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The first page of a lesson is a maths problem. Don't look at the next page until you have had a go! The third and fourth pages give you practice, so you can check your understanding.



# Lesson 1

## Finding a rule

### Discover



- a) More pairs of geese land. What is the rule for the number of geese on the lake?
- b) Is Richard correct?

### Share

- a)
- |  |                          |                       |
|--|--------------------------|-----------------------|
|  | $7 + 2 = 9$              | $7 + 1 \times 2 = 9$  |
|  | $7 + 2 + 2 = 11$         | $7 + 2 \times 2 = 11$ |
|  | $7 + 2 + 2 + 2 = 13$     | $7 + 3 \times 2 = 13$ |
|  | $7 + 2 + 2 + 2 + 2 = 15$ | $7 + 4 \times 2 = 15$ |

Geese at the start	7	7	7	7	7
More pairs fly in	1	2	3	100	$n$
Total geese	$7 + 1 \times 2$	$7 + 2 \times 2$	$7 + 3 \times 2$	$7 + 100 \times 2$	$7 + n \times 2$

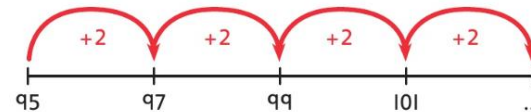
If  $n$  more pairs land on the lake, there will be  $7 + n \times 2$  geese in total.

The letter  $n$  is used here as the letter  $x$  would look like the multiplication sign. I wonder if that is confusing in algebra.

You can write  $2n$  instead of  $2 \times n$  or  $n \times 2$ . This rule can be written  $7 + 2n$ .



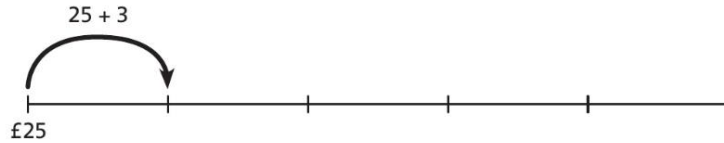
- b) No, Richard is not correct because there will never be exactly 100 geese. The rule adds on a multiple of 2 to 7, so the answer will always be an odd number.



# Lesson 1

## Finding a rule

- 1 a) Olivia has £25 in the bank. Each week she saves £3. Complete the table.



Week	1	2	3	5	10	11
Total savings	28					

- b) Complete the rule for how much Olivia has saved after  $y$  weeks.  
 After  $y$  weeks, Olivia has saved  $\square + \square \times \square$  pounds.

- 2 Max has £50 in the bank. Each week he spends £4 on a comic. Complete the table and the rule.



Week	1	2	3	5	10	$n$
Money left						

After  $n$  weeks, he has  $\square \circ \square \times \square$  pounds left.

- 3 Here is a growing pattern of triangles made from sticks.



In a growing pattern, there is a rule for how it grows each time.



Complete the table.

Number of triangles	1	2	3	4	5	10	100
Number of sticks used							

Write the rule for the number of sticks needed to make  $n$  triangles.

To make 1 triangle,  $\square$  sticks are used.

To make 2 triangles,  $\square$  sticks are used.

To make 3 triangles,  $\square$  sticks are used.

To make  $n$  triangles, \_\_\_\_\_ sticks are used.

- 4 Ebo makes this pattern of houses. What is the rule for the number of sticks needed for a pattern with  $g$  houses?



For  $g$  houses, you need \_\_\_\_\_ sticks.

Using a rule 1

Discover



Jamilla

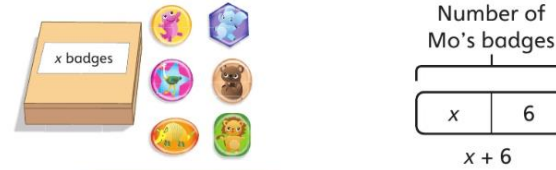
Mo

Danny

- 1 a) If Jamilla has  $x$  badges, how can the number of badges that Mo and Danny have be represented?  
 b) How many badges do Mo and Danny have if Jamilla has 4 badges?

Share

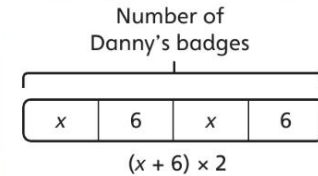
- a) Jamilla has  $x$  number of badges. Mo has 6 more badges than Jamilla. We can write that Mo has  $x + 6$  badges.



Danny has twice as many badges so I think we can write that he has  $2x$ .

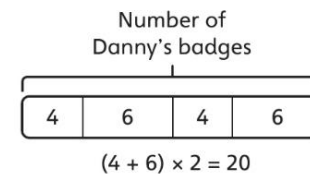
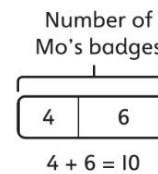


I do not think that is right. Danny has twice as many badges as Mo, **not** Jamilla, so it is not  $2x$ . I will show it with a bar model.



We can write that Danny has  $(x + 6) \times 2$  badges.

- b) Jamilla has 4 badges, so  $x = 4$ .



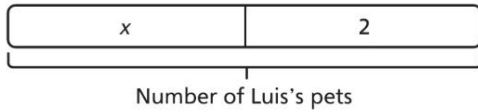
If Jamilla has 4 badges, Mo has 10 badges and Danny has 20 badges.

# Lesson 2

## Using a rule 1

1 Richard has  $x$  pet guinea pigs. Luis has 2 more than Richard. Ambika has 3 times as many as Luis.

a) Complete the rule for how many pets Luis has.



If Richard has  $x$  guinea pigs, Luis has   guinea pigs.

b) Draw a bar model to represent how many guinea pigs Ambika has.



c) Calculate the number of guinea pigs for Ambika, if Richard has 3 guinea pigs.

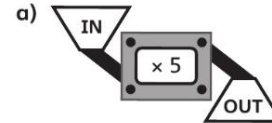


Ambika has  guinea pigs.

d) Complete the table.

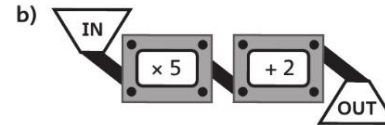
	Number of guinea pigs				
Richard	1	2	5	10	20
Luis	3				
Ambika	9				

2 Complete the table of inputs and outputs from each function machine.



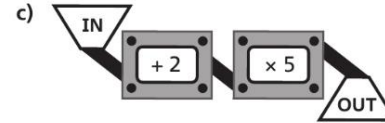
Input	1	2	3	5	10
Output					

If the input is  $a$ , the output is \_\_\_\_\_



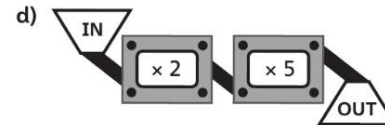
Input	1	2	3	5	10
Output					

If the input is  $b$ , the output is \_\_\_\_\_



Input	1	2		
Output				

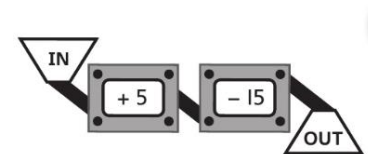
If the input is  $b$ , the output is \_\_\_\_\_



Input					
Output					

If the input is  $b$ , the output is \_\_\_\_\_

3 Max says: 'This is just the same as having a machine with one function of  $-10$ .'



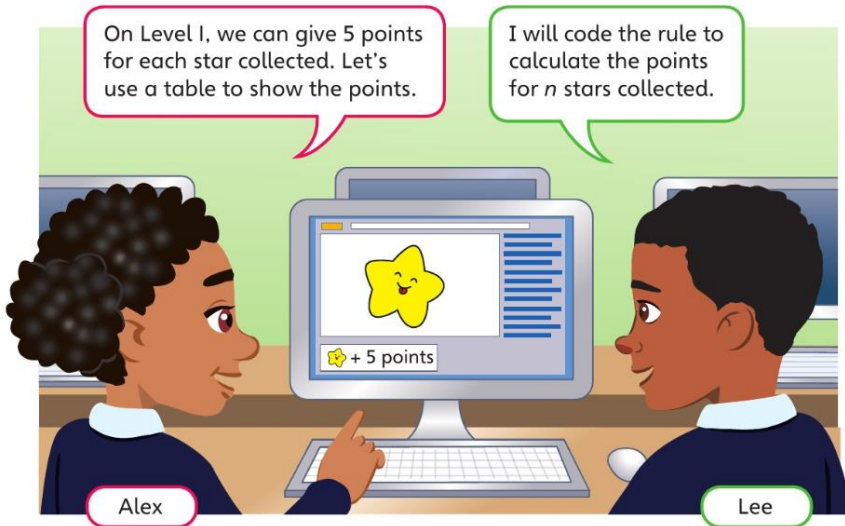
Do you agree? Compare the outputs in the table.

Input	1	2	5	100	1,000	$a$
Output for $-10$						
Output for $+5 - 15$						

# Lesson 3

## Using a rule 2

### Discover




- 1** a) Complete the table.  
Write the rule for  $n$  stars.  
How many points will you have for Level 1 if the value of  $n$  is 13?
- b) What happens to the score if the value of  $n$  increases by 10 to 23?

Number of 	Points for Level 1
1	
2	
3	
4	
$n$	

### Share

a)

Number of 	Points for Level 1
1	$5 \times 1 = 5$
2	$5 \times 2 = 10$
3	$5 \times 3 = 15$
4	$5 \times 4 = 20$
$n$	$5n$

When  $5 \times n$  is written as  $5n$ , it is called an **expression**.



When a specific value is given for  $n$ , you **substitute** the value for  $n$  into the rule. So here you substitute 13 for  $n$ .

If the value of  $n$  is 13, that means 13 stars have been collected.

The rule is  $5n$  which means  $5 \times n$  or  $n \times 5$ .

When  $n = 13$ ,  $5n = 5 \times 13$ .

$$5 \times 13 = 65$$

If the value of  $n$  is 13, you will have 65 points.

- b) Now  $n = 23$ .

#### Method 1

Work out  $5 \times 23$ .

$$5 \times 20 = 100$$

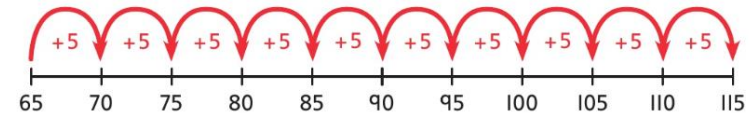
$$5 \times 3 = 15$$

If  $n = 23$ , you will have 115 points.

#### Method 2

If  $n$  increases by 10, that means 10 more stars have been collected. So the number of points will increase by  $10 \times 5$ .

If  $n = 23$ , the score will be  $65 + 50 = 115$  points.



# Lesson 3

## Using a rule ②

1 Reena has a pile of 5 pence coins.



a) Write the rule for the total value when the number of coins is  $n$ .

There are  $n$  5 pence coins. The total value =  pence.

b) Complete the table for different values of  $n$ .

Number of coins	Reena's total value
4	$5p \times 4 =$ <input type="text"/> p
5	
10	
30	
50	

2 To hire a squash court costs 20 pence per minute.

a) Write the rule for hiring the court for  $n$  minutes.

\_\_\_\_\_

b) Complete the table.

Time in minutes	Cost
$n$	$20 p \times n =$ <input type="text"/> $n$
10	<input type="text"/> $\times 10 =$ <input type="text"/>
30	
60	

3 Calculate the result for different values of  $x$  by completing the table.

	$x + 30$	$30 - x$	$30x$
$x = 5$			
$x = 10$			
$x = 30$			
$x = 0$			

4 Aki has to substitute  $x = 7$  into  $10x + 5$ .



Aki



I can work this out by finding  $7 + 5$  first, then multiplying by 10.



Does this work?

Explore and explain.

\_\_\_\_\_

\_\_\_\_\_

5 Explain how to choose values of  $y$  for the following rule, so that the result is a multiple of 10.

$100 - 5y$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Solving equations 1

### Discover

You must both remove a weight from each side, but it must stay balanced. Keep going until only the mystery weight remains on the left side.

Mr Jones      Aki      Ambika

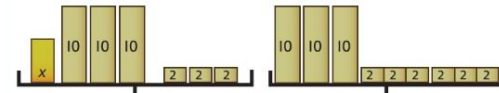
- 1 a) What is the mystery weight?  
Explain how knowing this helps you solve the equation  $x + 36 = 42$ .
- b) Solve the equation  $36 + x = 42$ .

### Share

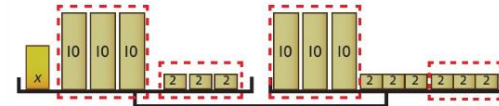
I drew the scales and then crossed out one weight from each side at the same time. It is like solving an equation.



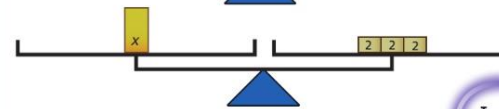
a)



$$x + 36 = 42$$



Subtract 36 from each scale.



$$x = 6$$

The mystery weight is 6 kg.

Finding the mystery weight means you can replace  $x$  with 6 to solve the equation.

I can check my answer.  $6 + 36 = 42$ . Correct!



b)

36	$x$
42	

$$36 + x = 42$$

I drew a bar model. It shows me that 36 and the unknown ( $x$ ) added together make 42.

To find the missing number, subtract 36 from 42.

$$x = 42 - 36, \text{ so } x = 6.$$



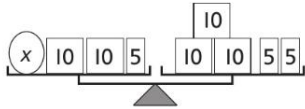


# Lesson 4

## Solving equations 1

1 Complete and solve the equations.

a)

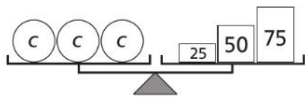


$$x + 25 = 40$$

Subtract  from each scale.

$$x = \text{$$

b)

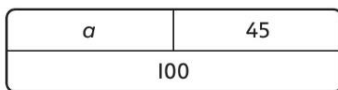


$$3c = \text{$$

each side by

$$c = \text{$$

c)

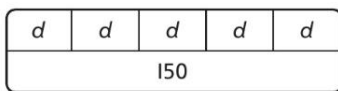


$$a + 45 = 100$$

$$100 - 45 = \text{$$

$$a = \text{$$

d)



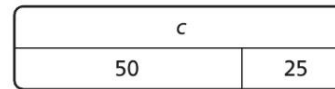
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2 Match each model with the correct equation, then solve.

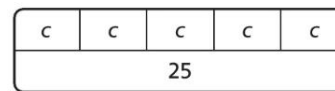
a)



$$25 = 5c$$

$$c = \text{$$

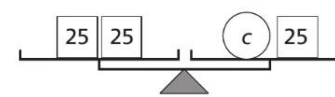
b)



$$25 + c = 50$$

$$c = \text{$$

c)



$$c - 25 = \text{$$

$$c = \text{$$

3 Solve each equation.

a)  $40 - f = 37$

d)  $4,000 - i = 3,750$

b)  $g + 37 \cdot 5 = 40$

e)  $4 \cdot 4 = 40 \cdot 4 - j$

c)  $400 = h + 37$

f)  $4k = 4$

