

Unit 2 Problem solving

Five daily lessons

National
Numeracy Strategy

Year 5
Spring term

Unit Objectives Year 5

- Begin to use brackets.
- Use doubling or halving, starting from known facts
- Use factors.
- **Use all four operations to solve simple word problems involving numbers and quantities.**
- Choose and use appropriate number operations to solve problems, and appropriate ways of calculating: mental, mental with jottings, written methods, and calculator.
- Check with the inverse operation when using a calculator.
- Check with an equivalent calculation.

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Link Objectives

Year 4

Year 6

- Use doubling or halving, starting from known facts.
- **Choose and use appropriate number operations and appropriate ways of calculating (mental, mental with jottings, pencil and paper) to solve problems.**
- Check with the inverse operation.
- Check with an equivalent calculation.

- Use brackets.
- Use factors.
- **Identify and use appropriate operations (including combinations of operations) to solve word problems involving numbers and quantities.**
- Check with the inverse operation when using a calculator.
- Check with an equivalent calculation.

(Key objectives in bold)

This unit plan is designed to guide your teaching. You will need to adapt it to meet the needs of your class.

Resources needed to teach this unit:

- Resource sheet 2.1
- Whiteboards
- OHP calculator
- Calculators
- Dice

Planning sheet	Day One (page 1 of 2)	Unit 2 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 5
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions
<p>Identify factor pairs of small two-digit numbers.</p> <p>VOCABULARY factor pair factors divide product square</p> <p>RESOURCES Whiteboards</p>	<ul style="list-style-type: none"> Write the number 36 on the board. Explain to the children that you will write on the board a factor of 36. They are to record the other number in the factor pair whose product is 36 on their whiteboard. Write 9, 3, 18, 1 and 6. Collect and record children's answers as a list on the board. $\begin{array}{ll} 9 \times 4 = 36 & 1 \times 36 = 36 \\ 3 \times 12 = 36 & 6 \times 6 = 36 \\ 18 \times 2 = 36 & \end{array}$ Discuss the list of factors. Agree that 36 is special as one factor pair has 2 identical numbers i.e. 6. <p>Q What do we call such numbers?</p> <p>Collect answers. Establish 36 is a square number.</p> <ul style="list-style-type: none"> Repeat for 40, 24, 64. 	<p>Use factors as a strategy for mental multiplication.</p> <p>VOCABULARY factors commutative</p>	<ul style="list-style-type: none"> Write on the board $4 \times 3 \times 5$ <p>Q How would you work this out in your head?</p> <p>Establish that the operation of multiplication is commutative and that there are different ways in which the calculation can be carried out. Discuss the different ways the children did the calculation.</p> <p>Repeat with $15 \times 3 \times 2$ and $2 \times 3 \times 4 \times 5$.</p> <ul style="list-style-type: none"> Write on board: 17×12 <p>Explain to class that this calculation might look too difficult to carry out mentally but that there are ways of simplifying it.</p> <p>Q How can we change this calculation?</p> <p>Remind children of the factors they have been finding.</p> <p>Q What factors can we find for 17 and 12?</p> <p>List the factors.</p> <p>Record on the board $17 \times 12 = 17 \times 3 \times 2 \times 2$.</p> <p>Q How does this make the calculation easier?</p> <p>Explain that rewriting the calculation this way means that we can multiply 17 by 3 and then double and double.</p> <ul style="list-style-type: none"> Demonstrate use of tree diagram to illustrate a method of recording. <p>e.g.</p> $\begin{array}{c} 17 \times 12 \\ \swarrow \quad \searrow \\ 17 \times 6 \quad \times 2 \\ \swarrow \quad \searrow \\ 17 \times 3 \times 2 \end{array}$ <p>$17 \times 3 \times 2 \times 2 = 51 \times 2 \times 2 = 102 \times 2 = 204$.</p> <ul style="list-style-type: none"> Ask the children to work in pairs and use this method to find 23×6, 17×4 and 19×8. <p>Collect answers and compare the methods the children used.</p>	<ul style="list-style-type: none"> Write on the board 22×18 <p>Invite children to explain how to find the answer using factors.</p> <p>Record the different ways of carrying out the calculation.</p> <div> <p>By the end of the lesson children should be able to:</p> <ul style="list-style-type: none"> Use factors to carry out multiplication mentally. <p>(Refer to supplement of examples, section 6, page 61.)</p> </div>

Planning sheet	Day One (page 2 of 2)	Unit 2 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 5
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions
			<ul style="list-style-type: none"> Write on the board: 26×6. Explain that to help work this out we will find factor pairs for each number. Work through and record: $\begin{aligned} 26 \times 6 &= (2 \times 13) \times (2 \times 3) \\ &= 3 \times 13 \times 2 \times 2 \\ &= 39 \times 2 \times 2 \\ &= 78 \times 2 \\ &= 156 \end{aligned}$ Repeat for 34×6 asking children to prompt you at each stage. Give children similar calculations to do using this method of recording e.g. 14×8, 23×6, 24×9, 18×22 etc. Collect answers and discuss methods. Correct any mistakes and misunderstandings. 	

Planning sheet		Day Two		Unit 2 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 5
Oral and Mental		Main Teaching				Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities			Teaching Activities/Focus Questions
<p>Order a set of positive and negative integers.</p> <p>VOCABULARY negative positive reflection</p> <p>RESOURCES Whiteboards</p>	<ul style="list-style-type: none"> On the board draw a horizontal empty number line; label it -20 at the left hand end, +20 at the right. Establish that 0 is in the middle. Ask children to draw the same line on their whiteboards. Ask children for 3 positive and 3 negative numbers between -20 and +20. Write these numbers on the board. Ask the children to order the 6 numbers, placing them on their number line. Collect answers and record these on the board. Tell the children that you are now going to change the signs of the 6 numbers, making the positive numbers negative numbers and the negative numbers positive. Record these on the board. <div>Q How will the numbers change on the number line?</div> <p>Take responses and discuss children's observations.</p> <ul style="list-style-type: none"> Ask the children to record these 6 numbers and on a second number line explain their responses. <p>Encourage children to describe the change as a reflection about 0.</p> <ul style="list-style-type: none"> Repeat using other sets of negative and positive numbers. 	<p>Solve simple word problems.</p> <p>Begin to use brackets.</p> <p>VOCABULARY brackets solve listing</p> <p>RESOURCES Dice</p>	<ul style="list-style-type: none"> Write up on the board: fish £2 chips £1 <div>Q I have just spent £9. What could I have bought?</div> <p>Discuss the different possibilities.</p> <div>Q How many fish could I have bought?</div> <p>Establish that I could have bought 0, 1, 2, 3 or 4 fish and that listing these this is a good way of sorting all the possibilities. On the board draw up a list with the children: Fish 0 1 2 3 4 Chips 9 7 5 3 1 Start with the numbers of fish, then the chips needed to make £9. Discuss each case and establish there are 5 possibilities. Say a cola cost 50p and pizza £1.50. If I spend £8 what can I buy? Ask the children to make a list to find all the answers. Collect solutions and discuss strategies. Set children in pairs to create a similar problem for other pairs to answer. Discuss the problems and solutions. Return to the first problem. Say a child goes to the chip shop, and asks for "two fish and chips". The owner asks for £6, but the child expects the total to be £5. <div>Q Can you explain why?</div> <p>Write on the board 'two (fish and chips)', and '(two fish) and chips'.</p> <div>Q What is the difference between the two statements?</div> <p>Establish the difference between the two statements and how brackets can be used to explain the difference: $2 \times (£2 + £1)$ and $(2 \times £2) + £1$.</p> <p>Point out how the brackets remove the confusion, and that when doing the calculation, the step in brackets is always done first.</p> <ul style="list-style-type: none"> Write on the board: $6 + 3 - 2$ and $6 - 3 + 2$. <div>Q How would you work out this calculation?</div> <p>Compare $(6 + 3) - 2$ and $6 + (3 - 2)$ and agree that these give the same answer, 7. Compare $(6 - 3) + 4$ and $6 - (3 + 2)$. Agree the first is 5 while the second is 1. Emphasise this difference and how we use etc. Emphasise the difference and how use of brackets helps to ensure there is only one answer.</p> <ul style="list-style-type: none"> Ask a child for a target number between 20 and 50. Roll a die 3 times and record the numbers on the board. Children work in pairs to make a calculation using the 3 numbers and brackets so that the calculation is as close to the target number as possible e.g. for target 30 – compare: $(6 - 1) \times 4$, $(6 \times 4) + 1$, $6 \times (4 + 1)$, $(6 + 1) \times 4$. Play the game - Discuss some of the calculations the children have created and the solutions they have obtained. Repeat. </p>			<ul style="list-style-type: none"> Write on the board $4 + 7 \times 3$ $4 + 7 + 3$ $4 \times 2 \times 3$ $4 - 2 \times 3$ <p>Say that children can use brackets anywhere they like for these calculations.</p> <div>Q Which calculation could give the biggest answer?</div> <div>Q Which calculation could give the smallest answer?</div> <ul style="list-style-type: none"> Discuss children's solutions and reasons, explore the use of brackets to make the largest and smallest totals. <div>By the end of the lesson children should be able to:</div> <ul style="list-style-type: none"> Use brackets: Solve simple word problems by listing. <p>(Refer to supplement of examples, section 6, pages 53 and 82 to 89.)</p>

Planning sheet		Day Three		Unit 2 <i>Problem solving</i>		Term: <i>Spring</i>		Year Group: 5		
Oral and Mental			Main Teaching				Plenary			
Objectives and Vocabulary		Teaching Activities		Objectives and Vocabulary		Teaching Activities		Teaching Activities/Focus Questions		
Use doubling and halving, starting from known facts.		<ul style="list-style-type: none">Write an even single-digit number on the board. Invite children to double the number, keep doubling until no child can go any further. Then half the number until the children stop.Write on the board: $24 \times 4 = 24 \times 2 \times 2$		Use all four operations to solve simple word problems.		<ul style="list-style-type: none">Write on the board a number of simple calculations, with all four operations represented. Include one-step calculations, and two-step calculations, for example: $48 \div 8$ $43 + 27 + 12 + 14$ $617 - 322$ $(33 - 18) \times 2$ $23 - 17$ $(3 + 5) \times 2$ $(12 \div 2) - 2$ $36 \div (4 + 2)$ Remind the children that the brackets indicate the first stage of a calculation. Ask: <div>Q In a class of 33 children, 18 children had no pets, the others had two pets each. How many pets is that?</div> Discuss the problem and ask children to identify the calculation, from the list on the board, needed to solve the problem. <div>Q Why did you choose that calculation?</div> Establish that children recognised why $(33 - 18) \times 2$ is the calculation needed.		<ul style="list-style-type: none">Explain that the answer to a problem is 37 legs. Discuss the different objects or 'things' that have legs and ask the children to work in pairs to make up a word problem to which the answer is 37 legs. Discuss some of the problems and explore the different calculations and use of brackets.		
VOCABULARY double halve		Agree the answer is $48 \times 2 = 96$.		Begin to use brackets.		Discuss the problem and ask children to identify the calculation, from the list on the board, needed to solve the problem.		HOMEWORK - On the board write four number sentences. Ask the children to copy these into their books. For homework the children are to use the number sentences and make up associated word problems they are then to solve.		
RESOURCES Whiteboards		<div>Q How can we work out the answer to 24×4 using the above statement?</div> Agree the answer is $48 \times 2 = 96$.		VOCABULARY operation		<div>Q Why did you choose that calculation?</div> Establish that children recognised why $(33 - 18) \times 2$ is the calculation needed.		<div>By the end of the lesson children should be able to:</div> <ul style="list-style-type: none">Solve 'story' problems about numbers in real life, choosing the appropriate operation and method of calculation;Explain and record using numbers, signs and symbols how the problem was solved. (Refer to supplement of examples, section 6, pages 82-89.)		
		<div>Q How can we work this out?</div> Collect suggestions and write on the board: $(560 \div 2) \div 2$.				Working in pairs, invite the children to develop and write down word-based problems for which the other calculations listed on the board will be the solutions.				
		Explain that dividing by 4 is the same as halving and halving again. In this case: $560 \div 2 = 280$ $280 \div 2 = 140$.				Invite children to read out their problems to the rest of the class. Ask the class about the calculation they would use to solve the problem.				
						<div>Q Which calculation matches the word problem? How did you decide?</div> Ensure children can identify and use the correct vocabulary associated with the four operations to help them match the calculations to the problems. Ask the class how they would work out the calculations to ensure they understand how to use the brackets.				
						Invite the children to write their own calculation, and then to develop a word problem from it. Encourage them to develop problems which use all four operations.				
						Select children to read out their problem to the rest of the class. Write up the problem on the board. Children work in pairs on the word problems presented.				
						Discuss children's solutions and compare them with the methods used by the children presenting the problem.				

Planning sheet		Day Four		Unit 2 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 5
Oral and Mental			Main Teaching			Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions		
<p>Develop calculator skills and use a calculator effectively.</p> <p>Begin to use brackets.</p> <p>VOCABULARY operation</p> <p>RESOURCES OHP calculator Calculators</p>	<ul style="list-style-type: none"> Present the following problem: A class of 37 children were deciding what type of drink they should have when they go on their day out. 15 children said they would like cola, 17 said they would like orange and the remainder said they would like fruit juice. Cola and orange cost 35p and fruit juice cost 27p. Ask the children to work in pairs and use calculators to calculate how much the drinks would cost for the class. <p>Tell them that they should record each calculation they make.</p> <p>Discuss children's methods and their calculations. Confirm the answer.</p> <ul style="list-style-type: none"> Explore the most efficient strategy. Write on the board $(37 \times 0.35) - (5 \times 0.08)$. <p>Discuss the meaning of he brackets and how to use the calculator to carry out calculations like these.</p> <p>Ask children to work out the answer to this calculation using their calculators. Confirm that it gives the answer to the problem.</p> <div>Q Why does this calculation work?</div> <p>Discuss children's responses and reasons.</p>	<p>Check with the inverse operation when using a calculator.</p> <p>Use all four operations to solve simple word problems.</p> <p>VOCABULARY inverse operation</p> <p>RESOURCES Calculators OHP calculator</p>	<ul style="list-style-type: none"> Discuss some of the children's word problems from the homework. Discuss word problems that associate with each of the four number sentences and highlight common features and vocabulary. Present the following problem ' 22 children each received the same number of merits. Between them they have 242 merits. How many merits does each child have?' <div>Q What calculation would I carry out to solve this problem?</div> <ul style="list-style-type: none"> Establish that the required calculation is $242 \div 22$. On the OHP calculator confirm that the answer is 11. <div>Q What calculation would I carry to check that the answer is 11?</div> <ul style="list-style-type: none"> Establish that the calculation will be 22×11. Explain to the children that checking a calculation in this way is called 'using the inverse operation'. Carry out the calculation on the OHP calculator. Say a reading book is 14 mm wide. There are 36 reading books on the classroom shelf. The shelf is 65 cm wide. How much space is left on the shelf? <div>Q What calculation would I carry out to solve this problem?</div> <p>Collect answers, ensure children take account of the units to establish the calculation is $650 - (36 \times 14)$.</p> <ul style="list-style-type: none"> Write on the board: CANS BOXES CHILDREN MONEY TIME WEIGHT Explain that the children are to work in pairs to make up word problems. Each word problem must contain at least two of the above words. <p>For each problem they make up they should record the calculation needed to solve the problem.</p> <ul style="list-style-type: none"> Invite pairs of children to come to the board. One child reads out the problem and the other records the required calculation along with their answer. <p>Confirm with the class that the calculation is correct and together use their calculators to work them out.</p> <ul style="list-style-type: none"> Ask the children to choose a calculation on the board and work out a way to check the answer by using the inverse operation. Discuss some of the strategies that the children have used to check using inverse operations. 	<ul style="list-style-type: none"> Write on the board $(18 \times 7) + 3$ $18 \times (7 + 3)$ Ask the children to work in pairs to make up a word problem for each calculation and that for both examples you want them to use the 18 to represent children, the 7 to represent pounds. Allow children some time to make up two problems. Discuss some of the problems made and for each of those ask: <div>Q What could the 3 represent?</div> Establish that the 3 will have to represent money in both problems if the calculation is to make sense. <div> <p>By the end of the lesson children should be able to:</p> <ul style="list-style-type: none"> Check answer by performing inverse calculation; Solve 'story' problems about numbers in real life choosing the appropriate operation and method of calculation. <p>(Refer to supplement of examples, section 6, pages 71, 73.)</p> </div>		

Planning sheet	Day Five (page 1 of 2)	Unit 2 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 5
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions
<p>Add or subtract any pair of two-digit numbers, including crossing 100.</p> <p>VOCABULARY sum difference two-digit</p> <p>RESOURCES Whiteboards</p>	<ul style="list-style-type: none"> Write on the board 23 and 57. <div>Q What is the sum of these numbers? Q What is the difference between these numbers?</div> <p>Collect and confirm the answers.</p> <ul style="list-style-type: none"> Tell the children that you are going to call out a two-digit number. Before you call out the number you will say if the number is more than or less than 50 and give a property of the number. <p>For example 'I am going to call out a number greater than 50 that is a multiple of 5.</p> <div>Q What numbers might I call out?</div> <ul style="list-style-type: none"> Explain that before you say the number the children have to write a two-digit number on their whiteboards. They should choose a number so that the sum of their number and your number will be a multiple of 5. Ask the children write a two-digit number on their whiteboards. <p>Say that your number is 65.</p>	<p>Solve problems. Choose appropriate operations and methods.</p> <p>VOCABULARY one step two step</p> <p>RESOURCES Resource sheet 2.1 Calculators</p>	<ul style="list-style-type: none"> Give out Resource sheet 2.1. Explain that the table gives the costs of pizza from a take away. Discuss the table with the class. <div>Q What does a large mushroom pizza cost? What would it cost with an extra topping of cheese?</div> <p>Collect answers and correct any misunderstandings. Ensure that children can interpret the data in the table.</p> <ul style="list-style-type: none"> Ask children to find the cost of the pizzas set out under A. Collect answers and discuss the ways the children answered the questions. For example, ask: <div>Q For question 1, did you find the cost of the toppings first or start with the cost of the pizza? Which method is easier?</div> <div>Q For question 4, did you work out the cost of each pizza and then add them together or list the items and add them?</div> <ul style="list-style-type: none"> Ask the children for the calculations involved such as: Question 2, $(2 \times £4.65) + £4.50$, and for Question 3, $£3.80 + £0.60 + £5.80 + £0.40$. <p>Emphasise that the only operations used were addition and multiplication and brackets were not always needed.</p> <ul style="list-style-type: none"> Discuss part B and ask children to work out what pizzas Sue and Ravi could buy. This time they can use calculators if they wish. Collect answers. <div>Q Did you use a calculator or not? What jottings did you make?</div> <p>Discuss the methods the children used.</p> <div>Q Did you take away the cost of the toppings?</div> <p>Establish that as the toppings cost £1, the pizza must cost £9 or less. Use this to begin to identify the choices available to Sue and Ravi.</p> <ul style="list-style-type: none"> Discuss the extent the calculator was needed for this problem and when calculators are really helpful. 	<ul style="list-style-type: none"> Collect answers from the children and record these on the board. <div>Q What numbers did you try and why?</div> <p>Discuss children's strategies.</p> <div>Q As 5 is a factor what can you say about one of the consecutive numbers?</div> <p>Establish it must end in a 5 or a 0.</p> <div>Q As 4 is a factor, what must one of the other numbers be?</div> <p>Establish it must be even.</p> <ul style="list-style-type: none"> Write on the board: 100. <div>Q What three consecutive numbers can we try?</div> <p>Agree they could be 98, 99, 100 or 100, 101, 102 but not 99, 100, 101 as neither 99 nor 101 is even.</p> <div>Q Which of the two other sets should we discard? Why?</div> <p>Remind children that dividing by 4 is the same as halving and halving again. Half of 102 is 51 and so 4 does not divide into 102.</p> <div>Q Does 3 divide into 99?</div> <p>Agree it does. Half of 98 is 49 so 4 does not divide into 98 and neither set of numbers works.</p> <ul style="list-style-type: none"> Explain to the children that even though they could have used a calculator, applying what they know about numbers is often more efficient.

Planning sheet		Day Five (page 2 of 2)		Unit 2 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 5
Oral and Mental			Main Teaching			Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions		
	<ul style="list-style-type: none"> Children work out the sum and difference of the two numbers and record on their whiteboard. Repeat for other numbers and other properties and conditions. 		<ul style="list-style-type: none"> On the board write: 3, 4, 5. <p>Say that you want the children to find sets of three consecutive numbers. For one of the numbers 3 is a factor, for another 4 is a factor and 5 is a factor of the other number.</p> <p>Say that the first set of consecutive numbers is 3, 4 and 5, but there are many more sets of numbers to find.</p> <ul style="list-style-type: none"> After a while, collect a solution e.g. 8, 9, 10 and record it on the board. Ensure children understand the problem. Use 8, 9 and 10 to emphasise that the factors do not have to be in the order 3, 4 and 5. 	<div> <p>By the end of the lesson children should be able to:</p> <ul style="list-style-type: none"> Solve 'story' problems about numbers in real life choosing the appropriate operation and method of calculation; Make and justify decisions. <p>(Refer to supplement of examples, section 6, page 73.)</p> </div>		

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

A. Find the cost of:

1. One small mushroom pizza with extra cheese and tomato topping.
2. Two large cheese pizzas and one small chicken pizza.
3. A small ham pizza with extra cheese and a large tuna pizza with extra tomato.
4. A large salami pizza with extra cheese and two small cheese pizzas, one with extra tomato.

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