Unit 10
Calculations and problem solving

Five daily lessons

National
Numeracy *Strategy*

Year 4
Spring term

Unit Objectives
Year 4

• Approximate first. Use informal pencil and paper methods to support, record or explain multiplications and divisions.	Pages 66, 68
• Use informal pencil and paper methods to support, record or explain additions/subtractions.	Pages 48, 50
• **Choose and use appropriate number operations and appropriate ways of calculating (mental, mental with jottings, pencil and paper) to solve problems.**	Page 74
• Use all four operations to solve word problems involving numbers in 'real life', money and measures (including time), using one or more steps.	Page 88
• Check with the inverse operation.	Page 72

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 10.1
- Resource sheet 10.2
- Activity sheet 10.1
- Activity sheet 10.2
- OHT 10.1
- Whiteboards
- Large demonstration clock
- Set of clock faces

Link Objectives

Year 3

- Use known number facts and place value to carry out mentally simple multiplications and divisions.
- **Choose and use appropriate operations (including multiplication and division) to solve word problems,** and appropriate ways of calculating: mental, mental with jottings, pencil and paper.
- Use informal pencil and paper methods to support, record or explain HTU±TU, HTU±HTU.
- Check subtraction with addition, halving with doubling and division with multiplication.

Year 5

- Approximate first. Use informal pencil and paper methods to support, record or explain multiplications and divisions.
- Use informal pencil and paper methods to support, record or explain additions and subtractions.
- Choose and use appropriate number operations to solve problems, and appropriate ways of calculating: mental, mental with jottings, written methods, calculator.
- Check with the inverse operation when using a calculator.

(Key objectives in bold)

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Planning sheet	Day One	Unit 10 *Calculations and problem solving*	Term: *Spring*	Year Group: *4*

Oral and Mental		**Main Teaching**		**Plenary**
Objectives and Vocabulary	**Teaching Activities**	**Objectives and Vocabulary**	**Teaching Activities**	**Teaching Activities / Focus Questions**

Multiply any integer up to 1000 by 10 and understand the effect.	• Recite the 10 times table with the class. Repeat and record the numbers on the board: 1 10 2 20 3 30 4 40 5 50 6 60 7 70 8 80 9 90 10 100 **Q** What happens to the digits 1, 2, 3 etc. when you multiply by 10? Establish that the digits move one place to the left and a zero is placed in the units column. • **Q** What is 30×10? Agree the answer is 300 and add this to the list on the board next to 30. Complete the third column, multiplying 10, 20, etc. by 10. • **Q** If we multiply the numbers in this column by 10, what numbers will we add to the next column? • Complete the column and point to numbers in the table, asking the children to read them aloud, e.g. 700, 3000. • Write 60×4 on the board. Remind children that $60 = 10 \times 6$ so $60 \times 4 = 10 \times 6 \times 4$. **Q** What is $10 \times 6 \times 4$? **Q** Which part of this multiplication would you do first? Why?	Use informal pencil and paper methods to support, record or explain multiplications. Approximate first.	• Write 26×4 on the board and ask children to work it out mentally. **Q** How did you work it out? Discuss strategies (e.g. double, double again; $25 \times 4 + 4$; partitioning etc.). Focus on partitioning and show how this can be recorded as: $26 \times 4 = (20 \times 4) + (6 \times 4)$ $ = 80 + 24$ and $ = 104$ 	×	20	6
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4	80	24	$= 104$ Clarify how each part of the process represents the mental method. • Write 52×9 on the board. **Q** Can you work this out in your head? How? Establish that the numbers involved are difficult to handle mentally. **Q** Can we approximate the answer? Give the children time to work out an approximate answer. **Q** How did you make your estimation? Discuss and compare methods, (e.g. 52×10, 50×10, 100×9 halved etc.). Agree the answer is about 500. **Q** How can we work out the exact answer? Discuss suggestions, then demonstrate the grid method: 	×	50	2
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9	450	18	$= 468$ Compare answer with the approximation of 500. Emphasise the importance of an approximation. • Repeat with a similar calculation, e.g. 68×3, then set examples for children to multiply independently using the grid method. Emphasise that they must record their approximation first.	• Write on the board: How many sweets are needed for party bags if 23 children are to have 8 sweets each? **Q** What calculation do we need to solve this problem? • Work through steps of approximating and grid multiplication taking prompts from the children. • Write on the board: | ×	?	?
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?	300	25	$= 325$ Discuss what the original question might have been. **By the end of the lesson the children should be able to:** • **Explain how the grid method for $TU \times U$ can be used to solve multiplication questions;** • **Appreciate the value of approximating first.** (Refer to supplement of examples, section 6, page 66.)
RESOURCES Whiteboards		VOCABULARY approximate estimation		

Planning sheet	Day Two	Unit 10 *Calculations and problem solving*	Term: *Spring*	Year Group: *4*

Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	**Teaching Activities**	**Objectives and Vocabulary**	**Teaching Activities**	**Teaching Activities / Focus Questions**

Oral and Mental — Objectives and Vocabulary	Oral and Mental — Teaching Activities	Main Teaching — Objectives and Vocabulary	Main Teaching — Teaching Activities	Plenary — Teaching Activities / Focus Questions
Divide any integer up to 1000 by 10 (whole-number answers) and understand the effect.	• On the board write: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100. Point to one of the numbers, e.g. 60 **Q** What is $60 \div 10$? Agree the answer is 6 and $6 \times 10 = 60$. Repeat using other numbers listed. • **Q** What happens to the digits when we divide by 10? Establish the digits move one place to the right. Compare with the effect of multiplying by 10. • **Q** What is $300 \div 10$? Agree the answer is 30 as $30 \times 10 = 300$. Repeat using other 100s numbers. • **Q** What is $240 \div 10$? Agree the answer is 24 as $24 \times 10 = 240$. Emphasise the inverse relationship between division and multiplication using these examples. Ask quickfire division questions ($\div 10$). Children write their answers on whiteboards.	Use informal pencil and paper methods to support, record or explain divisions. Approximate first. Check with the inverse operation. VOCABULARY multiply divisor chunking inverse remainder	• Write $72 \div 4$ on the board. **Q** How can we approximate the answer? Discuss suggestions. Establish that as $20 \times 4 = 80$ and $15 \times 4 = 60$, the answer is between 15 and 20. • Demonstrate how to find the exact answer by subtracting chunks or multiples of the divisor 4 and record as you do so, e.g. ten fours make 40, that leaves 32. Refer to this method as 'chunking'. **Q** How many 4s make 32? **Q** There are 10 fours and 8 fours in 72, how many altogether? $$\begin{array}{r} 72 \\ -40 \quad (10 \times 4) \\ \hline 32 \\ -32 \quad (\ 8 \times 4) \\ \hline 0 \end{array}$$ Agree that $72 \div 4 = 18$ **Q** Is the answer correct? **Q** How can we check? Discuss suggestions. Compare the answer 18 with the estimates 15 and 20. As 18 lies between these numbers it supports 18 as the answer. Remind children that multiplication is the inverse of division and is a good way to check. • Confirm that $72 \div 4 = 18$ should mean $72 = 18 \times 4$. Demonstrate 18×4 using partitioning: $18 \times 4 = (10 \times 4) + (8 \times 4)$ $\quad\quad\quad = 40 + 32$ $\quad\quad\quad = 72$ and the grid method | $\times$	10	8	
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4	40	32	$= 72$ | • Repeat with a similar calculation, e.g. $87 \div 3$. Ask children to direct you through the process. Repeat until most children are confident. • Provide examples for children to practise, using calculations which divide exactly with no remainders. Interact with the children, discuss strategies and correct any mistakes and misunderstandings.	• Write on the board: A shop notice states that there are 95 shopping days to Christmas. How many weeks is that? **Q** What calculation do we need to solve this problem? Confirm it means we need to find how many 7s in 95, i.e. $95 \div 7$. **Q** How can we approximate the answer? Agree that $10 \times 7 = 70$ so the answer is bigger than 10, but $15 \times 7 = 105$ so the answer is less than 15. Work through the method: $$\begin{array}{r} 95 \\ -70 \quad (10 \times 7) \\ \hline 25 \\ 21 \quad (3 \times 7) \\ \hline 4 \end{array}$$ The answer is 13 R 4. **Q** What does this mean? Establish that the 13 means 13 weeks and the 4 means 4 days. Answer is 13 weeks 4 days. • Discuss remainders and how to use them when checking. Work through $13 \times 7 = 70 + 21 = 91$ days $91 + 4 = 95$ days. **By the end of the lesson the children should be able to:** • **Explain an informal pencil and paper method for division of TU ÷ U;** • **Understand that multiplication, the inverse operation, is very useful for checking division calculations.** (Refer to supplement of examples, section 6, pages 68 and 72.)
VOCABULARY inverse RESOURCES Whiteboards				

NNS Unit Plans

Planning sheet	Day Three	Unit 10 *Calculations and problem solving*	Term: *Spring*	Year Group: *4*

Oral and Mental		**Main Teaching**		**Plenary**
Objectives and Vocabulary	**Teaching Activities**	**Objectives and Vocabulary**	**Teaching Activities**	**Teaching Activities / Focus Questions**
Choose appropriate number operations to solve problems.	• Ask children to suggest words or phrases relating to each of the four rules, e.g. **Q** Can you give me a word or phrase that means we would subtract? • Use the cards cut from Resource sheets 10.1 and 10.2. Ask children to respond by writing the corresponding symbol (+, −, ×, ÷) on whiteboards as you hold up each card in turn. • On the board, arrange the cards into groups associated with each operation. Discuss words that may cover more than one operation, e.g. 'altogether' could be addition or multiplication. • Pick a word from each operation group. Ask children to form a statement or a question using that word which would require a calculation using the operation for the group, e.g. 'decrease' might be under subtraction. Decrease £25 by £9.	Choose and use appropriate number operations to solve problems. Approximate first.	• Write a problem on the board such as: In a group of 8 people each pays £24 to get into a theme park. How much do they pay altogether? **Q** Which words may tell us what type of calculation to do? **Q** What other important information do we need? Discuss children's suggestions. Underline key words and numbers in the problem. **Q** What is the calculation that we need to do? Write 24 × 8 on the board. Approximate using 8 × 20 = 160 and 8 × 25 = 200 (doubling 3 times). The answer is between 160 and 200. With the children work through the grid method on the board: <table><tr><td>×</td><td>20</td><td>4</td></tr><tr><td>8</td><td>160</td><td>32</td></tr></table> = 192 Compare 192 with the approximations 160 and 200. Agree 192 seems sensible. **Q** What does the answer tell us? Establish that this is the amount of money paid. Write on the board they paid £192 altogether. Emphasise the need to add the units and to use the approximations to see if the answer is sensible. • Give out Activity sheet 10.1 of assorted word problems. Pupils work in pairs to discuss each problem and sort into 4 groups, according to whether the problem requires a +, −, ×, ÷ calculation. Get feedback from children about the decisions they made. • Ask children to solve the multiplication and division problems using the grid method and chunking.	• Use question 9 from the Activity sheet 10.1. **Q** How did you decide it was a multiplication problem? **Q** What calculation is required? **Q** How did you partition the numbers? Work through the calculation, approximate first and check. Remind children to set the answer in context. • Use question 10 from the Activity sheet 10.1. **Q** How did you decide it was a division problem? **Q** What division is required? **Q** How did you work the calculation out? Work through the calculation, check using multiplication. **By the end of the lesson the children should be able to:** • **Make and justify decisions: – choose the appropriate operation(s) to solve word problems.** (Refer to supplement of examples, section 6, page 74.)
VOCABULARY plus sum total add increase take away minus subtract difference less than multiply decrease altogether divide share product more than RESOURCES Resource sheet 10.1 Resource sheet 10.2 Whiteboards		RESOURCES Activity sheet 10.1		

Planning sheet	Day Four	Unit 10 *Calculations and problem solving*	Term: *Spring*	Year Group: *4*

Oral and Mental

Objectives and Vocabulary	Teaching Activities
Add or subtract 2 two-digit numbers (not crossing the 100 boundary). Derive addition pairs that total 100. Write subtraction facts corresponding to given addition facts.	• Show OHT 10.1. <table><tr><td>55</td><td>13</td><td>81</td><td>23</td></tr><tr><td>40</td><td>63</td><td>45</td><td>60</td></tr><tr><td>19</td><td>70</td><td>20</td><td>33</td></tr></table> Ask a range of questions to practise addition and subtraction strategies and discuss different methods used, e.g – Can you find pairs of numbers that total 100? – Can you find two numbers with a difference of 10? . . . 20? . . . 50? – Choose two of the corner numbers and add them together. What strategies did you use? – Start with 70. Which number would you subtract from 70 to leave 30? . . . 57? . . . 15? – Which two numbers have the smallest difference? Children write their answers on whiteboards.
RESOURCES OHT 10.1 Whiteboards	

Main Teaching

Objectives and Vocabulary	Teaching Activities
Choose and use appropriate number operations and appropriate ways of calculating to solve problems.	• Remind children they have been using mental methods at the start of the lesson. Write the problem on board: There are 37 red cars in a car park and 56 blue. How many cars are there altogether? **Q** What calculating methods could we use to solve this? Make point that jottings may help with this calculation, e.g. 37 + 56 30 + 50 = 80 7 + 6 = 13 80 + 13 = 93 or $$\overset{+50}{\frown}\quad\overset{+6}{\frown}$$ 37 87 93 • Change the problem to: There are 358 red cars in a car park and 73 blue. How many cars are there altogether? **Q** What methods of calculating could we use now? Remind children how to use a pencil and paper method for addition. 358 + 73 or 300 120 11 431 358 + 73 11 120 300 431 • Write on the board: Alice's journey to school takes 46 minutes, John's takes 17 minutes. What is the difference between their journeys? **Q** What calculation do we need to carry out? **Q** What method could we use? Emphasise the use of jottings, e.g.
VOCABULARY mental method jottings pencil and paper method	

(Continued Teaching Activities, second column)

$$\overset{-20}{\frown}$$
$$\overset{+3}{\frown}$$
26   29   46

46 − 20 + 3 = 26 + 3 = 29

or,
$$\overset{+3}{\frown}\quad\overset{+20}{\frown}\quad\overset{+6}{\frown}$$
17   20   40   46

3 + 20 + 6 = 29

Set the answer in context i.e. 29 minutes.

Change the problem to:

Alice walks 826 paces to see her friend. John walks 88 paces to see his. How many more paces does Alice walk?

Explain that children can still use their jottings, e.g.

$$\overset{+12}{\frown}\quad\overset{+700}{\frown}\quad\overset{+26}{\frown}$$
88   100   800   826

826
− 88
 12   to make 100
700   to make 800
 26   to make 826
738

or,
$$\overset{-100}{\frown}$$
$$\overset{+12}{\frown}$$
726   738   826

826
− 88
726   (826 − 100)
+ 12   (since 100 − 88 = 12)
738

• Set children assorted problems involving addition and subtraction.

Interact with children, discuss methods and correct any misunderstandings.

Plenary

Teaching Activities / Focus Questions
• Write the number sentence $12 \times 7 = 84$ on the board. Ask pupils to work in pairs and suggest a word problem that would lead to this calculation. HOMEWORK Give the children the following calculations: 23×6, $467 + 78$, $342 − 65$, $95 ÷ 5$ Ask them to write four word problems of their own that use these calculations, then solve them. **By the end of the lesson the children should be able to:** • **Explain an informal pencil and paper method for addition and subtraction;** • **Choose appropriate ways of calculating to solve problems;** • **Explain and justify methods used and decisions made;** • **Make up a word problem to reflect given statements.** (Refer to supplement of examples, section 6, pages 48, 50 and 74.)

Planning sheet	Day Five	Unit 10 *Calculations and problem solving*	Term: *Spring*	Year Group: *4*

Oral and Mental		**Main Teaching**		**Plenary**
Objectives and Vocabulary	**Teaching Activities**	**Objectives and Vocabulary**	**Teaching Activities**	**Teaching Activities / Focus Questions**
Read the time from an analogue clock to the nearest minute and from a 12-hour digital clock. Use am and pm and the notation 9:53.	• Give pupils, in pairs, a clock face. Write 9:00am and 9:00pm on the board. Ask children to read these times. **Q** What does am and pm mean? Establish that am means the morning and pm means afternoon. Ask them to set the clock at 9:00am. Check they are accurate. • Tell pupils: I left home at 9:00am and drove for $2\frac{1}{4}$ hours to get to my friends. What time did I arrive? Children show the time on their clocks. Continue telling a story about the day, asking children to show the correct time. Record on the board the time using am and pm and the equivalent digital clock times. Emphasise that 9:00am is often shown as 09:00 on a digital clock. Repeat telling a different story. • Using a demonstration clock set it at a time e.g. 5:13. Show pupils. Ask them to write on a whiteboard all the different ways to record this time. Repeat with a range of times.	Use all four operations to solve word problems involving numbers in 'real life' (including time).	• Write the homework calculations on the board: 23×6, $467 + 78$, $342 - 65$ and $95 \div 5$. Ask children for examples of word problems for each of the calculations. Select some examples and discuss why they led to the particular calculation. Discuss the strategies the children used to do the calculations. • Write on the board: Darren gets up at 7:30am. He left for school 50 minutes later and walked for 25 minutes. When did he arrive? Discuss the problem and the strategies the children might use. Demonstrate how to use a time line. Emphasise that it is helpful to move to 8:00, whole hours, when adding on. Establish the answer is 8:45am. **Q** How else might you say/read this time? • Work through another problem and confirm children understand how to use the time line. • Give children Activity sheet 10.2. Discuss the problems and ask children to answer the first four questions. Interact with children, correcting any errors or misunderstandings.	• Discuss question 5 on Activity sheet 10.2. Highlight the idea of 35 minute intervals. Use a time line to demonstrate the times the buses arrive stepping up in intervals of 35 minutes, taking care to identify and use the hour boundaries. **Q** When will the next bus arrive? Ensure children understand the change from am to pm. **By the end of the lesson the children should be able to:** • **Solve 'story' problems involving units of time, and explain and record how the problem was solved.** (Refer to supplement of examples, section 6, page 88.)
VOCABULARY am, pm, noon, midnight arrive, depart hour, minute, second o'clock digital/analogue RESOURCES Clock faces Demonstration clock Whiteboards		VOCABULARY later time line RESOURCES Activity sheet 10.2		

plus	take away
sum	minus
total	subtract
add	difference
increase	less than

multiply	divide
times	share
altogether	product
how many are left?	decrease
how many groups?	more than

1. A jar holds 60 sweets. If you eat 23, how many sweets are left in the jar?

2. 96 blocks are shared among 8 people. How many blocks does each one get?

3. Jill scores 58 in a game and Tom scores 35. What is the difference between their scores?

4. Paul has 37 picture cards. Lisa has five times as many. How many picture cards does Lisa have?

5. There are 135 books on one shelf and 78 on another. What is the total number of books?

6. There are 23 marbles in a box. How many marbles are there in 8 boxes?

7. 78 children are put into groups of six. How many groups will there be?

8. Class 1 has 27 pupils, Class 2 has 29 pupils and Class 3 has 31 pupils. How many children are there altogether in the three classes?

9. In a class of 27 pupils, each pupil pays £3 for a school trip. What is the total amount paid?

10. The product of two numbers is 85. One number is 5, what is the other number?

1. Ian watched the TV from 6:45pm to 7:26pm. For how long did he watch TV?

2. Sarah spends Saturday morning at a sports club. She leaves home at 08:55 and gets back home at 11:24. How long is she away?

3. Dave is very late getting back from his grandparents' house. He left his grandparents at 10:15pm and his grandad took 55 minutes to get him home. When did he arrive?

4. The table shows bus times:

11:15am	11:45am	12:30pm	1:45pm

   Jennie arrives at the bus stop at 12:14pm. How long does Jennie have to wait for a bus?

5. Buses arrive every 35 minutes. The first bus arrives at 9:20am. When should the next 4 buses arrive?

55	13	81	23
40	63	45	60
19	70	20	33