

Unit 6b
Solving problems and puzzles

Year 5
Summer term

Unit Objectives

Year 5

- Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict.
- Suggest extensions asking 'What if...?'.
- Explain methods and reasoning, orally and in writing.

Page 79

Page 77

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

Link Objectives

Year 4

- Solve mathematical problems and puzzles, recognise and explain patterns and relationships, generalise and predict. Suggest extensions by asking 'What if...?'.
- Explain methods and reasoning about numbers orally and in writing.

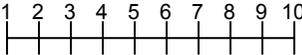
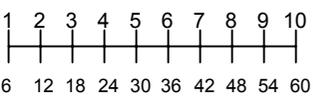
Year 6

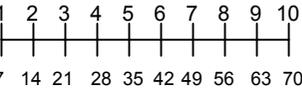
- Solve mathematical patterns and puzzles, recognise and explain patterns and relationships, generalise and predict. Suggest extensions asking 'What if...?'.
- Explain methods and reasoning, orally and in writing.

Resources needed to teach this unit:

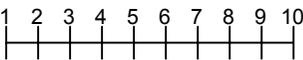
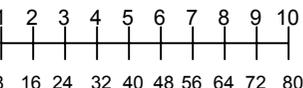
- Activity sheet 6b.1
- OHT 6b.1
- Self-assessment sheet 6b.1
- Bag to hold cubes
- Red cubes and blue cubes
- Whiteboards

(Key objectives in bold)

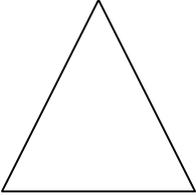
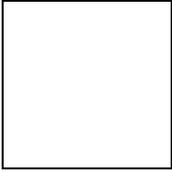
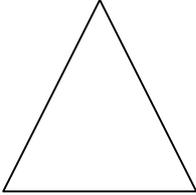
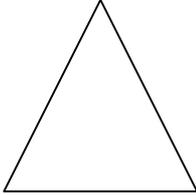
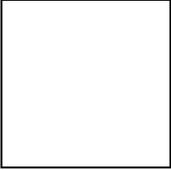
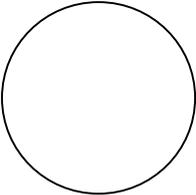
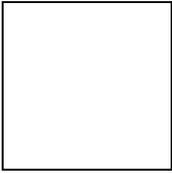
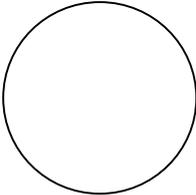
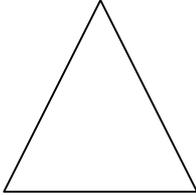
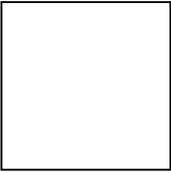
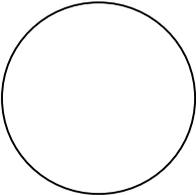
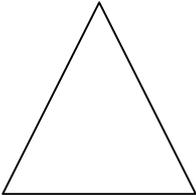
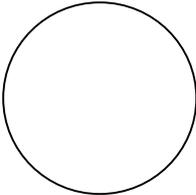
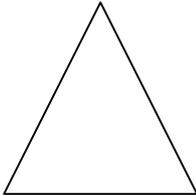
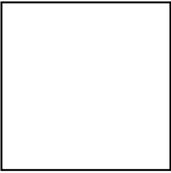
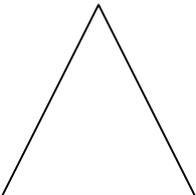
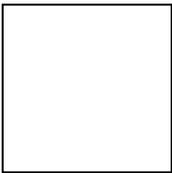
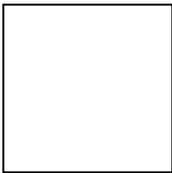
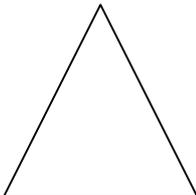
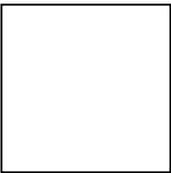
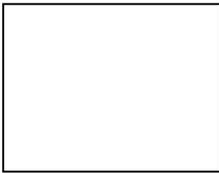
Planning sheet	Day One	Unit 6b <i>Solving problems and puzzles</i>	Term: <i>Summer</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
<p>Objectives and Vocabulary</p> <p>Recall multiplication facts and derive division facts from the six times table.</p> <p>VOCABULARY multiple</p>	<p>Teaching Activities</p> <ul style="list-style-type: none"> On the board draw the number line:  Ask the children to recite the six times table as you point to the numbers 1 to 10. Repeat for other tables. Return to the six times table and as the children recite the table, record the multiples on the number lines to show:  <p>Point to one of the multiples, e.g. 24.</p> <p>Q What is this multiplication fact?</p> <p>Collect answers.</p> <p>Q What are the associated division facts?</p> <p>Collect answers.</p> <ul style="list-style-type: none"> Repeat, pointing to other numbers and after the children have given the two division facts, remove the associated multiple e.g. 24 from the number line until none is left. Ask the children to imagine the multiples of six number line. <p>Q What division facts can you remember?</p> <p>Collect answers and replace the multiples of 6 back on the number line. Emphasise to the children that imagining a multiples number line like this can help them to derive and recall division facts.</p>	<p>Objectives and Vocabulary</p> <p>Solve mathematical problems or puzzles, recognise and explain patterns and relationships.</p> <p>RESOURCES OHT 6b.1 Activity sheet 6b.1 'My Mathematics' Self-assessment sheet 6b.1</p>	<p>Teaching Activities</p> <ul style="list-style-type: none"> Show OHT 6b.1. Explain that the shapes in the 4 by 4 grid represent numbers and the boxes on the side and at the bottom of the grid represent the totals of the four numbers in that row or column. Write on the board: Δ represents 3; \square represents 4; O represents 5. <p>Q What are the totals in the eight boxes?</p> <p>Collect answers and discuss the strategies the children used.</p> <ul style="list-style-type: none"> On the board change the 5 to a 6. <p>Q How many totals change now O represents 6?</p> <p>Agree that there are four to change, two rows and two columns.</p> <p>Q If Δ represented 2, how many totals would change?</p> <p>Agree this would change all eight totals.</p> <ul style="list-style-type: none"> Explain that this time you are not going to tell them what number the shapes represent. You will give them some of the totals and they have to work out the remaining totals. On OHT 6b.1 write the numbers 23 and 15 in the top 2 boxes on the right-hand side, and the number 24 in the right most box along the base. Collect answers and discuss the children's strategies. <p>Q Which of the three totals did you use first? How did this help you?</p> <p>Establish the total 24 meant the Δ represented 6.</p> <p>Q Which total did you use next?</p> <p>Ensure the children understand that as the first row has three Δs, \square represents 5. The next step was to work out that O represented 2.</p> <ul style="list-style-type: none"> Remove the three totals. Now write the numbers 20 and 18 in the bottom two boxes on the right-hand side and 12 in the right most box along the base. <p>Q What are the other totals?</p> <ul style="list-style-type: none"> Collect answers and discuss the children's answers and strategies. <p>Q Does it matter which three totals you are given?</p> <p>Ask the children to work in pairs and choose their own number for Δ, \square, O and find the eight totals. They give any three totals to another pair and are given three totals. Each pair has to try to work out the missing totals.</p> <ul style="list-style-type: none"> Discuss whether the children could always find the missing totals. Establish which worked easily and whether some did not work. Select some of those the children said did not work to see whether the rest of class agree or not. Give out Activity sheet 6b.1 and ask the children to find the missing totals. 	<p>Teaching Activities/ Focus Questions</p> <ul style="list-style-type: none"> Discuss the children's solutions and answers. Compare the strategies children used to solve the top two puzzles and the bottom two puzzles. Show OHT 6b.1 and write in the numbers 18 and 20 in the top and bottom boxes on the right-hand side. <p>Q What do these totals tell us about what the shapes represent?</p> <p>Establish the bottom total means that $\Delta + \square$ is 10. The top total means $\Delta + \Delta$ is 8 so Δ represents 4 and \square represents 6. With one more total we can find O.</p> <p>ASSESSMENT – Give out Self-assessment sheet 6b.1. Allow the children time to complete the first cloud question on the sheet.</p> <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Solve puzzles and problems involving missing totals. <p>(Refer to supplement of examples, section 6, page 79.)</p>

Planning sheet	Day Two (page 1 of 2)	Unit 6b Solving problems and puzzles		Term: Summer	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 facts and derive division facts from the seven times table.</p>	<ul style="list-style-type: none"> On the board draw the number line:  Ask the children to recite the seven times table as you point to the numbers 1 to 10. Repeat for other tables. Return to the seven times table and as the children recite the table, record the multiples on the number lines to show:  Point to one of the multiples, e.g. 56. <p>Q What is this multiplication fact?</p> <p>Collect answers.</p> <p>Q What are the associated division facts?</p> <p>Collect answers.</p> <ul style="list-style-type: none"> Repeat, pointing to other numbers, and after the children have given the two division facts, remove the associated multiple from the number line until none is left. Ask the children to imagine the multiples of seven number line. <p>Q What division facts can you remember?</p> <p>Collect answers and replace the multiples of 7 back on the number line.</p>	<p>Solve mathematical puzzles and problems.</p> <p>Explain methods and reasoning.</p> <p>RESOURCES Bag to hold cubes Red cubes and blue cubes Self-assessment sheet 6b.1</p>	<ul style="list-style-type: none"> On the board draw four small circles and four small squares. <p>Q What fraction of these eight shapes are circles?</p> <p>Establish that half of them are circles and record the fractions $\frac{4}{8}$ and $\frac{1}{2}$. Change two of the squares to circles.</p> <p>Q What fraction of the eight shapes are circles now?</p> <p>Agree that $\frac{6}{8}$ or $\frac{3}{4}$ of them are circles. Repeat with other sets of squares and circles.</p> <ul style="list-style-type: none"> Explain that this time you will give them the fractions but not the total number of shapes. <p>Write on the board: $\frac{1}{2}$ of the shapes are squares, $\frac{1}{2}$ of the shapes are circles. Two squares are replaced with two circles. Now $\frac{1}{3}$ of the shapes are squares, $\frac{2}{3}$ of the shapes are circles.</p> <p>Q How many shapes did we start with?</p> <ul style="list-style-type: none"> Collect children's answers and discuss the strategies they used. <p>Q If $\frac{1}{3}$ of the total number of shapes were squares what multiplication table will the total number of shapes be in?</p> <p>Establish that it must be in the three times table. On the board write the table below:</p> <table border="1" data-bbox="1182 1007 1570 1214"> <thead> <tr> <th>Total</th> <th>$\frac{1}{3}$ Squares</th> <th>$\frac{2}{3}$ Circles</th> </tr> </thead> <tbody> <tr><td>3</td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td></tr> <tr><td>18</td><td></td><td></td></tr> <tr><td>21</td><td></td><td></td></tr> </tbody> </table> <p>With the children identify the number of squares and circles when $\frac{1}{3}$ of the shapes are squares and $\frac{2}{3}$ are circles.</p> <p>Q As we have replaced two squares with two circles, what would the original numbers of squares and circles be?</p> <p>Add two more columns to the table and complete these with the class, transferring two circles back to squares.</p>	Total	$\frac{1}{3}$ Squares	$\frac{2}{3}$ Circles	3			6			9			12			15			18			21			<ul style="list-style-type: none"> Collect answers and discuss the children's strategies. <p>Hold up a bag which contains four red and 16 blue cubes that the children cannot see. Say that $\frac{1}{5}$ of the cubes are red and $\frac{4}{5}$ are blue.</p> <p>Q Altogether how many cubes might be in the bag?</p> <p>Record the children's suggestions on the board and establish the numbers are multiples of 5.</p> <p>Take out six blue cubes and replace them with six red cubes. Now half are red and half are blue.</p> <p>Q How many cubes are in the bag?</p> <p>Remind them we started with a multiple of five cubes. Start with five cubes, one red, four blue.</p> <p>Q Can we change six blue cubes into red cubes?</p> <p>Continue with 10, 15, 20 cubes to show that with four red and 16 blue the exchange works.</p> <p>ASSESSMENT – Give out Self-assessment sheet 6b.1. Allow the children time to complete the second cloud question on the sheet.</p>	
Total	$\frac{1}{3}$ Squares	$\frac{2}{3}$ Circles																											
3																													
6																													
9																													
12																													
15																													
18																													
21																													

Planning sheet	Day Two (page 2 of 2)	Unit 6b <i>Solving problems and puzzles</i>			Term: <i>Summer</i>	Year Group: 6																																								
Oral and Mental		Main Teaching				Plenary																																								
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities			Teaching Activities/Focus Questions																																								
			<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Total</th> <th>$\frac{1}{3}$ Squares</th> <th>$\frac{2}{3}$ Circles</th> <th>+2 Squares</th> <th>-2 Circles</th> </tr> </thead> <tbody> <tr><td>3</td><td>1</td><td>2</td><td>3</td><td>0</td></tr> <tr><td>6</td><td>2</td><td>4</td><td>4</td><td>2</td></tr> <tr><td>9</td><td>3</td><td>6</td><td>5</td><td>4</td></tr> <tr><td>12</td><td>4</td><td>8</td><td>6</td><td>6</td></tr> <tr><td>15</td><td>5</td><td>10</td><td>7</td><td>8</td></tr> <tr><td>18</td><td>6</td><td>12</td><td>8</td><td>10</td></tr> <tr><td>21</td><td>7</td><td>14</td><td>9</td><td>12</td></tr> </tbody> </table> <p style="border: 1px solid black; padding: 2px;">Q When were half the shapes squares, and half the shapes circles?</p> <p>Establish that when there were 12 shapes this was the case. Check the answer is correct by working through the problem to confirm that replacing two squares with two circles works.</p> <ul style="list-style-type: none"> Write on the board: <ul style="list-style-type: none"> Q1. $\frac{1}{3}$ of the shapes are squares, $\frac{2}{3}$ of the shapes are circles Three circles are replaced with three squares. Now $\frac{1}{2}$ of the shapes are squares, $\frac{1}{2}$ of the shapes are circles. How many squares and circles did we start with? Q2. $\frac{1}{4}$ of the shapes are squares, $\frac{3}{4}$ of the shapes are circles One circle is replaced by one square. Now $\frac{1}{3}$ of the shapes are squares, $\frac{2}{3}$ of the shapes are circles. How many squares and circles did we start with? 			Total	$\frac{1}{3}$ Squares	$\frac{2}{3}$ Circles	+2 Squares	-2 Circles	3	1	2	3	0	6	2	4	4	2	9	3	6	5	4	12	4	8	6	6	15	5	10	7	8	18	6	12	8	10	21	7	14	9	12	<p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Solve puzzles and problems involving fractions; Explain methods and reasoning. <p>(Refer to supplement of examples, section 6, pages 77, 79.)</p>
Total	$\frac{1}{3}$ Squares	$\frac{2}{3}$ Circles	+2 Squares	-2 Circles																																										
3	1	2	3	0																																										
6	2	4	4	2																																										
9	3	6	5	4																																										
12	4	8	6	6																																										
15	5	10	7	8																																										
18	6	12	8	10																																										
21	7	14	9	12																																										

Planning sheet	Day Three (page 1 of 2)	Unit 6b Solving problems and puzzles	Term: Summer	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 facts and derive division facts from the eight times table.</p>	<ul style="list-style-type: none"> On the board draw the number line:  Ask the children to recite the eight times table as you point to the numbers 1 to 10. Repeat for other tables. Return to the eight times table and as the children recite the table, record the multiples on the number lines to show:  Point to one of the multiples, e.g. 32. <p>Q What is this multiplication fact?</p> <p>Collect answers.</p> <p>Q What are the associated division facts?</p> <p>Collect answers.</p> <ul style="list-style-type: none"> Repeat, pointing to other numbers, and after the children have given the two division facts, remove the associated multiple from the number line until none is left. Ask the children to imagine the multiples of eight number line. <p>Q What division facts can you remember?</p> <p>Collect answers and replace the multiples of 8 back on the number line.</p>	<p>Solve problems and puzzles, recognise and explain patterns, relationships and reasoning.</p>	<ul style="list-style-type: none"> Write on the board: Large batteries cost £1. 60 Medium batteries cost £1.10. <p>Q What would ten large batteries cost?</p> <p>Establish they would cost £16.</p> <p>Q What would six medium batteries cost?</p> <p>Establish they would cost £6.60.</p> <p>Q How many medium batteries could you buy for £10?</p> <p>Agree it would be nine with 10p change.</p> <p>Q How many large batteries could you buy for £10?</p> <p>Agree it would be 6 with 40p change.</p> <ul style="list-style-type: none"> Say that a farmer bought batteries with a £20 note. <p>Q How many of each size of battery could the farmer buy?</p> <p>Collect and discuss the children's suggestions. Establish that the farmer could have bought up to 12 large batteries or up to 18 medium batteries.</p> <p>Q What if the farmer spent exactly £20? How many batteries did the farmer buy?</p> <p>Encourage the children to spend time in pairs thinking about how they might solve the problem.</p> <ul style="list-style-type: none"> Collect suggestions and establish that a list or table would be helpful. On the board draw the table: <table border="1" data-bbox="918 1149 1803 1252"> <tr> <td>Medium</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> </tr> <tr> <td>Cost</td> <td>£1.10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Large</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> </tr> <tr> <td>Cost</td> <td>£1.60</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>Start completing the table with the children and ask the pairs to copy and continue and use the list to see if they can find a solution to the problem.</p> <ul style="list-style-type: none"> Collect answers. Confirm that eight medium batteries and seven large batteries is an answer, by completing the table with the children. 	Medium	1	2	3	4	5	6	7	8	9	10	Cost	£1.10										Large	1	2	3	4	5	6	7	8	9	10	Cost	£1.60										<p>ASSESSMENT –</p> <ul style="list-style-type: none"> Give out Self-assessment sheet 6b.1. Allow children time to complete the third cloud question. <p>When the children have completed the question and indicated whether they did the question on their own or with some help, discuss the 3 questions with the class. Remind them that they have been solving mathematical problems and puzzles and looking for patterns in a table as in the first problem, and for relationships between numbers as on the other two problems. Ask them to think about what they want to get better at. Discuss suggestions with the class and then ask children to write down their target on the foot of the Self-assessment sheet.</p> <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Solve puzzles and problems involving money and lists; Explain methods and reasoning. <p>(Refer to supplement of examples, section 6, pages 77, 79)</p>
Medium	1	2	3	4	5	6	7	8	9	10																																						
Cost	£1.10																																															
Large	1	2	3	4	5	6	7	8	9	10																																						
Cost	£1.60																																															
<p>RESOURCES Self-assessment sheet 6b.1</p>																																																

Planning sheet	Day Three (page 2 of 2)	Unit 6b <i>Solving problems and puzzles</i>		Term: <i>Summer</i>	Year Group: 6
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: Small batteries cost 70p. <div style="border: 1px solid black; padding: 2px;"> Q How many small and medium batteries could we buy for exactly £5? </div> <p>Ask the children to work in pairs to find the answer.</p> <p>Encourage them to add two extra rows to the list for the cost of small batteries. Collect and discuss answers and methods.</p> <ul style="list-style-type: none"> Write on the board: <ul style="list-style-type: none"> How many small and large batteries could we buy for exactly £9? How many small, medium and large batteries could we buy for exactly £8? Collect answers and discuss their methods. Emphasise how making a list of the costs of the batteries was helpful, and how the costs in the list could be used to find different totals for combinations of batteries. These costs can be checked to see if they give the exact amounts of money. 		

△	□	△	○	17
□	○	□	△	
○	○	○	○	32
△	□	□	△	
□	26	□	□	

△	△	△	△	16
□	□	□	○	20
○	△	□	○	
△	□	□	△	
□	□	19	□	

○	○	□	○	19
△	△	□	△	
□	△	○	□	18
○	○	△	△	20
□	□	□	□	

○	○	□	○	
△	△	□	△	17
□	△	○	□	
○	○	△	△	
□	24	16	□	

My Mathematics

Find the missing trials

My calculation

A = B = C =

X = Y =

Show or discuss with a friend

I did this:

on my own

with some help

A third of the total number of counters are yellow, two thirds are blue. Four of the yellow counters are changed for blue counters. Now one sixth of the counters are yellow and five sixths are blue. How many counters are there?

My calculation

Show or discuss with a friend

I did this:

on my own

with some help

A bar of chocolate costs 28p and a packet of mints costs 16p. How many of each could you buy for exactly £2?

My calculation

Show or discuss with a friend

I did this:

on my own

with some help

Name: _____

I want to get better at _____