Use a calculator to solve problems involving multi-step calculations
• Use approximations, inverse operations and tests of divisibility to estimate and check results

Starters

1	**Negative numbers, including finding the difference** Rehearse **Objective:** Find the difference between a positive and a negative integer, or two negative integers, in context Use a counting stick. Tell children that the 'higher' end is 5. Before counting in unison, ask them what number the other end represents if they were to count backwards in steps of –1. Count together to check. • What is five more than negative two? • What is six less than four? Repeat for a starting point of 3, counting back in steps of –2 to –15. Mark on pairs of number cards at suitable points on the stick, say 3 and –7. • What is the difference between 3 and –7? Stress that a difference between two numbers is measured by the number of steps or distance between them. Check by counting, then repeat for other pairs of numbers. • The difference between two numbers on my counting stick is 6. One of the numbers is positive and the other is negative. What could the numbers be? • The difference between two numbers on my counting stick is 4. Both numbers are negative. What could the numbers be? Write on the board: –5 –4 –3 –2 –1 0 1 2 3 4 5 Ask children: • Which pair of numbers has a difference of 8? A different pair? And another pair? Now write on the board: –1 –0.5 0 0.5 1 1.5 • Which pair of numbers has a difference of 2? And a different pair?

2	**Counting supported by fingers to establish decimal multiplication facts** Recall **Objective:** Calculate mentally with integers and decimals: U.t ± U.t, TU × U, TU ÷ U, U.t × U, U.t ÷ U Count in unison from zero in increments of 0.3 up to 2.1 using fingers as they count. For 0.3 show one finger, for 0.6 show two fingers, for 0.9 show three fingers, etc. Ask children how many steps there were to reach 2.1. Children should make the link with the number of fingers that they have displayed. • Give me a number sentence using your displayed fingers and the number we arrived at. Look for 0.3 × 7 = 2.1 and 2.1 ÷ 7 = 0.3. Start again, this time counting in increments of 0.4, using fingers as before. Stop them at, say, 0.4 × 3 and 0.4 × 7. Each time, ask them for number sentences.
3	**Partitioning and rounding decimals with up to two places** Refine **Objective:** Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line Write on the board five or six numbers with two decimal places, such as 3.46, 4.06, 12.76, 8.60, 11.18. Ask children to read each number aloud. Stress that digits after the decimal point are read singly, so that it is 'three point four six' not 'three point forty-six'. Point to a digit from one of the numbers. Ask children what the digit represents. Remind the class how to partition the number. $3.46 = 3 + 0.4 + 0.06$ $3.46 = 3 + \frac{4}{10} + \frac{6}{100}$ Remind them also that $\frac{4}{10} + \frac{6}{100} = \frac{46}{100}$. Draw an analogy with 46p, which is equivalent to forty-six 1p coins or four 10p pieces and six 1p coins. Repeat with some of the other numbers on the board. Tell children they are going to play 'Ping-Pong'. Tell them that you will point to a number and ask either what the number is rounded to one decimal place or to the nearest whole number. Set a manageable rhythm. You say 'ping' and the children reply 'pong'. Point to a number (say 3.46) and say 'to one decimal place', and children reply 'three point five'. Point to another number (say 12.76) and say 'to the nearest whole number', and children reply 'thirteen'.

Main activities

1	**Discussing sequences** **Objective:** Explain reasoning and conclusions, using words, symbols or diagrams as appropriate Ask the class to imagine a machine that will help them to find patterns. Show an OHT made from Resource 6A1.1. Explain how the first machine will add 3 to any number. Work through the three inputs and outputs with children. Choose a rule for the second machine, such as '+ 5'. Ask children to suggest three numbers for the input boxes. Complete each output with the class. Enter three inputs and corresponding outputs for the third machine (e.g. 4, 8, 10 and 10, 14, 16). Ask children to identify the rule. Prompt with questions such as:

- What do you need to do to 4 to make 10?

Use a second copy of the OHT for more examples. For example, identify the rule for these sets of numbers: 2, 4, 5 and 6, 12, 15 (the rule is '× 3'), and for 35, 55, 95 and 26, 46, 86 (the rule is '– 9').

Show an OHT made from Resource 6A1.2, with two linked machines. Fill in the first input boxes with 3, 5, 7, and rules of '+ 1' and '÷ 2'. Work with the class to identify the final outputs (2, 3, 4). For the second example, you could use inputs of 1, 5, 7, a first rule of '– 1', and final outputs of 0, 12, 18. Ask children to identify the second rule ('× 3').

Take the opportunity to stress that multiplication of 0 results in 0.

Tell children that you have a machine that multiplies all numbers by 2, and then adds 1. Draw the table below on the board and complete it with children.

IN	OUT
5	11
13	
	17
0	
	99

Review

Display an OHT made from Resource 6A1.3. Write 'add 2' in the first box in the rule column and 21 in the starting number box. Say that 21 is the start of a pattern or sequence.

- What will be the next number in the sequence?
- What will be the next number after 23? (25)

Establish that there is a difference of 2 between each number, so the numbers go up in twos. Complete the other three terms with the class.

- How would you describe the numbers in this sequence? (odd numbers)

On the OHT, write the rule '+ 11' and the starting number of 0.

- What will the next five numbers be?

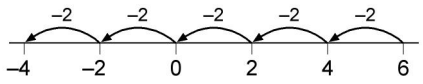
Establish that they will be 11, 22, 33, 44 and 55.

- What do you notice about the terms of this sequence? (the first digit and the last digit are the same) Will 99 be in this sequence? (yes)

On the OHT, write the rule '– 1' and the starting number of 13. Complete the next five numbers with the class.

- How would you describe the numbers in this sequence? (they are the counting numbers)
- What is the difference between this sequence and the previous two? (the first two were going up; this one is going down)

On the OHT, write the rule '– 2' and the starting number of 6. Complete 4, 2, 0 with the class. Establish that the next two terms would be –2 and –4 (negative two and negative four). Confirm by using an empty number line.



Complete the last sequence, with a rule of '× 2' and a starting number of 3.

- What do you notice about the terms of this sequence? (all even after the start number)

2

Multiplying integers and decimals

Objective: Use knowledge of place value and multiplication facts to 10 × 10 to derive related multiplication and division facts involving decimals (e.g. 0.8 × 7, 4.8 ÷ 6)

Write a decimal such as 3.275 on the board. Ask children to multiply it by 10 and explain how they did it. Repeat, multiplying and dividing by 10, 100 or 1000. Ask children to describe what is happening.

- How could we multiply 3.25 by 5?

Establish that one strategy is to multiply by 10 and halve. Extend to × 50, × 500, using × 100 and halving, or × 1000 and halving.

Give children a range of numbers to multiply by 5, 50 and 500, such as 4.65 × 5, 1.2 × 50, 3.78 × 500. Ask them to work individually and then to check their answers in pairs, discussing any differences. Draw children back together, asking for the answers and how they worked them out.

Show children how to use doubling and trebling to multiply by 4 and 6, for example:

44.3 × 4
double 44.3 → 88.6
double 88.6 →177.2

44.3 × 6 = (44.3 × 4) + (44.3 × 2)
double 44.3 → 88.6
double 88.6 → 177.2
88.6 + 177.2 = 265.8

Extend to × 40, × 600, etc.
Give children a range of questions to answer such as 25.5 × 50 and 7.65 × 600.

Use an OHP calculator or interactive whiteboard calculator to check answers and to discuss methods. Emphasise the position of the decimal point in the answers.

Review

Display this table of numbers:

1.2	76.4 × 10
550	0.32 × 10
3.2	120 ÷ 100
764	55 × 10
0.12	0.555 × 10
5.55	32 000 ÷ 100
320	12 ÷ 100
7.64	764 ÷ 100

Ask children to work in pairs to match a cell in the left-hand column with a calculation in the right-hand column.

3

Using the calculator, including the memory

Objective: Use a calculator to solve problems involving multi-step calculations

Ask children to calculate 2 + 4 × 3. Discuss the two possible answers: 18 and 14. Remind children of the meaning of brackets in a calculation. Work through examples where brackets are put in different places:

	7 × (8 + 6) (7 × 8) + 6 Get children to work in pairs to put in missing brackets for: 3 + 6 × 4 = 36 3 + 6 × 4 = 27 Discuss solutions. Stress that multiplication is completed before addition but that brackets help to avoid misunderstandings. Discuss the order of operations. Give out calculators. Use an OHP calculator or interactive whiteboard calculator to illustrate how to enter brackets. Link the use of brackets to the memory facility by presenting the following: (108 + 57) × (87 + 48) Show children how to use the [MC] key to clear the memory, the [M+] and [M–] keys to store and amend stored calculations, and the [MR] button to retrieve stored calculations. Ask children in pairs to find the missing operations in the calculations below, using their knowledge of the four operations: a (48 ○ 20) ÷ (10 ○ 3) = 4 b (352 ○ 32) ○ (416 – 338) = 858 c (472 ○ 8) + (1116 ○ 106) = 1069 d (483 ○ 20) × (119 ○ 7) = 8551 Take feedback on the answers and discuss the strategies used. Ask children to work in groups to make up their own missing-operation questions. Ask them to choose one of the questions to discuss in the review. **Review** As a class, find the answers to some of the questions. Encourage children to use correct vocabulary in explanations. Use children's strategies to exemplify calculator skills. Ask: • When would you use the memory on a calculator? • How do you enter a calculation in the memory? Discuss responses. Emphasise that the calculator is a useful tool but is not always necessary. Split the class into two groups. One group should use a calculator and the other group should use pencil and paper. Get children to close their eyes while you write on the board: (1.8 + 8.2) × (12.4 – 8.4) Ask the groups to open their eyes and to do the calculation. See if the non-calculator group can beat the calculator group.

Seven more lessons consolidating the above and extending to:

a	**Rounding decimals**
b	**Calculating mentally with integers and decimals: TU ÷ U, U.t ÷ U**
c	**Using approximations, inverse operations and tests of divisibility to estimate and check results**
d	**Solving problems and explaining reasoning and conclusions**

Unit 6A2 2 weeks

Counting, partitioning and calculating

Objectives
End-of-year expectations (key objectives) are highlighted
• Explain reasoning and conclusions, using words, symbols or diagrams as appropriate
• Solve multi-step problems, and problems involving fractions, decimals and percentages; choose and use appropriate calculation strategies at each stage, including calculator use
• Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line
• Use knowledge of place value and multiplication facts to 10 × 10 to derive related multiplication and division facts involving decimals (e.g. 0.8 × 7, 4.8 ÷ 6)
• Calculate mentally with integers and decimals: U.t ± U.t, TU × U, TU ÷ U, U.t × U, U.t ÷ U
• Use efficient written methods to add and subtract integers and decimals, to multiply and divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer
• Use a calculator to solve problems involving multi-step calculations
• Use approximations, inverse operations and tests of divisibility to estimate and check results

Starters

1	**Multiplication and division facts applied to decimals**	Recall

Objective: Calculate mentally with integers and decimals: U.t ± U.t, TU × U, TU ÷ U, U.t × U, U.t ÷ U

Use the counting stick. Count in multiples of 0.6 to 6.0, forwards and backwards.

Establish the value of the mid-point of the stick. Point to random divisions on the stick and ask individual children to identify them or the whole class to respond in unison. Move on to asking children to record their responses on individual whiteboards. Deal with any with misconceptions.

Point to a value on the stick.

- What is 0.6 more than this number? What is 0.6 less than this number?

Pair children appropriately. Ask them to record the sequence of multiples from 0.6 to 6.0. Point out the correspondence of 0.6, 1.2, 1.8, 2.4, … with the numbers in the 6 times-table.

Discard the stick. Tell children to refer to their recording and to use their fingers to support as necessary. Practise counting from 0.6 to 6.0, showing one finger and saying 0.6, two fingers and saying 1.2, and so on.

Without referring to recording, either in unison or as individuals, ask children to repeat the activity.

Pause throughout the activity, asking questions related to multiples of 0.6, such as:

- What is seven times nought point six?
- What is three point six divided by six?

Repeat for other decimal multiples, for example of 0.7.

2	**Writing and solving multi-step problems** Read **Objective:** Solve multi-step problems, and problems involving fractions, decimals and percentages; choose and use appropriate calculation strategies at each stage, including calculator use Write this scenario on the board, or have it ready on the interactive whiteboard. *Tomorrow is the school fair. Year 4 is responsible for putting up the balloons. These come in bags of 25 and cost £1.98 per bag. The children have hung 15 balloons in each corner of the rectangular hall and 18 in the centre of the hall. There are 35 more balloons in the entrance hall.* In pairs, ask children to write a question to go with this information. Then ask them to give their question to another a pair to solve. Share one or more of the problems with the whole class, discussing the methods used.
3	**Solving problems with a calculator, including using the memory** Rehearse **Objective:** Use a calculator to solve problems involving multi-step calculations Remind children of the function of the CLEAR [C] and CLEAR ENTRY [CE] keys. Write these calculations on the board or have them ready on the interactive whiteboard: 12.4 – (3.6 + 6.7) 49.5 × (3.45 + 7.4) 36.7 + (4.3 × 7) 234 ÷ (0.78 × 4) 55 × (26.5 ÷ 6) Ask children in pairs to work out the first calculation using a calculator. • Which parts did you do first? • Did the order you worked out the calculation matter? Why? Explain the significance of brackets. Deal with any misconceptions by demonstrating how to do the calculation on the OHP calculator or interactive whiteboard calculator. Get children to repeat the calculation on their own calculators, clearing the display first.

Main activities

1	**Identifying calculations and strategies needed to solve problems** **Objective:** Solve multi-step problems, and problems involving fractions, decimals and percentages; choose and use appropriate calculation strategies at each stage, including calculator use Present children with this problem. *A shop sells comics that cost 35p each. In one day the takings from comics were £23.80. How many comics did the shop sell?* • How much would the shop take if they sold 100 comics? 50 comics? • How can we estimate what the answer might be? Take suggestions, for example, £25 ÷ 50p, or 50 comics. Agree that the calculation they need to do is £23.80 ÷ 35p. • Now we know what calculation we need to carry out, how shall we do the calculation? Take suggestions. Encourage children to realise that now that they have an estimate, this is an ideal calculation to tackle with a calculator.

Get children to work out the answer with a calculator. Make sure that they know that both amounts of money must be in the same units, so that they can work out 2380 ÷ 35 or 23.8 ÷ 0.35. Check that both calculations give the same answer.

- What is the answer? (68)
- How can we check that it is correct?

Emphasise how important it is to check answers and that using the inverse operation is one way to check. Demonstrate checking using the inverse, multiplying the answer of 68 by 35 to get 2380, or by 0.35 to get 23.8.

- What calculation could you use to check using an equivalent calculation?

Take feedback and demonstrate answers, for example (2380 ÷ 5) ÷ 7.

Write this problem on the board.

Parminder saves some of her pocket money each week for a year. She saves £1.20 per week for 14 weeks and 65p per week for the remaining weeks of the year. How much does she save?

Ask children to work in pairs to solve this problem. Stress that they should record their key presses and check their answer.

- How did you work out your estimate?
- What is the answer?
- How should you interpret the calculator display?
- How did you check your answer?

Discuss with children how they recorded their solutions. Show them how to set out a solution so that someone else can follow it.

Present this problem.

A box holds 120 sewing pins. How many boxes are needed to hold 1 000 000 pins?

Ask children to work this out and then discuss how they solved it. Discuss how to interpret the calculator display after the calculation of 1 000 000 ÷ 120, in this case 8333.333.

Give other problems for children to solve with a calculator and check. For example:

There is space in a multi-storey car park for 17 rows of 32 cars on each of 4 floors. How many cars can park?

Check results. Discuss the methods used and how they were recorded.

Review

Write on the board:

□ × □ × □ = 2197

Explain that the same number must go in each box.

- What strategies can we use to solve this problem?

Allow a few moments for children to discuss their approaches. Invite a child to come forward and test their strategies, for example:

10 × 10 × 10 = 1000

20 × 20 × 20 = 8000

So the answer must lie between 10 and 20. Work systematically through the numbers 11 to 19 to find the answer. Discuss how to present solutions and ‘show your method’.

Write on the board:

□ × △ × ○ = 4897

	Explain that the three missing numbers are different prime numbers. Discuss answers and the strategies that children use, and how to present solutions.
2	**Decimal place value** **Objective:** Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line Write these numbers on the board: 4.235 2.34 23.4 5.423 3.41 243.5 4.35 0.234 Explain that when numbers have three decimal places, the third decimal place is for the thousandths. Show children how to partition 4.235: $4.235 = 4 + 0.2 + 0.03 + 0.005$ $4.235 = 4 + \frac{2}{10} + \frac{3}{100} + \frac{5}{1000}$ Show how 4.235 is written as a fraction: $4.235 = 4\frac{235}{1000}$ Point to each number in turn. • What is the value of the digit 3 in this number? Remind children of the rules for rounding numbers. Point to different numbers in turn and ask for the number when rounded to the nearest whole number, or to one decimal place. Once again, point to different numbers. This time, ask children to use their whiteboards to write the answer when each of the numbers is multiplied or divided by 10 or 100. (Make sure that, for division, the answer has no more than three decimal places.) Now ask children to write the set of numbers in ascending order. • How did you decide on the order of the numbers? • What is the most significant digit when you are ordering by size? • What do you do when two numbers have the same most significant digit, such as 4.235 and 4.25? Discuss children's answers. Remind children of the terms 'less than' and 'greater than' and the symbols < and >. Write 17.09 and 17.11 on the board. • Which sign could be placed between these numbers? Repeat using similar examples, e.g. 0.36 and 0.307. Give out copies of Resource 6A2.1 and ask children to complete it. Take feedback on the answers, discuss methods and correct mistakes. **Review** Write these numbers on the board: 5.16 51.06 15.6 6.51 1.615 1.65 0.156 1.56 Ask children to put the numbers in descending order. • What useful tips would you give to someone about ordering decimals? • Which of the numbers is equal to 156 ÷ 10? How do you know? Repeat with 15.6 ÷ 100, 5.106 × 10 and 0.156 × 100.

3	**Long multiplication** **Objective:** Use efficient written methods to add and subtract integers and decimals, to multiply and divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer Quickly draw on children's previous knowledge of the grid method and partitioning. Demonstrate one example and encourage participation. Use the ITP 'Grid multiplication' in support. 135 × 28 is approximately 140 × 30 = 4200. $\begin{array}{r\|rrr} \times & 100 & 30 & 5 \\ \hline 20 & 2000 & 600 & 100 \\ 8 & 800 & 240 & 40 \end{array}$ $\begin{array}{r} 2700 \\ +1080 \\ \hline 3780 \end{array}$ Now demonstrate an expanded 'long multiplication' on the board: $\begin{array}{rl} 135 & \\ \times\ 28 & \\ 2000 & 100 \times 20 \\ 600 & 30 \times 20 \\ 100 & 5 \times 20 \\ 800 & 100 \times 8 \\ 240 & 30 \times 8 \\ 40 & 5 \times 8 \\ 3780 & \end{array}$ Explain the steps and links to the grid method. Demonstrate how to make this more compact and efficient. Show how 135 × 20 and 135 × 8 can each be calculated in one step. Explain that 'carry' figures can be held in the head or can be jotted at the side of the paper. $\begin{array}{rl} 135 & \\ \times\ 28 & \\ 2700 & 135 \times 20 \\ 1080 & 135 \times 8 \\ 3780 & \end{array}$ Get children to work through 213 × 34 in pairs, using first the expanded and then the compact long multiplication. Make sure that they first estimate the answer, and remind them to compare the final answer with their estimates. Check answers and correct errors. Set a problem: *There are 154 screws in a box. Albert buys 36 boxes of screws. How many screws does he buy?* Encourage children to discuss their calculations then explain and demonstrate their method. Set the class further questions involving HTU × TU. **Review** Give children a multiplication statement (HTU × TU). Ask them to suggest a real-life word problem to match the statement. Then ask them to show how they would carry out the calculation, explaining their method. Finally, ask them to say how they would check their answer.

Seven more lessons consolidating the above and extending to:

a	**Deriving related multiplication and division facts involving decimals (e.g. 0.8 × 7, 4.8 ÷ 6)**
b	**Using efficient written methods to add and subtract integers and decimals**
c	**Using efficient written methods for HTU × U and HTU ÷ U, and for HTU × TU**
d	**Solving problems without and with a calculator, explaining reasoning and checking results**

Unit 6A3 2 weeks

Counting, partitioning and calculating

Objectives
End-of-year expectations (key objectives) are highlighted
• Explain reasoning and conclusions, using words, symbols or diagrams as appropriate
• Solve multi-step problems, and problems involving fractions, decimals and percentages; choose and use appropriate calculation strategies at each stage, including calculator use
• Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line
• Calculate mentally with integers and decimals: U.t ± U.t, TU × U, TU ÷ U, U.t × U, U.t ÷ U
• Use efficient written methods to add and subtract integers and decimals, to multiply and divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer
• Use a calculator to solve problems involving multi-step calculations
• Use approximations, inverse operations and tests of divisibility to estimate and check results

Starters

1	**Decimal place value using a calculator**	Read and refine

Objective: Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line

Ask children to enter 'six point seven two five' into their calculators. Check that they have entered the correct number by demonstrating on the OHP calculator or interactive whiteboard calculator. Then ask:

- What is one tenth more than the number in your display? What will the display show? (6.825) What keys should you press?
- What is one hundredth less than the number that is now in your display? (6.815)
- What is one thousandth more than the number now in the display? (6.816)

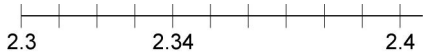
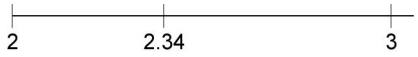
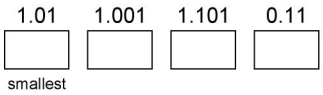
Make sure that children know that to add one tenth they key in + 0.1, to add one hundredth they key in + 0.01, and to add one thousandth they key in + 0.001. Read aloud the new numbers. Then ask:

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

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

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

Repeat, starting with 'nought point nine'.

2	**Rounding and ordering decimals** Rehearse **Objective:** Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line Remind the class how to round 2.34 to the nearest tenth. Explain that they need to decide which tenths numbers 2.34 lies between, and whether to round up or round down. Model this on a number line marked in tenths.  Explain that, as 2.34 is closer to 2.3 than to 2.4, it will be rounded down to 2.3. • Which other numbers (with two decimal places) on this line would round down to 2.3? Which would round up to 2.4? Discuss the special case of 2.35, which by convention is rounded up to 2.4. Return to 2.34. Explain how to round it to the nearest whole number. Explain that this time they must decide which whole numbers 2.34 lies between, and which it is nearest to. Model on a number line.  Ask for more examples of numbers with two decimal places that would round down to 2 when rounded to the nearest whole number, and for examples that would round up to 3. Draw a number line on the board from 5.9 to 6.1. Ask students to place 5.93, 5.99, 6.06, 6.01, 5.91 on the line. Discuss their methods and address misunderstandings. Now ask children to write these numbers in order of size, starting with the smallest. 
3	**Converting metric measurements** Rehearse **Objective:** Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line Remind children of the abbreviations for kilometre (km), metre (m), centimetre (cm) and millimetre (mm). Write these measurements on the board. 1 km = 1000 m 1 m = 100 cm 1 cm = 10 mm 1 m = 1000 mm • How do we convert or change kilometres to metres? (multiply by 1000) • How do we convert or change metres to kilometres? (divide by 1000) Ask similar questions about changing metres to centimetres, centimetres to millimetres and metres to millimetres, and vice versa. Demonstrate a few examples, changing these to metres: 1.3 km, 254 cm, 2100 mm. Add to the list on the board, pointing out the abbreviations for the units. • How do we convert or change kilograms to grams? (multiply by 1000) • How do we convert or change millilitres to litres? (divide by 1000) Demonstrate a few examples. Change 3.5 litres to millilitres, 250 grams to kilograms.

Main activities

1	**Solving word problems using a calculator** **Objective:** Use a calculator to solve problems involving multi-step calculations Make sure that calculators are available so that children can make choices about their calculation method. Write on the board: *Trainers £37.99* *Shoes £29.50* *T-shirt £12.25* *Jumper £19.75* *Socks £3.80* *Alice buys shoes and socks and pays with two £20 notes. How much change is given?* Ask children to discuss the question in pairs. Take feedback. • What operations are needed? (addition and subtraction) • What is the best way to do the calculations? Is this the most efficient way? • What is the answer? • How do you know that the answer is reasonable? • How could you check that the answer is accurate? • How would you record your solution to this problem so that someone else can follow it? Work through the calculations using column addition and then subtraction. Repeat the calculations using a calculator, demonstrating using an OHP or interactive whiteboard calculator, and getting children to follow the steps with their own calculators. Give out copies of Resource 6A3.1. Ask children to read the first question and to say how they would solve it. *Lucy's school bag weighed 5.75 kg.* *She took out a textbook weighing 0.87 kg and her lunch box weighing 0.55 kg.* *What does her bag weigh now?* Ask children to estimate the answer and discuss. Work through the question with the class, emphasising how children are to present their calculations. Ask children to answer the rest of the questions, stressing the need to make estimates before using their calculation strategies. **Review** Take feedback on solutions. Correct any mistakes and misunderstandings. • How did you record your calculation methods? Ask children to exchange their recordings for the same problem. They should give each other feedback on the recording. Does it make sense? Would they be able to follow the recording and carry out the calculation in the same way?
2	**Calculating with integers and decimals** **Objective:** Use efficient written methods to add and subtract integers and decimals, to multiply and divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer **Objective:** Use approximations, inverse operations and tests of divisibility to estimate and check results

- How can we use the answer to 5 × 7 to work out 5 × 0.7?

Establish that we can divide the answer to 5 × 7 by 10. Write:

5 × 0.7 = 35 ÷ 10 = 3.5

Remind children that multiplication can be done in any order, so that 0.7 × 5 = 5 × 0.7.

- How can we work out 5 × 0.07 or 0.07 × 5?

Establish that this time 35 should be divided by 100, so that:

5 × 0.07 = 35 ÷ 100 = 0.35

Write on the board 9 × 4, 9 × 0.04 and 9 × 0.004. Ask children to show the answers on their whiteboards. Repeat for other examples, including some in the form 0.08 × 5, stressing that 0.08 × 5 = 5 × 0.08.

Write on the board 32.6 × 4.

- What is an approximate answer?

Agree that it is about 30 × 4 = 120.

- How could you work out this calculation?

Explain that they could calculate 326 × 4 and divide the answer by 10.

Give out copies of Resource 6A3.2. Complete the first question with the class (use the other questions in subsequent lessons). Encourage children to use the more efficient short multiplication method rather than the grid method.

- If 326 × 4 = 1304, what is 1304 ÷ 4?

Agree that it is 326.

- How could we work out 1304 ÷ 4?

With the class work through the calculation.

$$
\begin{array}{r|l}
4\overline{)1304} & \\
-400 & 100\times 4 \\
\hline
904 & \\
-400 & 100\times 4 \\
\hline
504 & \\
-400 & 100\times 4 \\
\hline
104 & \\
40 & 10\times 4 \\
\hline
64 & \\
40 & 10\times 4 \\
\hline
24 & \\
24 & 6\times 4 \\
\hline
0 &
\end{array}
$$

- This is very inefficient. How could you reduce the number of steps?

Agree that they could have subtracted 300 × 4 and 20 × 4 rather than the 100s and 10s.

$$
\begin{array}{r|l}
4\overline{)1304} & \\
-1200 & 300\times 4 \\
\hline
104 & \\
80 & 20\times 4 \\
\hline
24 & \\
24 & 6\times 4 \\
\hline
0 &
\end{array}
$$

Write 1304 ÷ 4 = 326.

Work through other divisions involving division by a single digit. Include divisions with a

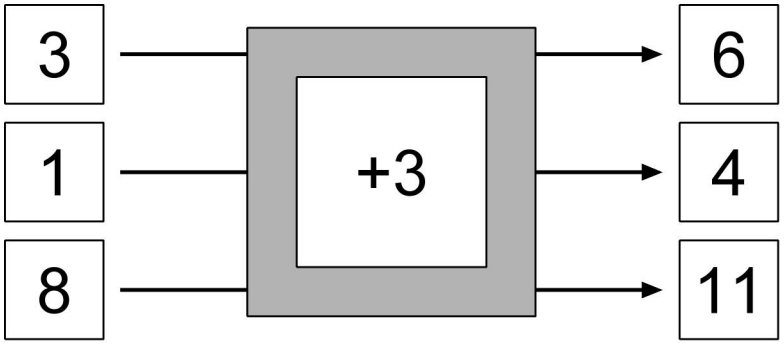
	remainder, e.g. 474 ÷ 7 = 67 R 5. Give children some divisions to work out. Ask children to complete the remaining questions on the resource sheet. **Review** Take feedback on answers and correct any errors.
3	**Exploring number relationships using a spreadsheet** **Objective:** Explain reasoning and conclusions, using words, symbols or diagrams as appropriate Children will need access to computers in this lesson. Open the Excel spreadsheet 'Sum product difference quotient' (download from www.nwnet.org.uk/pages/maths/y56/excel.html). Explain that there are two hidden numbers and that it is possible to work out what they are by using information given. Say that they can be given the sum of the two numbers, the difference, the product or the quotient. Explain that the quotient is the answer that you get when you divide one number by the other. In this case they will be given the sum and the product. Reveal the sum of the two hidden numbers. • What could the two numbers be if this is their sum? Take suggestions, noting possibilities. Reveal the product of the two numbers and ask: • Do you need to change the numbers you suggested when you only knew the sum? Why? Give children a few moments to discuss the suggested numbers, and whether any two numbers also give the correct product. • How do you go about finding numbers that satisfy the sum and the product? Take feedback. Agree that children could make a list of pairs of numbers that give the sum and decide for each pair whether they also give the product. For example, if the product is 24 and the sum is 11, you know that 5 and 6 sum to 11, but they cannot be correct as 5 × 6 = 30. Ask children to use their computers to work out one pair of hidden numbers. They should reveal the sum first, and then the product. They should use these two pieces of information to work out the hidden numbers, revealing them to check their answers. Reset the spreadsheet by hiding all the revealed information and selecting 'Reset numbers'. • I can only reveal two pieces of information. Which two would help to find the hidden pair of numbers? Why? Take feedback. Children may well choose addition or subtraction, as these are the operations they are often most comfortable with. Reveal the quotient. For example, the number 4 could be revealed. • What could the calculation be if this is the quotient? Agree that we know that the first number divided by the second number is 4. Ask children to provide examples of pairs of numbers that could generate this quotient. Record these, listing them systematically. For example: 4 ÷ 1, 8 ÷ 2, 12 ÷ 3, 16 ÷ 4, 20 ÷ 5, 24 ÷ 6, 28 ÷ 7, 32 ÷ 8, 36 ÷ 9, 40 ÷ 10 Discuss all choices, and then reveal the difference (for this example it is 27). • How does this extra information help us to find the two hidden numbers?

	Explore the differences between the dividend and the divisor. Agree that the pair 36 and 9 has a difference of 27. Some children may notice the pattern in the differences and use it to help them to find the difference that they are seeking. • What would the sum of our pair of numbers be? Reveal the sum of the two numbers to check before revealing the numbers themselves. Ask children in pairs to use the spreadsheet to work out pairs of hidden numbers. As they work through each pair of numbers ask them to consider: • How did you use the two pieces of information to find the pair of hidden numbers? They should experiment with the first piece of information they reveal and then use the second piece of information. Encourage pairs to discuss and then record the possibilities, using ICT or pencil and paper. They should also keep notes about why they chose this information. Once children have solved their problem they set a new one by first hiding revealed information and then resetting the numbers. **Review** Draw the class together. Say that you want to explore how the two pieces of information helped them to find the hidden numbers efficiently. • Which pieces of information generated the most possibilities? Why? Which generated the fewest? Ask children to refer to their notes. Agree that the quotient and product often give fewer possible pairs of numbers in a given range, so that these are useful first choices. The sum or difference can then be used to pinpoint the correct pair of numbers. A third piece of information can be used as a check before revealing the numbers themselves.

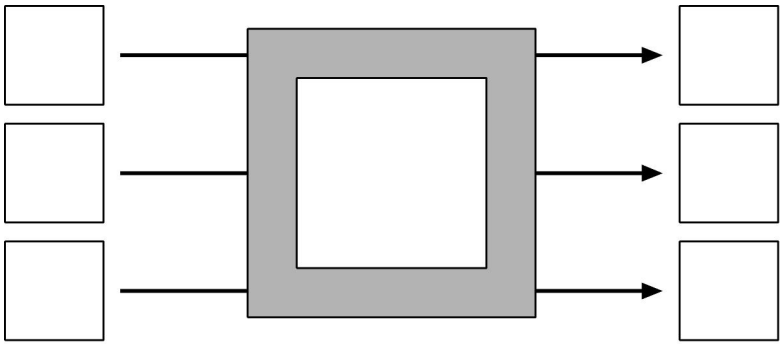
Seven more lessons consolidating the above and extending to:

a	**Calculating mentally with integers and decimals: U.t ± U.t, TU × U, TU ÷ U, U.t × U, U.t ÷ U**
b	**Using efficient written methods to multiply two- and three-digit integers by a two-digit integer (TU × TU and HTU × TU)**
c	**Solving problems involving percentages**
d	**Solving problems involving fractions**

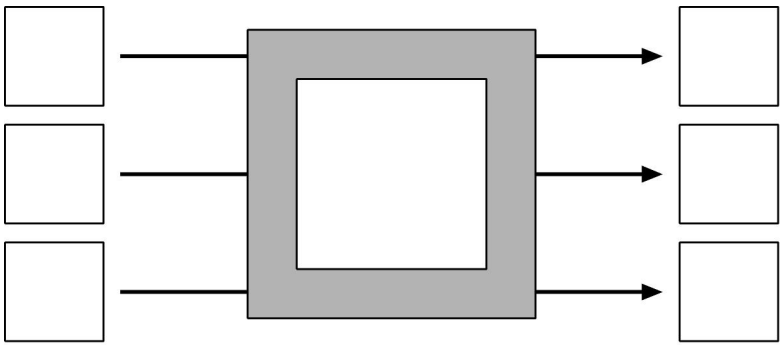
This machine adds 3 to any number.

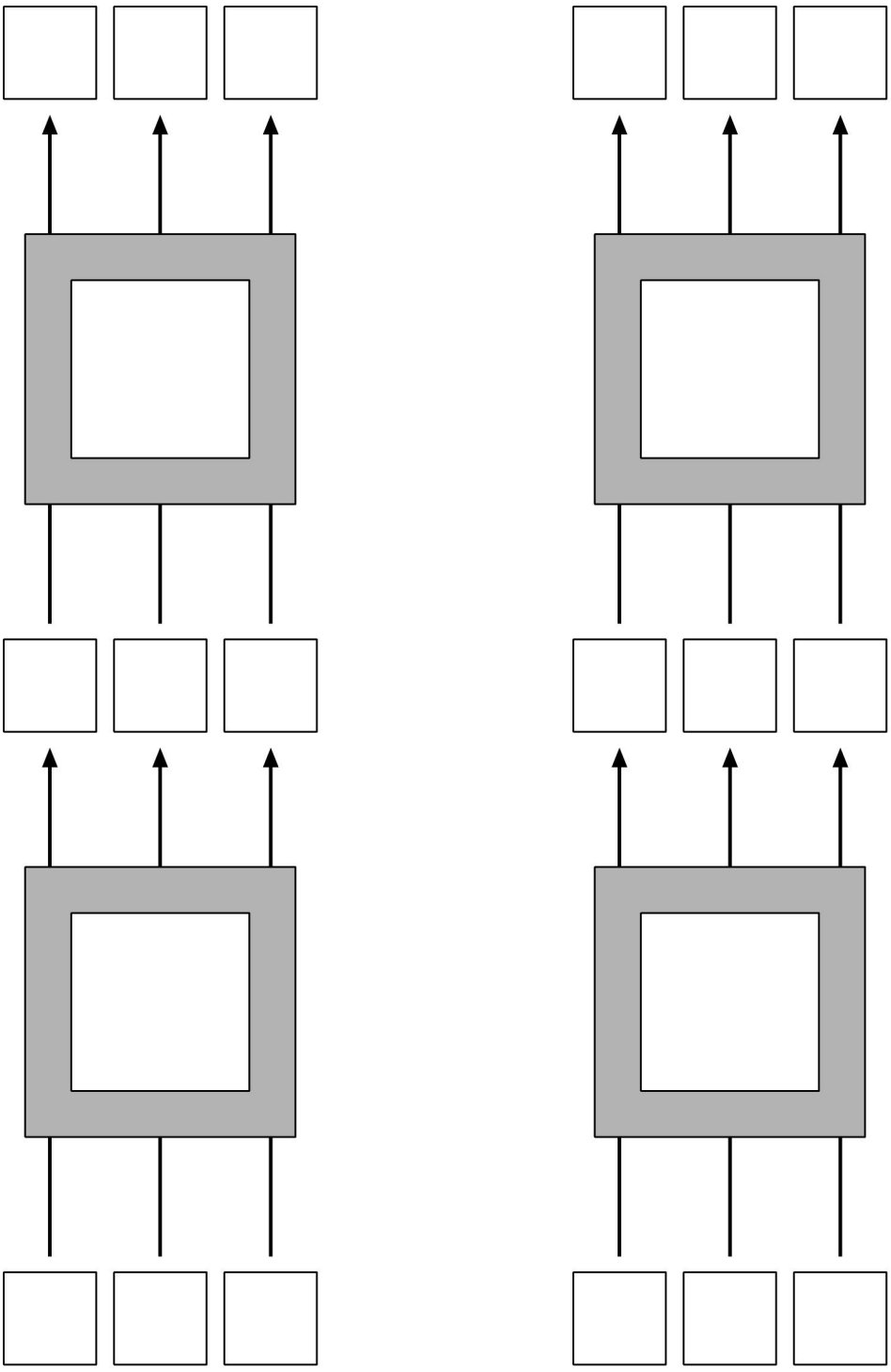


What answers will this machine give?



What is the rule for this machine?





Rule	Starting number	Next five numbers				

Put <, > or = between these pairs of numbers.

1	3.8	3.18	2	41.05	41.50
3	6.01	60.1	4	1.35	1.53
5	7.12	21.7	6	620	619.99

Write a number in each box to make each sentence true.

1 6.7 >

2 < 23.4

3 2.05 >

4 > 181.3

5 23.4 < < 35.2

6 812.6 < < 1014.1

7 6 < < 7

8 2.1 < < 2.2

1 Lucy's school bag weighed 5.75 kg.
She took out a textbook weighing 0.87 kg and her lunch box weighing 0.55 kg.
What does her bag weigh now?

2 Ben had £40 in tokens for his birthday.
He bought a CD for £13.75 and a video for £17.99 with them.
How much did he have left to spend?

3 Adam's telephone bill for January was £37.56.
February's bill was £12.48 less.
In March, the bill was £5.97 more than in January.
What was Adam's total bill for the three months?

4 Sally and Nasreen each had £10. They went to the cinema. Their return bus journey cost them £1.80 each.
Their cinema ticket was £3.75 each.
Sally bought a drink for £1.20 and a bag of popcorn for 75p.
Nasreen had an ice cream costing 90p.
How much money did Sally and Nasreen each have left?

5 Asif went to a Christmas sale.
He bought four presents originally costing
£6.99, £3.99, £5.99 and £2.99.
The sale price of the four presents was a total of £12.80.
How much money did Asif save?

32.6×4

×	300	20	6
4			

$$\begin{array}{r} 326 \\ \times \quad 4 \\ \hline \\ \hline \end{array}$$

Estimate: 30 × 4 = 120

Calculate: 326 × 4 = ☐

Answer: ☐ ÷ 10 = ☐

24.5×7

×			
7			

$$\begin{array}{r} 245 \\ \times \quad 7 \\ \hline \\ \hline \end{array}$$

Estimate: ☐ × ☐ = ☐

Calculate: ☐ × ☐ = ☐

Answer: ☐ ÷ ☐ = ☐

37.8×0.6

×			
6			

$$\begin{array}{r} 378 \\ \times \quad 6 \\ \hline \\ \hline \end{array}$$

Estimate: ☐ × ☐ = ☐

Calculate: ☐ × ☐ = ☐

Answer: ☐ ÷ ☐ = ☐

5.37×5

×			
5			

$$\begin{array}{r} 537 \\ \times \quad 5 \\ \hline \\ \hline \end{array}$$

Estimate: ☐ × ☐ = ☐

Calculate: ☐ × ☐ = ☐

Answer: ☐ ÷ ☐ = ☐

10.62×0.3

×				
3				

$$\begin{array}{r} 1062 \\ \times \quad 3 \\ \hline \\ \hline \end{array}$$

Estimate: ☐ × ☐ = ☐

Calculate: ☐ × ☐ = ☐

Answer: ☐ ÷ ☐ = ☐