

Unit 12

Number sequences

Five daily lessons

National
Numeracy Strategy

Year 6
Autumn term

Unit Objectives Year 6

- Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict.
- Recognise and extend number sequences, such as the sequence of square numbers, or the sequence of triangular numbers.
- Explain methods and reasoning, orally and in writing.
- Develop from explaining a generalised relationship in words to expressing it in a formula using letters as symbols.

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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 12.1
- Resource sheet 12.2
- Activity sheet 12.1
- Activity sheet 12.2
- OHT 12.1
- OHT 12.2
- OHP calculator
- Counting stick
- Squares of paper
- Related Key Stage 2 national test questions

Link Objectives

Year 5

Year 7

- Recognise and extend number sequences formed by counting from any number in steps of constant size.
- Know squares of numbers to at least 10×10 .
- Explain a generalised relationship (formula) in words.

(Key objectives in bold)

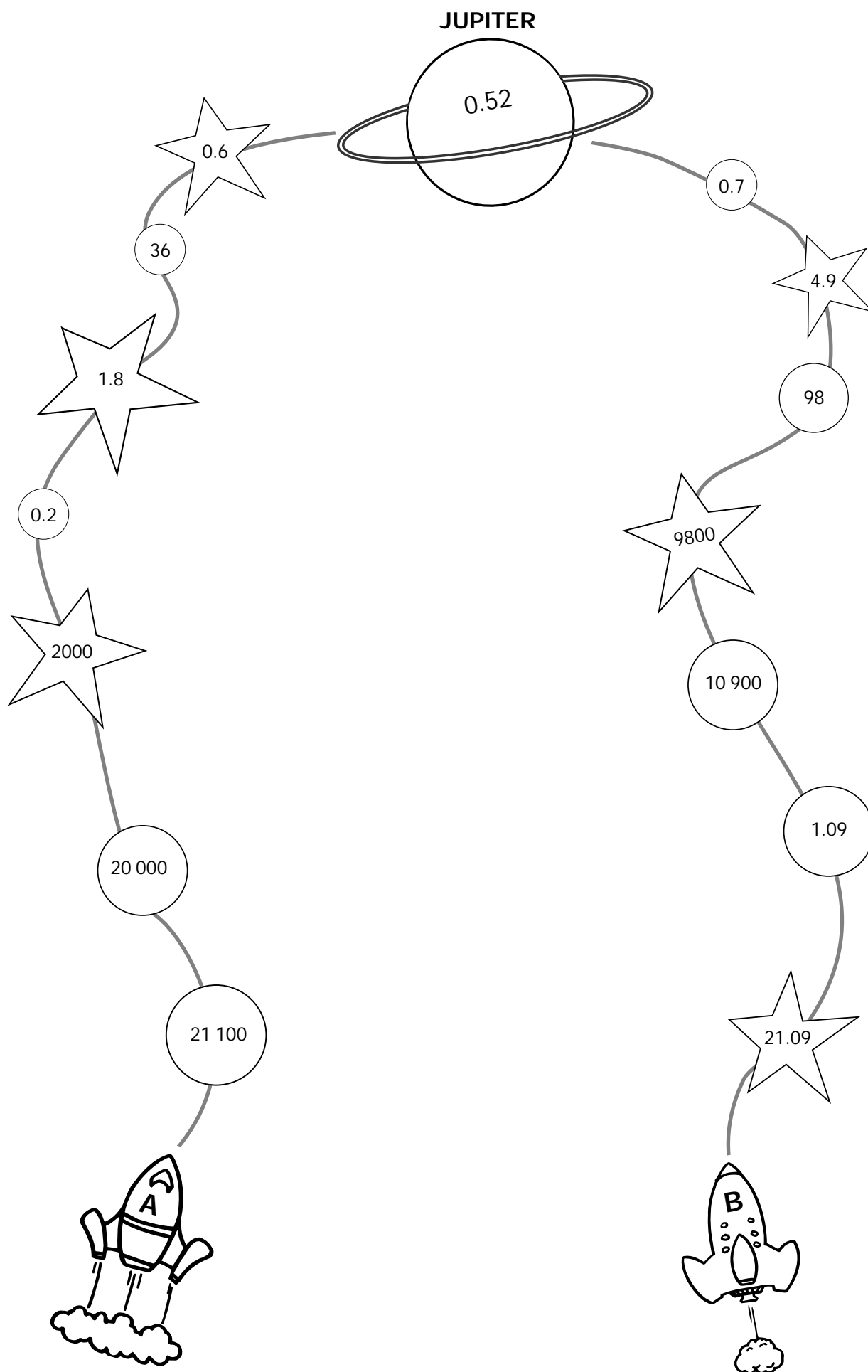
- Recognise the first few triangular numbers, squares of numbers to at least 12×12 and the corresponding costs.
- **Use letter symbols to represent unknown numbers or variables.**
- Generate and describe simple integer sequences.
- Generate terms of a simple sequence, given a rule.

Planning sheet	Day One	Unit 12 <i>Number sequences</i>	Term: <i>Autumn</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>Consolidate knowing by heart: multiplication facts up to 10×10 (focusing on multiples of 7).</p> <p>Recognise and extend number sequences: count on in steps: units, tens and decimals.</p> <p>VOCABULARY sequence steps multiple term</p>	<ul style="list-style-type: none"> Show a counting stick. Identify the 3rd step as 21 and the 7th step as 49. <div>Q What is each step worth?</div> <div>Q How did you use the given numbers to help you identify the steps?</div> <p>Count up or down to check.</p> <div>Q What if the 3rd term was 210 and the 7th term 490?</div> <p>Count up from a given point to check answers.</p> <div>Q What would the 6th term in the sequence be?</div> <div>Q How did you work it out?</div> <p>Identify the 3rd term as 2.1 and the 7th term as 4.9.</p> <div>Q What is each step worth?</div> <p>Take feedback and count up / down to check.</p>	<p>Recognise and extend number sequences formed by counting on and back in steps of different size, extending beyond zero when counting back.</p> <p>VOCABULARY sequence steps term rule</p> <p>RESOURCES Squares of paper Resource sheet 12.1</p>	<ul style="list-style-type: none"> Write 3 numbers on the board such as 10.2, 10.4, 10.6. Tell children these are 3 consecutive terms in a sequence. They are to continue it first forwards then backwards. Take responses. <p>Choose a starting number and get children to count upwards in steps of 0.25.</p> <div>Q If my start point is 2 and my steps are 0.25 what is the 6th term in my sequence?</div> <p>Collect children's strategies, compare them and discuss other examples using the vocabulary: term, step, sequence.</p> <p>Ask individual children for start numbers and steps. Practise using these examples.</p> <p>Model a sequence on board</p> <p>10, 25, <u> </u>, <u> </u>, 70, <u> </u>,</p> <div>Q What do you think this sequence is stepping in?</div> <div>Q How did you arrive at this decision?</div> <div>Q How would you check your idea?</div> <p>Ensure children are checking their ideas by matching the given sequence numbers. Use Resource sheet 12.1 as a reference.</p> <p>Children to generate their own number sequence on squares of paper.</p> <p>Arrange sequence in order with some pieces of paper face up and some face down.</p> <div>103</div> <div></div> <div></div> <div>112</div> <div></div> <div>118</div> <p>Partner to identify the missing numbers and explain the rule.</p> <p>Each child to generate or solve five number sequences.</p>	<ul style="list-style-type: none"> Children that had unsolved number sequences to show them to class. <div>Q How would you identify the step?</div> <p>Discuss and explore the strategies suggested.</p> <p>Write down 3 numbers that form a central part of a sequence, such as 1.75, 2.0, 2.25.</p> <div>Q If 2.0 is the middle term in the sequence of five numbers what are the start and end numbers?</div> <div>Q If 1.75 was the 3rd term what would the first term be?</div> <div>Q What would the 10th term be?</div> <p>By the end of the lesson children should be able to:</p> <ul style="list-style-type: none"> Describe, extend and explain number sequences; Explain each rule orally. <p>(Refer to supplement of examples, section 6, page 17.)</p>

Planning sheet	Day Three	Unit 12 <i>Number sequences</i>	Term: <i>Autumn</i>	Year Group: 6																																				
Oral and Mental		Main Teaching		Plenary																																				
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions																																				
Identify and use appropriate operations (including combinations of operations) to solve word problems based on real life (money).	<ul style="list-style-type: none">Display enlarged Resource sheet 12.2. <p>Ask children to discuss in pairs, using jottings where necessary, how to calculate each answer in turn.</p> <p>Discuss strategies and responses.</p>	<p>Recognise and extend number sequences.</p> <p>Explain methods and reasoning orally and in writing.</p> <p>Develop from explaining a generalised relationship in words to expressing it in a formula using letters as symbols.</p>	<ul style="list-style-type: none">Show this sequence of squares and circles <div><div><div>○</div><div>□○</div><div>○</div></div><div>1st term</div></div> <div><div><div>○</div><div>□○</div><div>○</div></div><div>2nd term</div></div> <div><div><div>○</div><div>□○</div><div>○</div></div><div>3rd term</div></div> <div>Q What would the 4th term look like?</div> <div>Ask the children to describe the sequence. Ask them to describe to a partner what they ‘see’.</div> <div>Q How many squares would there be in the 9th term?</div> <div>Q How many circles would there be in the 9th term?</div> <div>Q How did you work that out?</div> <div>Establish that there is 1 square for the number in the sequence and 3 circles for every square.</div> <div><ul style="list-style-type: none">Record in a table. Explain how the number sequence extends.<table><tr><td>No. of term</td><td>1st</td><td>2nd</td><td>3rd</td><td>4th</td><td>5th</td></tr><tr><td>Squares</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Circles</td><td>3</td><td>6</td><td>9</td><td>12</td><td></td></tr></table></div> <div>Q How would knowing this help us to work out the 100th term in the sequence?</div> <div><ul style="list-style-type: none">Give the children circles and squares. Invite them to create their own simple pattern, and repeat to generate a sequence.<p>Write a rule for your sequence, in words.</p><p>Complete a blank table to show their sequence.</p><table><tr><td>No. of term</td><td>1st</td><td>2nd</td><td>3rd</td><td>4th</td><td>5th</td></tr><tr><td>Squares</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Circles</td><td></td><td></td><td></td><td></td><td></td></tr></table></div> <div>Q What would the 50th number in your sequence be?</div>	No. of term	1st	2nd	3rd	4th	5th	Squares	1	2	3	4	5	Circles	3	6	9	12		No. of term	1st	2nd	3rd	4th	5th	Squares						Circles						<ul style="list-style-type: none">Choose a selection of children to show their patterns. <div>Q What is happening in the pattern?</div> <ul style="list-style-type: none">Encourage children to explain the relationship between the number of the sequence and the number of squares and circles in that pattern.Refer back to the pattern in the teaching activity: <p>Number in the squares equals the number of sequence. The number of circles is three times the number in the sequence.</p> <p>Express as:</p> <p>Squares = n Circles = $3n$ (n = number in the sequence).</p> <div>Q What shapes would the 12th term contain? 21st, 150th etc?</div> <div><p>By the end of the lesson children should be able to:</p><ul style="list-style-type: none">Begin to write a formula for the number of counters in the nth number in the sequence;Begin to express a relationship in symbols and start to use simple formulae.<p>(Refer to supplement of examples, section 6, pages 79, 81.)</p></div>
No. of term	1st	2nd	3rd	4th	5th																																			
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RESOURCES Resource sheet 12.2		VOCABULARY general rule n th term formula																																						

Planning sheet	Day Four	Unit 12 <i>Number sequences</i>	Term: <i>Autumn</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>Choose and use appropriate number operations to solve problems with calculator.</p> <p>VOCABULARY one step</p> <p>RESOURCES Calculator OHP calculator OHT 12.1</p>	<ul style="list-style-type: none">Model activity on board. <div><div>7.4</div><div>740</div></div> <p>Using the calculator and entering one calculation only (one step).</p> <div><div>Q How can I move from 7.4 to 740?</div></div> <p>Children to explain their reasoning, show OHT 12.1.</p> <ul style="list-style-type: none">Divide the class into two teams. <p>Take it in turns to state the operation needed to move them on towards Jupiter.</p> <p>Check answers on a calculator.</p> <p>Encourage the children to verbalise their reasoning.</p> <p>Discuss alternative strategies.</p>	<p>Recognise and explain patterns and relationships, generalise and predict.</p> <p>Develop from explaining a generalised relationship in words to expressing it in a formula using letters as symbols.</p> <p>RESOURCES Activity sheets 12.2, 12.3</p>	<ul style="list-style-type: none">Generate the first three terms of the sequence using different coloured counters <div><div><div>R</div><div>Y</div><div>R</div><div>Y</div></div><div><div>B</div><div>Y</div><div>R</div><div>Y</div><div>B</div></div></div> <p>Ask children to extend the sequence and explain reasoning (4th term).</p> <div><div>Q What is the relation between the 2nd term and the 3rd term?</div></div> <p>(Prompt: ‘add one more coloured counter to each arm’.)</p> <div><div>Q What would the 10th term look like?</div></div> <p>Allow time for groups to explore.</p> <ul style="list-style-type: none"><div><div>Q How many counters are there in each term from 1st to 10th?</div></div> <p>Record feedback in a chart</p> <table><tr><td>Number of term</td><td>Total number of counters</td></tr><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>4</td></tr><tr><td>3</td><td>7</td></tr></table> <p>Explain that now we are going look at the relationship between the numbers. Look at the term number and the number of counters.</p> <div><div>Q Is there a relationship?</div></div> <p>Children may suggest $\times 1$ $\times 2$</p> <p>Explore if the pattern is common to all terms. Look at multiplying by 3 and adjusting. Relate this back to prompt questions by adding three to the previous number.</p> <div><div>Q If I multiply by 3 how do I need to adjust the number?</div></div> <div><div>Q Does this rule apply to all terms? Look for $\times 3$ and $- 2$ as the rule.</div></div> <p>Encourage the children to predict and then test with the results they have generated.</p> <ul style="list-style-type: none">Use the rule to find the 100th term. Encourage children to verbalise rule.	Number of term	Total number of counters	1	1	2	4	3	7	<div><div>Q If n = number in the sequence, what is the rule? Number of counters = $3n - 2$.</div></div> <div><div>Q If I was trying to find the 20th number in the sequence, what would I do?</div></div> <ul style="list-style-type: none">Establish $3n - 2 = (3 \times 20) - 2$ as 20 is the number in the sequence, explain that 20 is the 20th term in the sequence. <p>HOMEWORK – Hand out Activity sheet 12.2.</p> <p>Model the first example, taking suggestions from children. Ask the children to describe in words.</p> <p>Arrive at formula $3n - 1$.</p> <p>Children to choose two of the four sequences to complete for homework.</p> <p>Complete sequence.</p> <p>Write a general rule in words.</p> <p>Express as a formula.</p> <div><div>By the end of the lesson the children should be able to:</div><ul style="list-style-type: none">Express a relationship in symbols and start to use simple formulae.<p>(Refer to supplement of examples, section 6, page 81.)</p></div>
Number of term	Total number of counters											
1	1											
2	4											
3	7											

Planning sheet	Day Five	Unit 12 <i>Number sequences</i>	Term: <i>Autumn</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>Use closely related facts and adjusting.</p> <p>VOCABULARY multiples</p> <p>RESOURCES OHT 12.2</p>	<ul style="list-style-type: none"> Recite 8 times table, forwards and backwards. <p>Show OHT 12.2.</p> <p>Explain that we are looking for numbers which are close to multiples of 8. e.g. 82 is 8 multiplied by 10 plus 2.</p> <p>Ask children to offer similar examples.</p> <div>Q My number is 2 multiplied by 8 minus 1. What is my number?</div> <p>Repeat with similar examples.</p> <p>Invite children to describe a number in the same way.</p>	<p>Recognise and explain patterns and relationships, generalise and predict.</p> <p>RESOURCES Activity sheet 12.2</p>	<ul style="list-style-type: none"> Display an enlarged copy of Activity sheet 12.2 and go through the homework. <p>Work through each pattern in turn with children contributing the rule, the given terms in the sequence and expressing the rule, firstly in words and then as a formula.</p> <ul style="list-style-type: none"> Set the problem: In groups of four, investigate how many Christmas cards there will be if everyone in the group sends and receives a card from every one in the group. <p>Ask the children to investigate how many Christmas cards would be sent.(Prompt – what if there were 2, 3, 4, 5, 6 children in the group).</p> <p>Take feedback.</p> <div>Q How did you keep track of the number of cards?</div> <p>Discuss the different ways of recording.</p> <p>Ask the children to investigate how many Christmas cards would be sent if there were 2, 3, 4, 5, 6 children in the group?</p> <p>Record the numbers of Christmas cards on board.</p> <p>Number of people: 2 3 4 5 6 Number of cards: 2 6 12</p> <p>Encourage the children to predict the number of cards if there were 10 people in the group.</p>	<ul style="list-style-type: none"> Ask children to explain a generalised relationship in words for finding the number of cards for 10 people. <p>Consolidate this rule for 12 people, 21 people and the whole class.</p> <p>Look for children explaining: The number of cards equals the number in the sequence multiplied by one less than the number in the sequence. e.g. 4 people would send $4 \times (4 - 1) = 12$ cards.</p> <div>Q If there were n people in the group how many cards would be sent and received?</div> <div> <p>By the end of the lesson children should be able to:</p> <ul style="list-style-type: none"> Write a formula for the nth term in the sequence; Express a relationship in symbols. <p>(Refer to supplement of examples, section 6, pages 79, 81.)</p> </div>



82	75	15	79	11
19	8	44	37	17
100	46	73	28	89
35	107	26	62	98
104	212	99	114	230

Complete these sequences

- (a) 10, 25, , , 70, ,
- (b) 1, 4, , , 36,
- (c) , , -61, -42, -23,
- (d) , , , 6, 13, 20
- (e) , 0.9, , 2.3, , 3.7,
- (f) -22, , 11, , 44



A packet of crisps costs Joe 26p.

Can you work out the cost of:

- 2 bags of crisps
- 10 bags of crisps
- 3 bags of crisps
- 5 bags of crisps
- 8 bags of crisps
- 19 bags of crisps?

Joe also wants to buy some cans of fizzy pop.

Three cans cost 78p.

How much would 10 cost?

21	35	14	350	7
5.6	4.2	6.3	35	2.1
700	49	0.7	28	70
280	560	1.4	63	2.8
140	490	42	3.5	210

Number of term	1	2	3	4	5	10	20	100	n
Dots	2	5	8	11	14				

Number of term	1	2	3	4	5	10	20	100	n
Dots	8	14	20	26	32				

Number of term	1	2	3	4	5	10	20	100	n
Dots	7	17	27	37	47				

Number of term	1	2	3	4	5	10	20	100	n
Dots	-1	1	3	5	7				

Number of term	1	2	3	4	5	10	20	100	n
Dots	9	14	19	24	29				

- Choose any two tables
- Complete the sequence
- Write a rule in words and / or a formula

Related Key Stage 2 national test questions:

2000 Test A

20

This sequence of numbers **goes up by 40** each time.

40 80 120 160 200 ...

This sequence continues.

Will the number **2140** be in the sequence?
Circle Yes or No.



Yes / No

Explain how you know.



.....

.....

.....

20

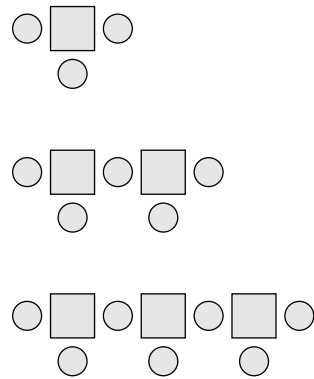
1 mark

Total

2001 Test A

23

Here is a sequence of patterns made from squares and circles.



number of squares	number of circles
1	3
2	5
3	7

The sequence continues in the same way.

Calculate how many **squares** there will be in the pattern which has **25 circles**.



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

23

2 marks

Total

2001 Test B

22

The rule for this sequence of numbers is 'add 3 each time'.

1 4 7 10 13 16 ...

This sequence continues in the same way.

Mary says,

'No matter how far you go there will never be a multiple of 3 in the sequence.'

Is she correct?
Circle Yes or No.



Yes / No

Explain how you know.



.....

.....

.....

22

1 mark


Total

2000 Test B

18

 n stands for a number.

Complete this table of values.



n	$5n - 2$
20	<input type="text"/>
<input type="text"/>	38

18a

1 mark

18b

1 mark

2002 Test A

20

A sequence starts at 500 and 80 is **subtracted** each time.

500 420 340...

The sequence continues in the same way.

Write the **first two numbers** in the sequence which are **less than zero**.

20

2 marks

Total