

Unit 4

Problem solving

Five daily lessons

National
Numeracy Strategy

Year 6
Spring term

Unit Objectives Year 6

- Choose and use appropriate number operations to solve problems, and appropriate ways of calculating: mental, mental with jottings, written methods, calculator.
- Explain methods and reasoning.
- Check with an equivalent calculation.
- Develop calculator skills and use a calculator effectively.

Page 75

Pages 82-89

Page 73

Page 71

Link Objectives

Year 5

Year 7

- **Use all four operations to solve simple word problems, involving numbers and quantities based on 'real life', money and measures (including time), using one or more steps, including making simple conversions of pounds to foreign currency and finding simple percentages. Explain methods and reasoning.**
- Choose and use appropriate number operations to solve problems, and appropriate ways of calculating: mental, mental with jottings, written methods, calculator.
- Develop calculator skills and use a calculator efficiently.

- **Solve word problems and investigate in a range of contexts.**
- **Break a complex calculation into simpler steps choosing and using appropriate and efficient operations, methods and resources, including ICT.**
- Carry out calculations with more than one step using brackets and the memory.

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 4.1
- OHT 4.1
- OHP calculator
- Calculators
- Squared paper
- Digit cards 1-20
- CD ROM from NNS ICT pack
- Whiteboards
- Related Key Stage 2 national test questions

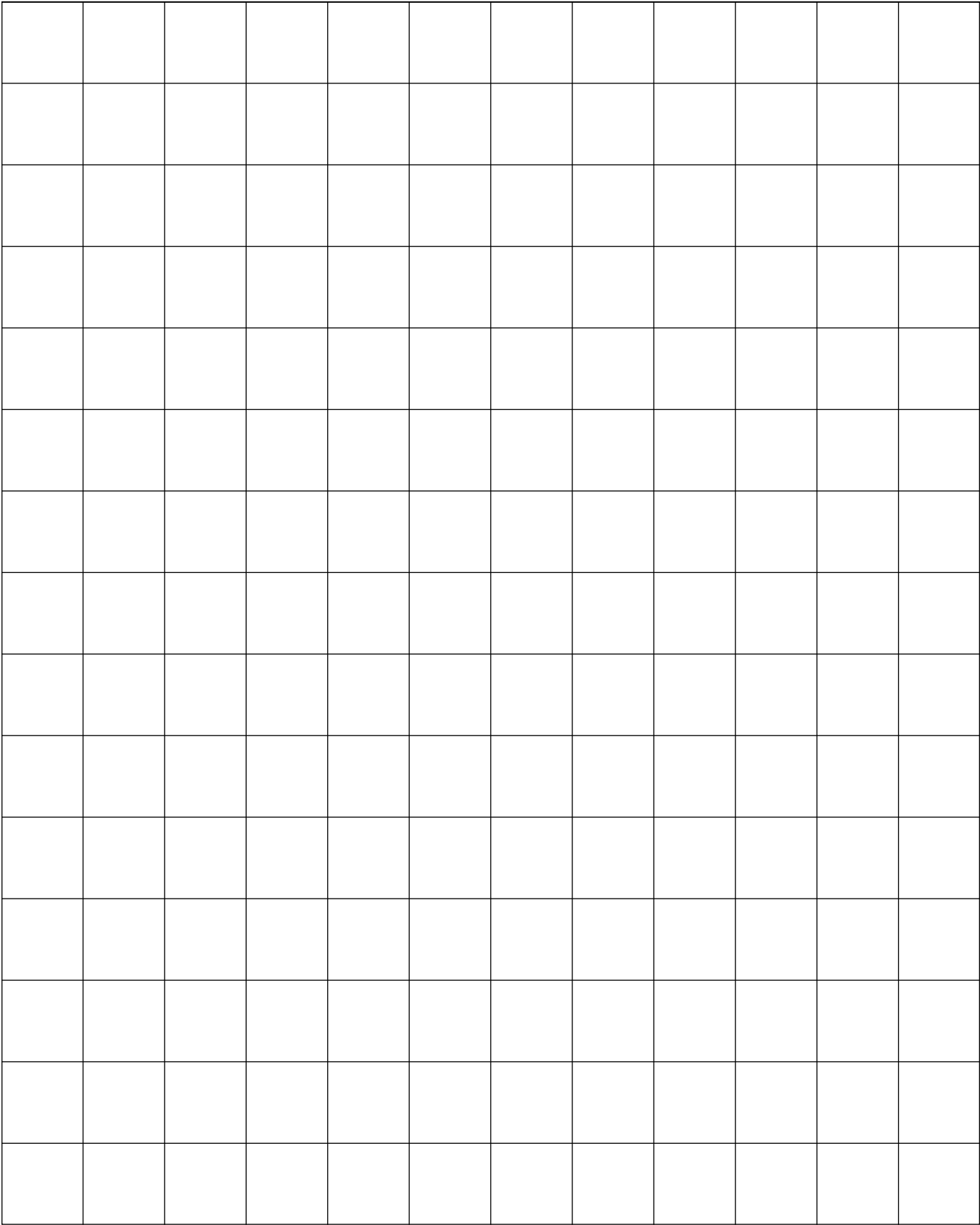
(Key objectives in bold)

department for
education and skills

Measures Table

2.5	7	5000	0.2	700	0.25
0.7	50	20	500	2500	5
0.05	7000	100	70	250	0.02
2	2000	25	0.5	200	0.07

OHP Centimetre Grid

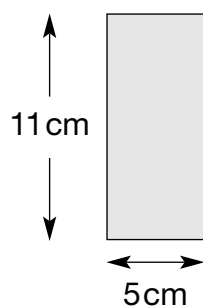


Related Key Stage 2 National test questions:

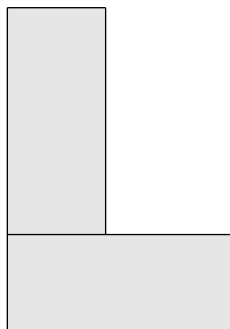
2000 Test A

19

Liam has two rectangular tiles like this.



He makes this L shape.



What is the **perimeter** of Liam's L shape?



cm

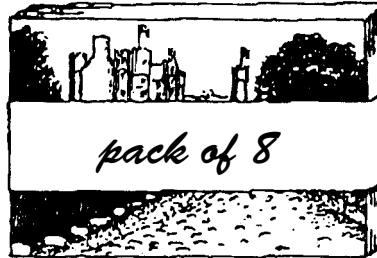
19

1 mark

Total

5

A shop sells postcards in **packs of 6** and **packs of 8**.



Alan bought **4 packs of 8 cards**.

How many cards did he get?



5a

1 mark

Shereen bought some **packs of 6 cards**.

Altogether she has **30 cards**.

How many **packs of 6** did she buy?



5b

1 mark

Total

Unit 4 Year 6 (Spring Term)

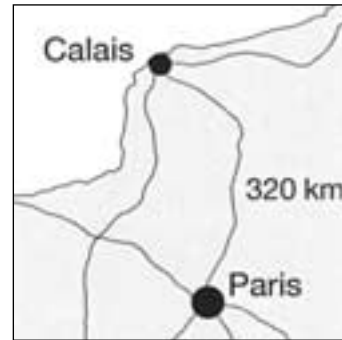
2000 Test B

21

Here is a map of part of France.

The map shows that the distance from Calais to Paris is **320 kilometres**.

5 miles is approximately **8 kilometres**.



Use these facts to calculate the approximate distance in **miles** from Calais to Paris.



Show your **working**.
You may get a mark.

miles

Samira bought this present in France.

She paid **44.85 French Francs** for it.

9.75 French Francs equal £1.



44.85 FF

What was the cost of the present in **pounds** and **pence**?



Show your **working**.
You may get a mark.

£

21a

2 marks

21b

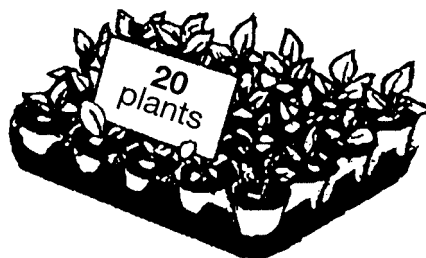
2 marks

Total

2001 Test B

5

Plants are sold in trays of 20



Ivana buys **7 trays** of plants.

How many plants is this?



5a

1 mark

David wants **240 plants**.

How many trays does he need to buy?



5b

1 mark

Total

2001 Test B

27

p and **q** each stand for whole numbers.

$$p + q = 1000$$

p is 150 **greater** than **q**.

Calculate the numbers **p** and **q**.



Show
your **working**.
You may get
a mark.



p =

q =

27

2 marks

Total

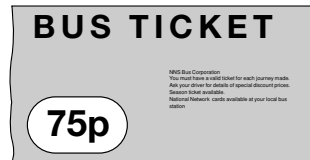
2002 Test A

4

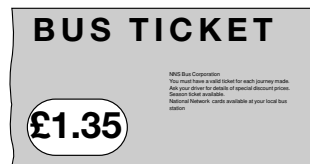
Asif, Vicky and Nita go to town by bus.

This is what they pay.

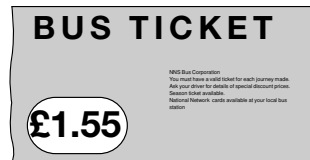
Asif



Vicky



Nita



How much **more** does **Nita** pay than **Asif**?



4a

1 mark

Vicky then takes **another** bus from town to visit her auntie.

She pays **90p** on this bus.

How much has Vicky paid **altogether** for her two bus tickets?



4b

1 mark

2002 Test A

18



6 green apples for 75p



10 red apples for 90p

Jason bought some bags of green apples and some bags of red apples.

He spent **£4.20**

How many **bags** of each type of apple did he buy?



Show your **working**.
You may get a mark.

**bags of
green apples**

**bags of
red apples**

Nika and Hassan bought some bags of apples.

'I bought more apples than Hassan, but I spent less money.'

Explain how this is possible.



.....

.....

.....

18a

2 marks

18b

1 mark

Total

2002 Test B

6



A box of four balls costs **£2.96**

How much does each ball cost?



6a

1 mark

Dean and Alex buy **3 boxes** of balls between them.

Dean pays **£4.50**

How much must Alex pay?



Show
your **method**.
You may get
a mark.



£

6b

2 marks

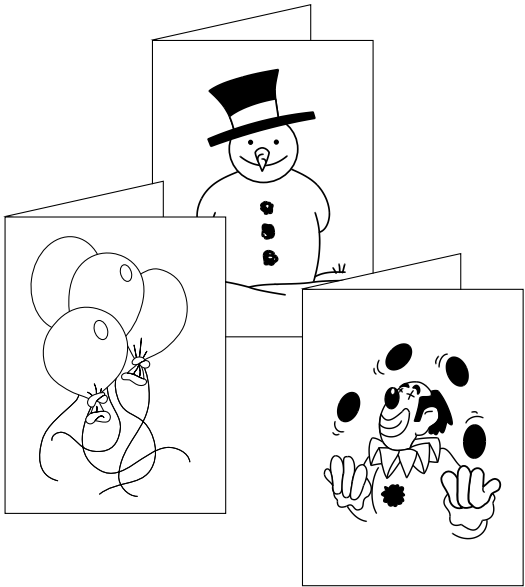
Total

2002 Test B

6

A shop sells greetings cards.
Each card has a price code on it.
These are the codes.

code	price
AA	75p
BB	£1.15
CC	£1.55
DD	£1.70
EE	£1.99



Tina buys two cards.
One card has code **AA** on it.
The other card has code **DD** on it.

How much does Tina pay?



£

6a

1 mark

Omar buys a card. He pays with a £2 coin.
He gets 45p change.

What is the **code** on his card?



.....

6b

1 mark

2002 Test B

9

Jemma thinks of a number.

She says,

***'Add 3 to my number and then
multiply the result by 5.
The answer is 35'***

What is Jemma's number?



9a

1 mark

Riaz thinks of a number.

He says

***'Halve my number and then
add 17. The answer is 23'***

What is Riaz's number?

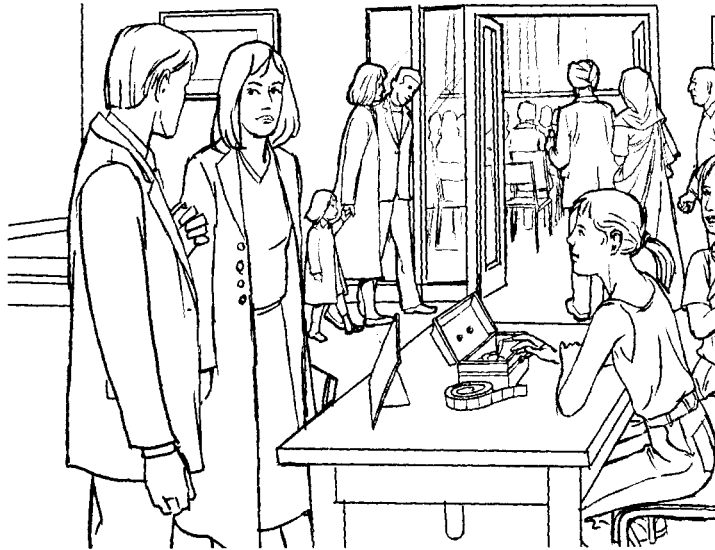


9b

1 mark

2002 Test B

11



185 people go to the school concert.

They pay **£1.35** each.

How much ticket money is collected?



11a

1 mark

Programmes cost **15p** each.

Selling programmes raises **£12.30**.

How many **programmes** are sold?



Show
your **method**.
You may get
a mark.



11b

2 marks

2002 Test B

14



The table shows the cost of coach tickets to different cities.

		Hull	York	Leeds
Adult	single	£12.50	£15.60	£10.25
	return	£23.75	£28.50	£19.30
Child	single	£8.50	£10.80	£8.25
	return	£14.90	£17.90	£14.75

What is the total cost for a **return** journey to York for one adult and two children?



£

14a

1 mark

How much **more** does it cost for two adults to make a **single** journey to Hull than to Leeds?



£

14b

1 mark


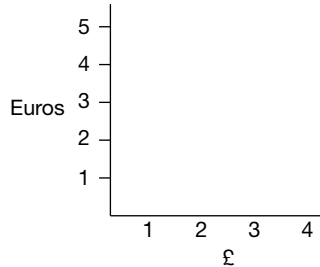
Unit 4 Year 6 (Spring Term)

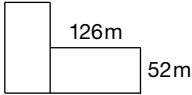
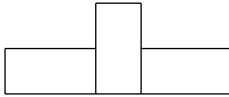
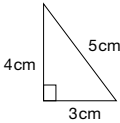
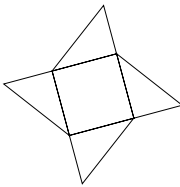
2002 Mental Arithmetic

20	Six cakes cost one pound eighty. How much do ten cakes cost?	£	£1.80
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Planning sheet	Day One	Unit 4 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Convert between hours, minutes, seconds, km and mm, kg and g, litres and millilitres.</p> <p>RESOURCES Resource sheet 4.1</p>	<ul style="list-style-type: none"> Display Resource sheet 4.1. Ask questions like: <div> <p>Q 500cm is how many metres?</p> <p>Q 2½ litres is how many millilitres?</p> <p>Q How many grams in 7kg?</p> </div> Explain that the answers are in the Measures Table. Ask children questions like: <div> <p>Q How many weeks have you been alive?</p> </div> Discuss how to solve this problem and then let the children work it out in pairs using jottings. Extend this by asking: <div> <p>Q How many days would that be?</p> </div> 	<p>Choose and use appropriate number operations.</p> <p>Check with an equivalent calculation.</p> <p>Develop calculator skills and use a calculator effectively.</p> <p>VOCABULARY inverse</p> <p>RESOURCES Calculators OHP calculator</p>	<ul style="list-style-type: none"> Present the children with this problem. A shop sells comics that cost 35p each. In one day they sold £23.80's worth of comics. How many comics did they sell? <div> <p>Q How can we estimate what the answer might be?</p> </div> Ask children how much the shop would receive if they sold 100 comics? 50 comics? Agree that the calculation is £23.80 ÷ 35p. Get the children to work out the answer, with a calculator. <div> <p>Q What is the answer?</p> <p>Q How can we check that it is correct?</p> </div> Ensure children enter the correct numbers to deal with the units. Emphasise how important it is to check answers and that doing this by the inverse operation is one way to check. Demonstrate checking using the inverse. <div> <p>Q What calculation could you use to check using equivalent calculation?</p> </div> Collect and demonstrate answers, e.g. $2380 \div 35$ $238 \div 3.5$ $(238 \div 7) \times 2$ $(238 \times 2) \div 7$ Present this problem to the children. Parminder saves some of her pocket money each week for a year. She saves £1.20 for 14 weeks and 65p for the rest of the year. How much does she save? The children work in pairs to solve this problem. Stress they should record their key presses and check their answer. <div> <p>Q What is the answer?</p> <p>Q How did you check?</p> </div> Discuss with the children how they recorded their answers. Discuss interpreting the calculator display correctly. Present this problem. A factory produces one million paper clips a day. A box can hold 120 paper clips. How many boxes will be needed per day? Ask the children to work this out and then discuss how they solved it. Discuss interpreting calculator display, in this case 8333:333. Give other problems for children to solve with a calculator and check. Collect answers and check results. Discuss the methods used and their recorded notes. 	<ul style="list-style-type: none"> Write on the board. $\square \times \square \times \square = 2197$ The same number must go in each box. <div> <p>Q What strategies can we use to solve this problem?</p> </div> Ask children to come out and test their strategies e.g.: $10 \times 10 \times 10 = 1000$ $20 \times 20 \times 20 = 8000$ Answer lies between 10 and 20. Write on the board: $\square \times \square \times \square = 4807$ The missing numbers are different prime numbers. Discuss answers and strategies the children use. <div> <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Choose the appropriate operations to solve word problems and number puzzles; Explain and record how the problem was solved; Use the clear and clear entry keys, all operation keys, the = key and decimal point to calculate with realistic data; Key in and interpret the outcome of calculations involving sums of money. <p>(Refer to supplement of examples, section 6, pages 71 and 75.)</p> </div>

Planning sheet	Day Two	Unit 4 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Find simple percentages.</p> <p>VOCABULARY discount</p>	<ul style="list-style-type: none"> Write 10% on the board. Explain that items are being discounted by 10%. Write £340 on the board. <div> <p>Q What is the discount?</p> <p>Q What is the new price?</p> </div> <p>Repeat using other percentages and prices.</p>	<p>Use all four operations to solve problems involving 'real life'.</p> <p>Choose appropriate operations and calculation methods.</p> <p>Explain methods.</p> <p>Use a calculator effectively.</p> <p>RESOURCES Calculators Squared paper</p>	<ul style="list-style-type: none"> Present this problem: <p>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?</p> <div> <p>Q How could we quickly estimate the answer?</p> </div> <p>Get children to work out $20 \times 30 \times 4$ in their heads.</p> <p>Give out calculators and ask the children to find the answer to the problem and compare this with the estimate.</p> <ul style="list-style-type: none"> Present the problem: <p>A friend has a garden 12.5m by 15m, and wants to pave an area big enough for a table and 4 chairs using slabs 30cm by 30cm, and grass the rest. The slabs cost £1.95 each and turf is £3.75 a strip 2m by 25cm.</p> <p>Design a garden and find out what it would cost, to cut down any waste.</p> <div> <p>Q What size area should be paved?</p> </div> <ul style="list-style-type: none"> Collect responses and discuss the children's designs and strategies. 	<ul style="list-style-type: none"> <p>Q How would you use a calculator to answer these questions?</p> <p>$774.9 \div \square = 28.7$</p> <p>48% of 675</p> <p>Discuss what operation the children would use and why.</p> <p>HOMEWORK – Tell children that the value of a car decreases by 10% each year. What would a £15 000 car be worth at the end of each year for 6 years?</p> <div> <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Decide on the most appropriate calculation method for a 'real life' or mathematical problem and justify their choice; Use all four operations to solve 'real life' or mathematical word problems; Use a calculator to respond to questions. <p>(Refer to supplement of examples, section 6, pages 81 and 71.)</p> </div> <p>RESOURCES Calculators</p>

Planning sheet	Day Three	Unit 4 Problem solving	Term: Spring	Year Group: 6																										
Oral and Mental		Main Teaching		Plenary																										
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions																										
Round decimals to the nearest whole number or nearest tenth.	<ul style="list-style-type: none">Write these numbers on the board: 27.28 48.87 96.21 121.1 72.72 9.8 <div><p>Q Which three numbers when rounded to the nearest whole number add up to a total of 179? (96 + 73 + 10).</p><p>Q Which two decimals when rounded to the nearest whole number have a difference of 22, 72?</p></div> <p>Children work out and show their answers on whiteboards.</p> <ul style="list-style-type: none">Write these numbers on the board: 12.36 19.22 7.29 128.31 103.91 9.72 <div><p>Q Which three numbers when rounded to the nearest tenth add up to a total of 150.4? (128.3 + 12.4 + 9.7).</p></div> <p>Repeat giving different totals and differences.</p>	Use all four operations to solve word problems involving money including pounds to foreign currency and vice versa. Use a calculator effectively.	<ul style="list-style-type: none">HOMEWORK Discuss the homework. Draw up a table to show how the decreases get smaller because the value of the car is less each year.Use the 'Counter' program on the CD ROM in the NNS ICT pack. Set the display to show two counters.<div><table><tr><td colspan="3">0</td><td colspan="3">0</td></tr><tr><td>Start No.</td><td>Step</td><td>Inc.</td><td>Start No.</td><td>Step</td><td>Inc.</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1.43</td><td>0</td></tr></table><p>Explain that the counter on the left is pounds and the one on the right shows how many euros there are in one pound.</p></div>Use the icon  to show the children how it can go up in steps. Keep going but stop at £10.<div><p>Q How many euros for £15?</p></div><p>Discuss children's answers and confirm using the program.</p><div><p>Q How many euros for £30?</p></div>Demonstrate how to change from euros to pounds by dividing by 1.43. Use an OHP calculator or with the children working on their calculators.<div><p>Q If something cost 127 euros what would that be in pounds?</p></div>Present the following fairground information:<table><tr><td>Big Dipper</td><td>4.5 €</td></tr><tr><td>Ghost Train</td><td>3.0 €</td></tr><tr><td>Bumper Cars</td><td>3.75 €</td></tr><tr><td>Waltzer</td><td>2.25 €</td></tr></table><p>Ask the children to answer the following questions:</p><p>Amy has two rides on the big dipper and one ride on the waltzer. How much is that in euros? How much is that in pounds?</p><p>Amy's aunt gives her £5.00 to spend. How many different rides can she go on? What change will she have left?</p>Collect answers, discuss methods and correct errors.	0			0			Start No.	Step	Inc.	Start No.	Step	Inc.	0	1	0	0	1.43	0	Big Dipper	4.5 €	Ghost Train	3.0 €	Bumper Cars	3.75 €	Waltzer	2.25 €	<ul style="list-style-type: none">Remind children that another way to work out equivalent values is to draw a line graph. Using the grid on OHT 4.1, draw the graph with the children. Ask questions like:<div><p>Q What shall we put on the vertical axis?</p><p>Q Where shall we mark the point for one euro? etc.</p></div><p>Use the graph to ask questions like:</p><div><p>Q How can we work out what £2.50 is worth in euros?</p></div> <div><p>By the end of the lesson the children should be able to:</p><ul style="list-style-type: none">Convert to European or foreign currency;Solve problems involving money, choosing the appropriate operation;Explain and record how the problem was solved;Key in and interpret the outcome of calculations involving sums of money.<p>(Refer to supplement of examples, section 6, pages 85 and 71.)</p></div>
0			0																											
Start No.	Step	Inc.	Start No.	Step	Inc.																									
0	1	0	0	1.43	0																									
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RESOURCES Whiteboards		VOCABULARY euro € RESOURCES CD ROM from NNS ICT pack OHP calculator Calculators		RESOURCES OHT 4.1																										

Planning sheet	Day Four	Unit 4 <i>Problem solving</i>	Term: <i>Spring</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Recall multiplication and division facts to 10×10. Recall squares, and primes.</p> <p>VOCABULARY square prime factor</p> <p>RESOURCES Digit cards 1 to 20</p>	<ul style="list-style-type: none"> Ask the children to tell you what square numbers are. Ask them to draw a 2×3 grid in their books and write a square number from 1–100 in each cell. Shuffle the 1 to 10 digit cards . Pull out a card randomly and show it to the children. They have to square that number. Do not replace the card. If the square number is on their grid they cross it out. The first child to cover all six numbers wins. Shuffle the 1 to 20 pack of cards. Pull out a card at random, and ask: <div>Q Is this a square number?</div> <div>Q Is this a prime number?</div> <div>Q Is this number a factor of 50?</div> <p>Repeat using these and other questions.</p>	<p>Use all four operations to solve problems involving measures (length).</p> <p>Choose appropriate operations/ calculation methods.</p> <p>Explain working.</p> <p>VOCABULARY perimeter efficient</p> <p>RESOURCES Calculators</p>	<ul style="list-style-type: none"> Present the following problem. <div>  </div> <p>There are two identical fields which are to be joined into one. The owner wants to build a fence around the new field.</p> <div>Q What is the distance around a shape called?</div> <div>Q How many metres of fencing will the owner need?</div> <p>Let the children work this out.</p> <div>Q How did you solve this problem? What strategies did you use?</div> Present the following problem. <p>Here are some paving slabs.</p> <div>  </div> <p>Each slab measures 1.2m by 57cm.</p> <div>Q What is the most efficient method of calculating the perimeter of this arrangement of paving slabs?</div> <p>Allow the children time to solve this problem.</p> <div> <div>Q What method did you use?</div> <div>Q Why is your method efficient?</div> </div> Give the following problems to the children and discuss efficient methods with them. <p>Can you arrange 6 squares with sides 35cm long so that the perimeter is 420cm?</p> <p>What are the maximum and minimum perimeters that can be made making a shape using 3 touching rectangles that measure 48cm by 17cm? What if you had 5?</p> Collect answers, correct errors and discuss maximum and minimum perimeters. <div>Q How do you know ... is the maximum/minimum perimeter?</div> 	<ul style="list-style-type: none"> On the board draw the triangle <div>  </div> <p>Remind children that this angle shown is a right angle. Say that 4 of these triangles are put on a square as shown.</p> <div>  </div> <div>Q What size square could it be?</div> <p>Establish that there are two possible answers, 3×3 or 4×4cm.</p> <div>Q What could the perimeter of these shapes be?</div> Ask the children to discuss how they would solve this problem. Collect answers and ensure that children understand there are two possible answers, $4 \times (4 + 5)$ or $4 \times (3 + 5)$ cm. <div> <p>By the end of the lesson the 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. <p>(Refer to supplement of examples, section 6, page 83.)</p> </div>

Planning sheet	Day Five	Unit 4 Problem solving	Term: Spring	Year Group: 6						
Oral and Mental		Main Teaching		Plenary						
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions						
<p>Recall squares and primes.</p> <p>VOCABULARY square prime factor multiple</p>	<ul style="list-style-type: none">Write on the board: Is it prime? Is it square? Is it bigger than □? Is it smaller than □? Is □ a factor? Is it a multiple of □?Say to the children you are thinking of a number. They can use one of each of the questions on the board in turn to try to find your number.Repeat the above process but get a child to think of a number.	<p>Choose appropriate operations and calculation methods.</p> <p>Explain methods and reasoning.</p>	<ul style="list-style-type: none">Set the children a range of multi-step problems like those below:<div><p>Q 208 children and 27 adults went on a school trip. Each coach can hold 56 people. How many coaches are needed?</p><p>Q Two numbers sum to 150, one is 30 more than the other, what are the numbers?</p><p>Q I think of a number, add 4·6 and multiply it by 6. The answer is 33. What is my number?</p></div><p>For each question discuss how to tackle the problem. Ask how they would tackle each step.</p>On the board write:<div><table><tr><td>a</td><td>b</td><td>Luke says:</td></tr><tr><td><div>16 15 19 21 18 17</div></td><td><div>8 5 6 10 7 9</div></td><td>a – b < 15, for all a and b Is this true?</td></tr></table><p>Ask:</p><div><p>Q What are a and b? What does a – b mean?</p></div><p>Establish that a represents a number in the first box and b a number in the second box. Discuss Luke’s statement.</p><p>Ask children if what Luke says is true? Allow time for children to establish that 21 – 5 = 16 and so Luke’s statement is false.</p><p>Ask children to write down statements they think are true. Ask children to discuss them in groups.</p>Collect statements and ask children to explain their reasoning.</div>	a	b	Luke says:	<div>16 15 19 21 18 17</div>	<div>8 5 6 10 7 9</div>	a – b < 15 , for all a and b Is this true?	<ul style="list-style-type: none">Present this problem.<div><p>Q a and b are 2 numbers. a + b = 45 and a is 7 less than b. What are a and b?</p></div>Allow the children to discuss the problem and present solutions. Compare this question with the earlier one in the lesson about 150. Ask children to interpret the question in the same way. <div><p>By the end of the lesson the children should be able to:</p><ul style="list-style-type: none">Solve ‘story’ problems about numbers in ‘real life’ and puzzles, choosing the appropriate operation and method of calculation;Explain and record using numbers, signs and symbols how the problem was solved.<p>(Refer to supplement of examples, section 6, pages 83 and 79.)</p></div>
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