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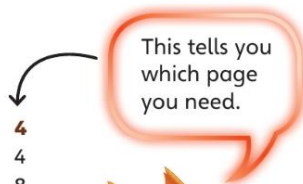
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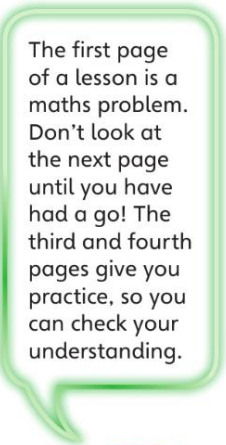
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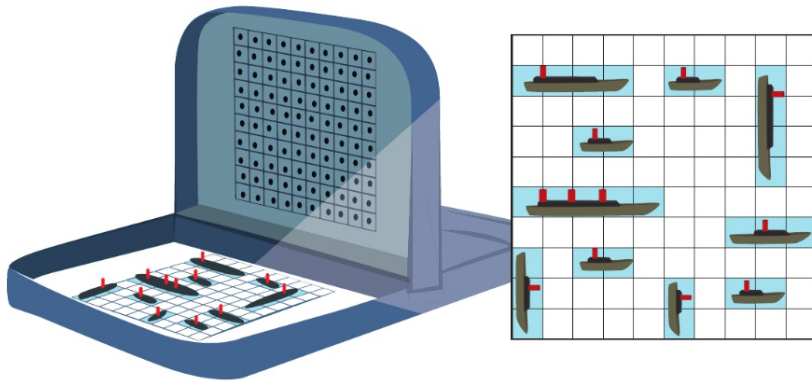
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# Lesson 1

## Understanding percentages

### Discover



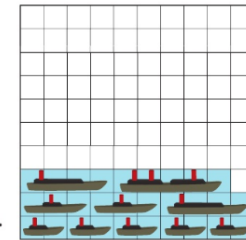
- 1 a) Reena has placed her ships on the grid.  
How much of the grid is covered?  
How much of the grid is empty?
- b) She removes these two ships.  
Now how much of the grid is covered and how much is empty?



### Share

I moved the ships side by side to make it easier to work out.

- a) The grid is 10 rows of 10 squares.  
 $10 \times 10 = 100$   
There are 100 squares in total.  
The ships cover 29 out of 100 squares.  
 $100 - 29 = 71$   
So 71 squares out of 100 are not covered.

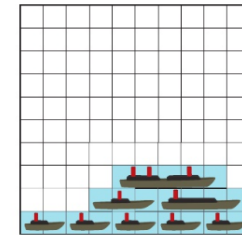


**Per cent (%)** means 'parts out of 100'. So 1 per cent means 1 part out of 100 or  $\frac{1}{100}$ . 10 per cent means 10 parts out of 100 or  $\frac{10}{100}$ .

Percentages can describe this situation.  
29% of the grid is covered.  
71% of the grid is empty.



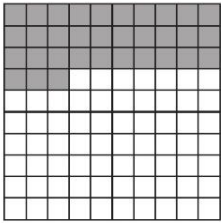
- b) The two ships covered  $4 + 3 = 7$  squares.  
 $29 - 7 = 22$   
So now only 22 out of 100 are covered.  
22% of the grid is covered.  
 $100 - 22 = 78$   
So now 78 out of 100 squares are uncovered.  
78% of the grid is empty.



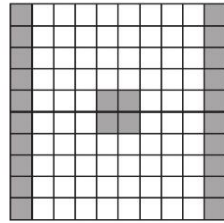
# Lesson 1

## Understanding percentages

1 How much of each grid is shaded?



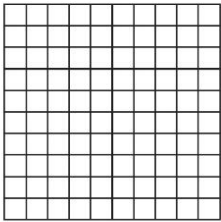
a)  out of 100 are shaded.  
That is  %.



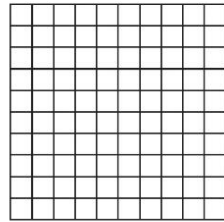
b)  out of  are shaded.  
That is  %.

2 Shade each grid as indicated.

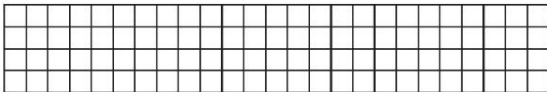
a) Shade 4 out of 100.



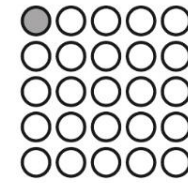
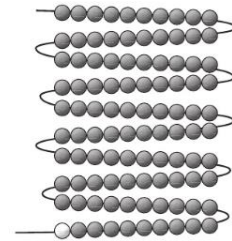
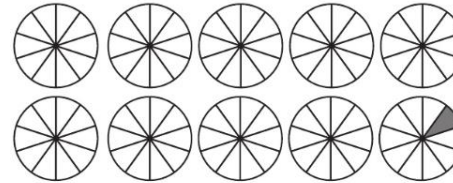
b) Shade 96%.



c) Shade 24%.



3 Circle diagrams that represent 1%.



4 There are 100 children in a school. Olivia carries out a survey amongst the children to find out what they wear to school on rainy days.

Item	Tally	Total
wellies		61
scarf		51

61 + 51 = 112. So 112% of the children wear wellies or scarves.

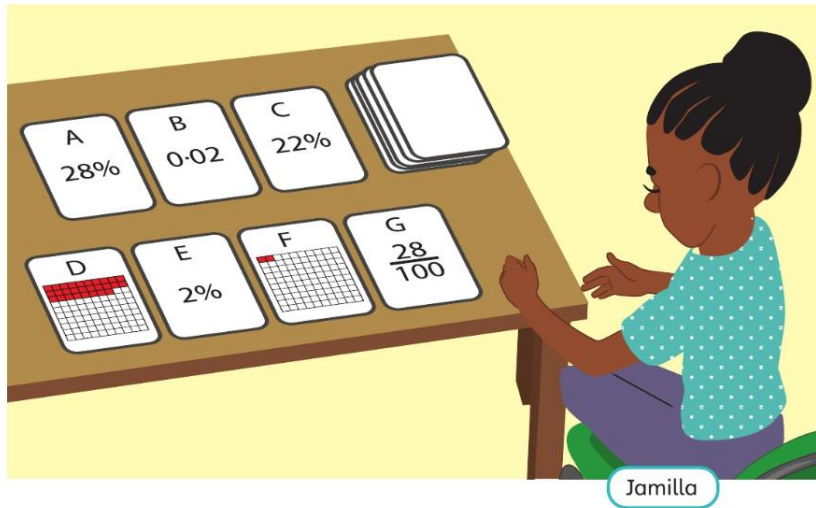
Olivia

Do you agree with Olivia? What percentages can you say for certain about the children?

## Lesson 2

### Percentages as fractions and decimals

#### Discover

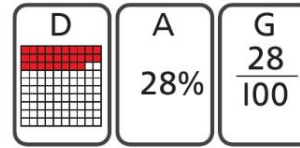


Jamilla

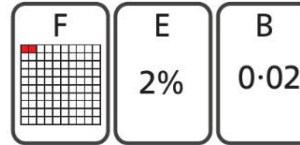
- a) Find two sets of three matching cards.
- b) Write a fraction and draw a diagram to match the remaining card.

#### Share

- a) Card D shows 28 squares shaded out of 100. This can be written as 28% (Card A) and as  $\frac{28}{100}$  (Card G).



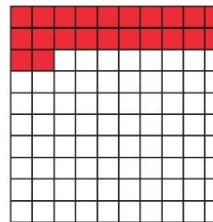
Card F shows 2 squares shaded out of 100. This can be written as 2% (Card E) and as  $\frac{2}{100} \cdot \frac{2}{100}$  is the 2 hundredths which is equivalent to the decimal 0.02 (Card B).



- b) The remaining card is Card C, which shows 22%.

22% is 22 equal parts out of 100 and so can be written as  $\frac{22}{100}$ .

This can be represented on a hundredths grid like this:



We can say  
 $22\% = \frac{22}{100}$ .  
 The percentage  
 and the fraction  
 are equivalent.



I will start with the diagram cards. Each shows 100 equal parts. This represents hundredths.

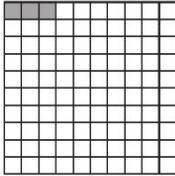
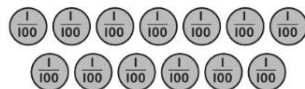
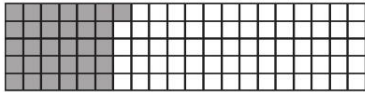


# Lesson 2

## Percentages as fractions and decimals

1 Match each diagram to its equivalent fractions, decimals and percentages.

Each diagram will match two fractions, decimals or percentages.

0.31		33%								
$\frac{33}{100}$		0.13								
3%		0.03								
13%	<table border="1" style="border-collapse: collapse; text-align: center; width: 100%;"> <tr> <td style="width: 25%;">0</td> <td style="width: 10%;">•</td> <td style="width: 25%;">Tth</td> <td style="width: 25%;">Hth</td> </tr> <tr> <td>0</td> <td>•</td> <td>3</td> <td>3</td> </tr> </table>	0	•	Tth	Hth	0	•	3	3	31%
0	•	Tth	Hth							
0	•	3	3							

2 Complete the place value grid to represent the fraction. Then write the equivalent decimal and percentage.

0	•	Tth	Hth
	•		

$\frac{32}{100}$  as a decimal is  .        $\frac{32}{100}$  as a percentage is  %

3 Complete the table to show equivalent decimals, fractions and percentages.

Fraction	Decimal	Percentage
$\frac{48}{100}$		
		99%
	0.01	

4 Fill in the missing digits.

a) $\frac{\square 3}{100} = 0.53 = 5\square\%$	c) $\square 2\% = \frac{\square 2}{100} = 0.\square\square$
b) $0.3\square = \frac{\square 5}{100} = \square\%$	d) $0.7\square = \frac{\square 8}{100} = \square\%$

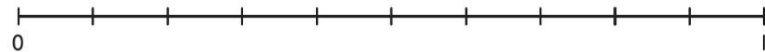
5 Arrange these numbers in order from least to greatest. 

8%      88%      0.8      0.18       $\frac{81}{100}$       1

Least \_\_\_\_\_ Greatest

6 Draw arrows to mark each number on the number line.

25%       $\frac{95}{100}$       49%      0.06      100%      5%



## Adding and subtracting decimals 1

### Discover



- How much orange paint can Olivia and Luis make?
- How much more orange paint do they need to make?

### Share

I used column addition, just like when adding whole numbers.



- Olivia and Luis can add 0.23 l of yellow paint to 0.45 l of red paint.

O	•	Tth	Hth	O	•	Tth	Hth	
		01 01	00 00 00	0	•	2	3	
		01 01 01 01	00 00 00 00 00	+	0	4	5	
						0	6	8

$0.23 + 0.45 = 0.68$  Olivia and Luis can make 0.68 l of orange paint.

- A subtraction will show how much more orange paint they need to make.

O	•	Tth	Hth	O	•	Tth	Hth
		01 01 01 01 01	00 00 00 00 00	0	•	6	8
		01 01	00 00 00 00 00	-	0	6	8
							7

First, exchange 1 tenth for 10 hundredths. Then, subtract the hundredths.

O	•	Tth	Hth	O	•	Tth	Hth	
		01 01 01 01 01	00 00 00 00 00	0	•	7	5	
		01	00 00 00 00 00	-	0	6	8	
						0	0	7

Subtract the tenths.  
 $0.75 - 0.68 = 0.07$  l

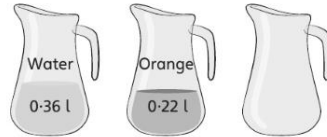
O	•	Tth	Hth	O	•	Tth	Hth	
		01 01 01 01 01	00 00 00 00 00	0	•	7	5	
		01	00 00 00 00 00	-	0	6	8	
						0	0	7

Olivia and Luis need to make 0.07 l more orange paint.

# Lesson 3

## Adding and subtracting decimals 1

1 Mo adds different amounts of water and orange to make orange squash. Complete the additions.



a)  $0.36 \text{ l} + 0.22 \text{ l} = \square \text{ l}$

O	•	Tth	Hth
	•	○ ○ ○	○○ ○○ ○○ ○○ ○○ ○○
	•	○ ○	○○

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 36 \\ + 0 \cdot 22 \\ \hline \end{array}$$

b)  $0.25 \text{ l} + 0.47 \text{ l} = \square \text{ l}$

O	•	Tth	Hth
	•	○ ○	○○ ○○ ○○ ○○ ○○ ○○
	•	○ ○ ○ ○ ○	○○ ○○ ○○ ○○ ○○ ○○

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 25 \\ + 0 \cdot 47 \\ \hline \end{array}$$

c)  $0.55 + 0.31 = \square$

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 55 \\ + 0 \cdot 31 \\ \hline \end{array}$$

d)  $0.38 + 0.38 = \square$

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 38 \\ + 0 \cdot 38 \\ \hline \end{array}$$

2 Kate works out  $0.05 + 0.12$  as a column addition. Explain Kate's mistake.

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 5 \\ + 0 \cdot 12 \\ \hline 0 \cdot 62 \end{array}$$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3 A running race is 0.65 km long. Lee runs 0.34 km. How far is left to run?

$0.65 \text{ km} - 0.34 \text{ km} = \square \text{ km}$

O	•	Tth	Hth
	•	○ ○ ○ ○ ○	○○ ○○ ○○ ○○ ○○ ○○
	•	○ ○	○○

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 65 \\ - 0 \cdot 34 \\ \hline \end{array}$$

4 Complete the subtractions.

a)  $0.92 - 0.58 = \square$

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 92 \\ - 0 \cdot 58 \\ \hline \end{array}$$

c)  $0.71 - 0.24 = \square$

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 71 \\ - 0 \cdot 24 \\ \hline \end{array}$$

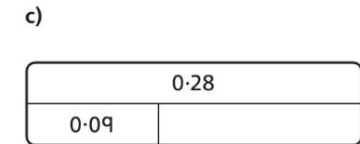
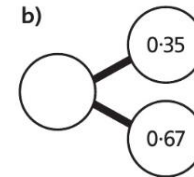
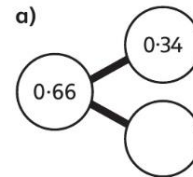
b)  $0.49 - 0.19 = \square$

$$\begin{array}{r} \text{O} \cdot \text{Tth Hth} \\ 0 \cdot 49 \\ - 0 \cdot 19 \\ \hline \end{array}$$

d)  $0.60 - 0.45 = \square$



5 Complete the missing numbers in these models.



## Adding and subtracting decimals 2

### Discover

We recorded how high each plant has grown since the start of the month.

Plant	Height at the start of the month	Amount grown	Height at the end of the month
Bamboo tree	0.7 m	0.9 m	
Cactus	0.92 m	0.33 m	

bamboo tree

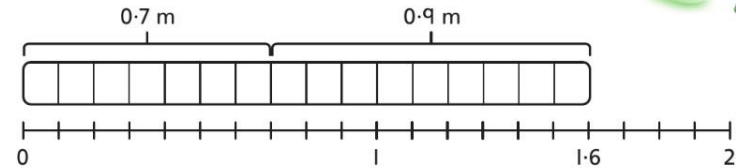
cactus

- I** a) What is the height of each plant at the end of the month?  
 b) How much taller than the cactus is the bamboo tree?

### Share

- a) At the start of the month the bamboo tree was 0.7 m tall. It grows by 0.9 m. We need to add 0.7 and 0.9.

I used a number line to help me work out the height of the bamboo tree.



$0.7 + 0.9 = 1.6$ . At the end of the month the height of the bamboo tree is 1.6 m.

The cactus is 0.92 m tall at the start of the month. It grows by 0.33 m. We need to add 0.33 to 0.92.

O	•	Tth	Hth
		0.1 0.1 0.1 0.1 0.1	0.2 0.2
		0.1 0.1 0.1 0.1 0.1	0.2 0.2
		0.1 0.1 0.1	0.2 0.2 0.2

$$\begin{array}{r}
 0.92 \\
 + 0.33 \\
 \hline
 1.25
 \end{array}$$

$0.92 + 0.33 = 1.25$

At the end of the month the height of the cactus is 1.25 m.

I used column addition to add 0.92 and 0.33. When I added the tenths, I got 12 tenths. This is the same as 1 whole and 2 tenths.





# Lesson 4

## Adding and subtracting decimals 2

1 Complete these decimal additions.

a)  $0.37 + 0.82 = \square$

0	•	Tth	Hth
	•	○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub>	○ <sub>00</sub> ○ <sub>00</sub> ○ <sub>00</sub> ○ <sub>00</sub> ○ <sub>00</sub>
	•	○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub>	○ <sub>00</sub> ○ <sub>00</sub>

0	•	Tth	Hth
0	•	3	7
+	•	8	2
<hr/>			

b)  $0.675 + 0.721 = \square$

0	•	Tth	Hth	Thth
	•	○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub>	○ <sub>00</sub> ○ <sub>00</sub> ○ <sub>00</sub> ○ <sub>00</sub> ○ <sub>00</sub>	○ <sub>000</sub> ○ <sub>000</sub> ○ <sub>000</sub> ○ <sub>000</sub> ○ <sub>000</sub>
	•	○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub> ○ <sub>01</sub>	○ <sub>00</sub> ○ <sub>00</sub>	○ <sub>000</sub>

0	•	Tth	Hth	Thth
0	•	6	7	5
+	•	7	2	1
<hr/>				

c)  $0.56 + 0.78 = \square$

0	•	Tth	Hth
0	•	5	6
+	•	7	8
<hr/>			

d)  $0.7 + 0.7 = \square$

0	•	Tth
0	•	7
+	•	7
<hr/>		

e)  $0.82 + 0.78 = \square$

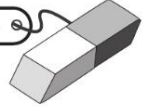
0	•	Tth	Hth
0	•	8	2
+	•	7	8
<hr/>			

2 Match each calculation with its answer.

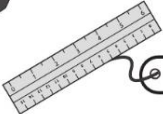
$0.23 + 0.84$	$0.76 + 0.52$	$1 + 0.17$	$0.74 + 0.63$	$0.54 + 0.85$
---------------	---------------	------------	---------------	---------------

1.39	1.37	1.07	1.28	1.17
------	------	------	------	------

3 How much do the ruler and eraser cost altogether?



£0.65



£0.89

The ruler and eraser cost £  altogether.

4 Amal uses the treadmill at the gym.

He thinks he ran further on Thursday than he did from Monday to Wednesday in total. Is Amal correct?

Day	Distance
Monday	0.625 km
Tuesday	0.193 km
Wednesday	0.208 km
Thursday	1.25 km