

# Addition and Subtraction: Inverse Operations








## (Addition and Subtraction)

<b>Aim:</b> <b>Add and subtract whole numbers with more than 4 digits, including using formal written methods.</b>  <b>To calculate using inverse operations.</b>	<b>Success Criteria:</b> <b>I can add and subtract numbers with more than four digits using formal written methods.</b>  <b>I can use different representations to show how the inverse works.</b>  <b>I can use inverse operations to check answers to calculations.</b>	<b>Resources:</b> <b>Lesson Pack</b>  Place value counters  Dice  Base ten blocks
	<b>Key/New Words:</b> Subtract, take, inverse, operation, difference, how many less, less, take away, minus, remove, fewer, decrease, add, addition, increase, more than, plus.	<b>Preparation:</b> Differentiated <b>Playing with Numbers Board Game</b> – one per pair  <b>100 Squares</b> – as required  <b>Diving into Mastery Activity Sheets</b> – one per child

**Prior Learning:** It will be helpful if children have a secure understanding of place value. They may have previously added and subtracted numbers with multiple regroupings or exchanges using formal written methods.

### Learning Sequence

	<b>Remember It:</b> Children use the calculation shown on the <b>Lesson Presentation</b> to create a modelled representation using or drawing place value counters.	
	<b>Inverse Representations:</b> Using the scales and bar models that are represented on the <b>Lesson Presentation</b> , children explore how inverse calculations work. The equals sign is described as a balance throughout this section, helping children to recognise how inverse operations can help them to solve addition and subtraction problems. <b>Can children use different representations to show how inverse works?</b>	
	<b>Calculating Using the Inverse:</b> Children choose an appropriate section as shown on the <b>Lesson Presentation</b> , attempting to answer calculations where the inverse is required. They may choose to represent the calculations in scales or bar models. <b>Can children add and subtract numbers with more than four digits using formal written methods?</b>	
	<b>Missing Number:</b> Show the number sentences on the <b>Lesson Presentation</b> . Children work in pairs to find the missing number. Discuss methods. Did children use the most efficient method?	
	<b>Solving Word Problems Using the Inverse:</b> Children use inverse operations to solve the word problems displayed on the <b>Lesson Presentation</b> .	
	<p><b>Playing with Numbers:</b> Children work in pairs with a differentiated <b>Playing with Numbers Board Game</b>. Each pair will be given a budget to start with. Children take it in turns to roll the dice and move the required number of spaces. When landing on an item, the child has to purchase the item and find out, using column subtraction, how much of their budget is left. Can anybody make it to the end of the game without spending all of their money?</p> <p>  Children play with a budget of £50 000, and may use place value counters, base ten blocks or <b>100 Squares</b> to aid understanding if required.            Children play with a budget of £100 000.            Children play with a budget of £500 000.         </p>	

	<p><b>Diving into Mastery:</b> Schools using a mastery approach may prefer to use the following as an alternative activity. These sheets might not necessarily be used in a linear way. Some children might begin at the 'Deeper' section and in fact, others may 'dive straight in' to the 'Deepest' section if they have already mastered the skill and are applying this to show their depth of understanding.</p> <p> Children develop their fluency by using inverse operations to calculate the missing numbers from equations represented on scales and bar models.</p> <p> Children answer reasoning questions which address misconceptions about inverse operations involving addition and subtraction of numbers with up to six digits.</p> <p> Children solve problems involving inverse operations, adding and subtracting numbers with up to six digits. They spot the odd one out of a set of four representations of a calculation and solve equations with missing numbers using their understanding of inverse.</p>	
	<p><b>The 60-Second Challenge:</b> Children turn to their partner and talk for 60 seconds about everything they remember from the lesson, using the success criteria to guide their discussion. After they have done this, children swap roles.</p>	

### ExploreIt

**PractiseIt:** As a class, use the interactive [Subtraction Grid Practice](#) to review children's learning and discuss strategies used to work out the answer.

**LearnIt:** Children will find this visually exciting [Knowledge Organiser](#) a useful tool to support addition and subtraction.

**WordIt:** These [Addition and Subtraction 4 Digit Worded Calculations Activity Sheets](#) help children become familiar with calculations expressed in words rather than digits and symbols.



# Maths

## Addition and Subtraction

# Inverse Operations (Addition and Subtraction)



# Aim

- To calculate using inverse operations.

# Success Criteria


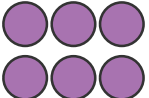
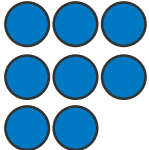
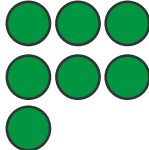

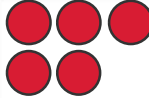
- I can add and subtract numbers with more than four digits using formal written methods.
- I can use different representations to show how the inverse works.
- I can use inverse operations to check answers to calculations.

# Remember It


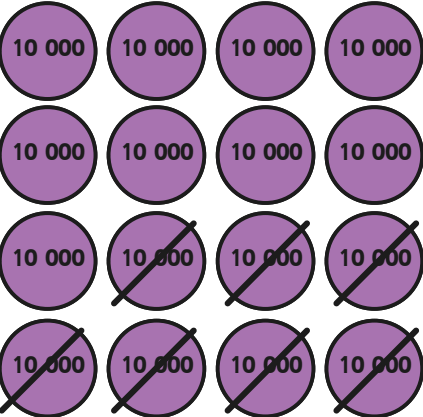
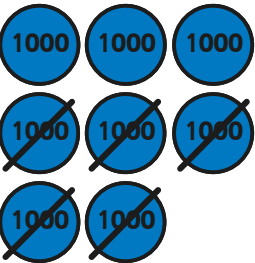
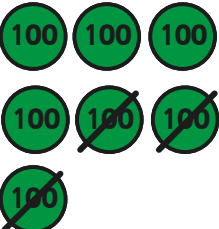




Use place value counters to complete the model, representing the calculation shown.

	HTh	TTh	Th	H	T	O
	3	6	8	7	2	5
-	1	7	5	3	1	3

Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
					

	HTh	TTh	Th	H	T	O
	<del>2</del>	16	8	7	2	5
-	1	7	5	3	1	3
	1	9	3	4	1	2

Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
					

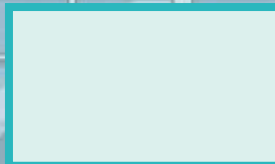
# Inverse Representations



Inverse operations can be used to find missing numbers within calculations.  
In this calculation, the number in the blue rectangle is unknown.

124 928

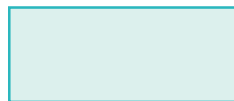
+



=

224 678

124 928 +



224 678

In mathematics, the equals sign is a balance.

=

Performing the inverse of addition, which is subtraction, will give the missing number.



# Inverse Representations



Therefore,  $124\ 928 + 99\ 750$  balances with  $224\ 678$ .

$124\ 928 +$

$224\ 678$

=

The difference between  $224\ 678$  and  $124\ 928$  is  $99\ 750$ .

	<del>1</del>	<del>11</del>	<del>13</del>	16	7	8
-	1	2	4	9	2	8
	0	9	9	7	5	0

# Inverse Representations

Bar models are often used to represent calculations where an inverse operation is required.

In this example, the numbers from the scales are represented using a bar model.

224 679	
124 928	<b>99 750</b>

# Inverse Representations



In this example, two separate calculations balance with each other. Solve the number hidden behind the blue rectangle, to make the scales balance.

$$230\,005 + 330\,059$$

$$467\,928 + \boxed{\phantom{000000}}$$

=

560 064

## Step 2:

Subtract 467 928 from the total on the left to find the missing number.

1

	<del>4</del>	<del>15</del>	<del>9</del>	10	<del>5</del>	14
-	4	6	7	9	2	8
	0	9	2	1	3	6

# Calculating Using the Inverse



Choose a section and answer these questions using the inverse.  
Remember to exchange and regroup where necessary.



1)

$$249 + \square = 300$$

$$2345 + \square = 6999$$

$$619\,497 - \square = 500\,101$$

2)

$$300 - \square = 249$$

$$13\,451 - \square = 10\,000$$

$$123\,582 + \square = 100\,992 + 312\,993$$

3)

$$445\,708 - \square = 109\,472$$

$$\square + 110\,192 = 334\,829 + 99\,294$$

4)

$$120 + 382 = 99 + \square$$

$$900\,008 + 88\,002 = \square + 522\,029$$

# Missing Number



Can you work out what the missing numbers are?

$$12\ 969 + \text{[orange splash]} = 26\ 394$$

$$\text{[orange splash]} - 1154 = 6100$$

$$\text{[orange splash]} + 4358 = 13\ 112$$

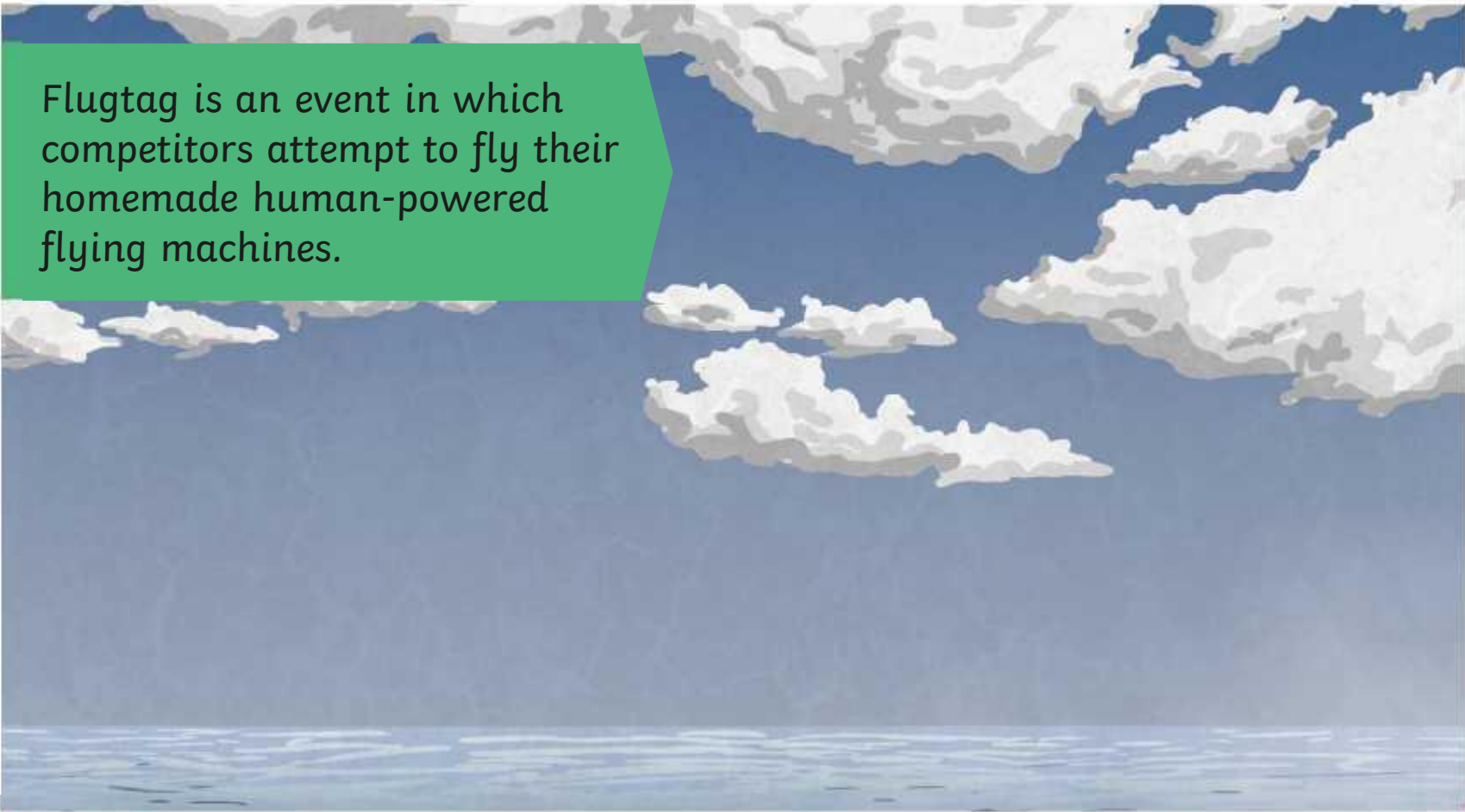
$$5764 + 4572 = \text{[orange splash]}$$



# Solving Word Problems Using the Inverse



Flugtag is an event in which competitors attempt to fly their homemade human-powered flying machines.



# Solving Word Problems Using the Inverse

In pairs, have a go at working out the answer to the word problem.

Jake wants to attend the London Flugtag.

It is **425km** from Leeds to London. Jake travels **118km** in the morning.

How many more kilometres does Jake need to travel to complete his journey to London?



307km  
Remaining

$$425\text{km} - 118\text{km} = 307\text{km}$$

# Solving Word Problems Using the Inverse

In pairs, have a go at working out the answer to the word problem.

A T-shirt stall at the Flugtag sold **1568 T-shirts** on **Saturday**, but on **Sunday**, sales **decreased** by **325 T-shirts**.

How many T-shirts did they sell at the weekend altogether? Represent your answer using bar models.

Saturday and Sunday = <b>2811</b>	
Saturday = 1568 T-shirts	Sunday = <b>1243</b> T-shirts



# Solving Word Problems Using the Inverse

In pairs, have a go at working out the answer to the word problem.

Two teams spent the same amount of money building their flying machine for the Flugtag.

Team A know every part of their budget.  
Part of Team B's budget is missing.

Use scales to solve and represent the total spent by each team.



Team A	Team B
£96 220	£89 109
£145 938	
£150	£1000

$$£96\ 220 + £145\ 938 + £150 = \mathbf{£242\ 308}$$

**£242 308**

$$£89\ 109 + £1000 = \mathbf{£90\ 109}$$
$$£242\ 308 - £90\ 109 = \mathbf{£152\ 199}$$

$$£89\ 109 + \mathbf{£152\ 199} + £1000$$

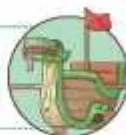


# Playing with Numbers



## Playing with Numbers

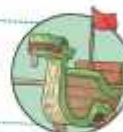
You have a budget of £50 000. Take it in turns to roll the dice and move the required number of squares. If you land on a payment space, you must subtract that amount from your budget. If you land on a reward space, you must add that amount to your budget. The aim of the game is to complete the board without running out of money. Good luck!



367	Spontaneous jumping +£25 015	363	364	Rising prices for honey -£100	366	367	Used an engine during the contest -£300	369	Finish
360	139	Report -£300	137	136	135	134	Purchase -£150	132	131
127	Raise investment +£80 000	123	124	125	Purchase -£50	127	128	129	130
120	119	Purchase -£750	117	116	115	114	113	Competition prize money +£7000	111
Purchase -£45	102	103	Face damage -£20 000	105	106	Purchase -£211	108	109	110
100	99	98	97	Purchase -£750	95	96	91	92	93
81	82	81	80	81	80	Purchase -£200	88	89	Purchase -£1500
80	79	Purchase -£380	77	Face entry charge -£19 925	75	76	Ribbon wing -£4500	72	71
Shopping Assistant -£1000	62	61	66	65	60	67	66	69	70
60	69	68	Caught cheating -£1000	66	65	64	61	62	63
61	62	63	64	Purchase -£650	60	67	Late for race -£800	69	60
60	59	58	57	56	55	54	53	52	51

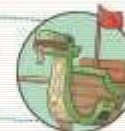
## ers

If number of budget, if you land to complete the



Used an engine during the contest -£300	149	Finish
Purchase -£1500	132	131
128	120	130
113	Competition prize money +£40 715	111
108	109	110
91	92	91
80	80	Purchase -£1500
Ribbon wing -£4500	72	71
66	69	70
65	62	61
Late for race -£800	60	60

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# 60-Second Challenge

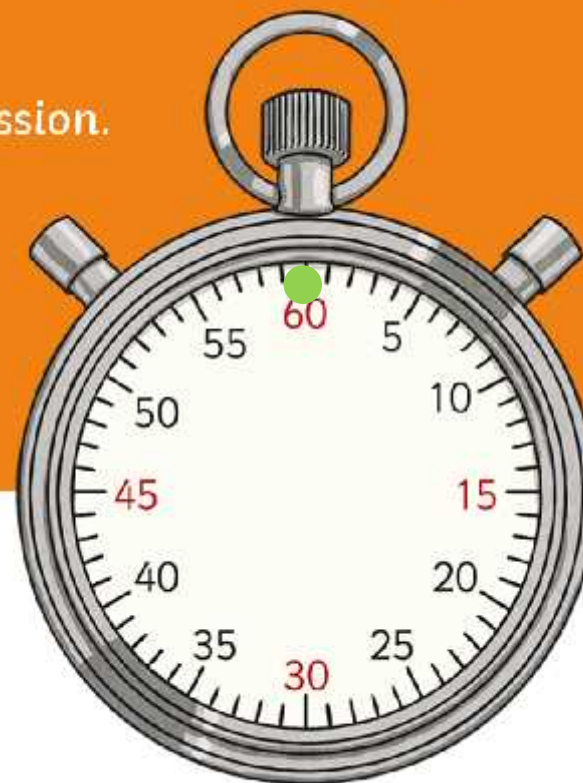


Turn to your partner and talk for 60 seconds about everything you remember about the lesson.

Use the success criteria to guide your discussion.

Then, swap roles.

Click the timer to start your 60-second countdown.



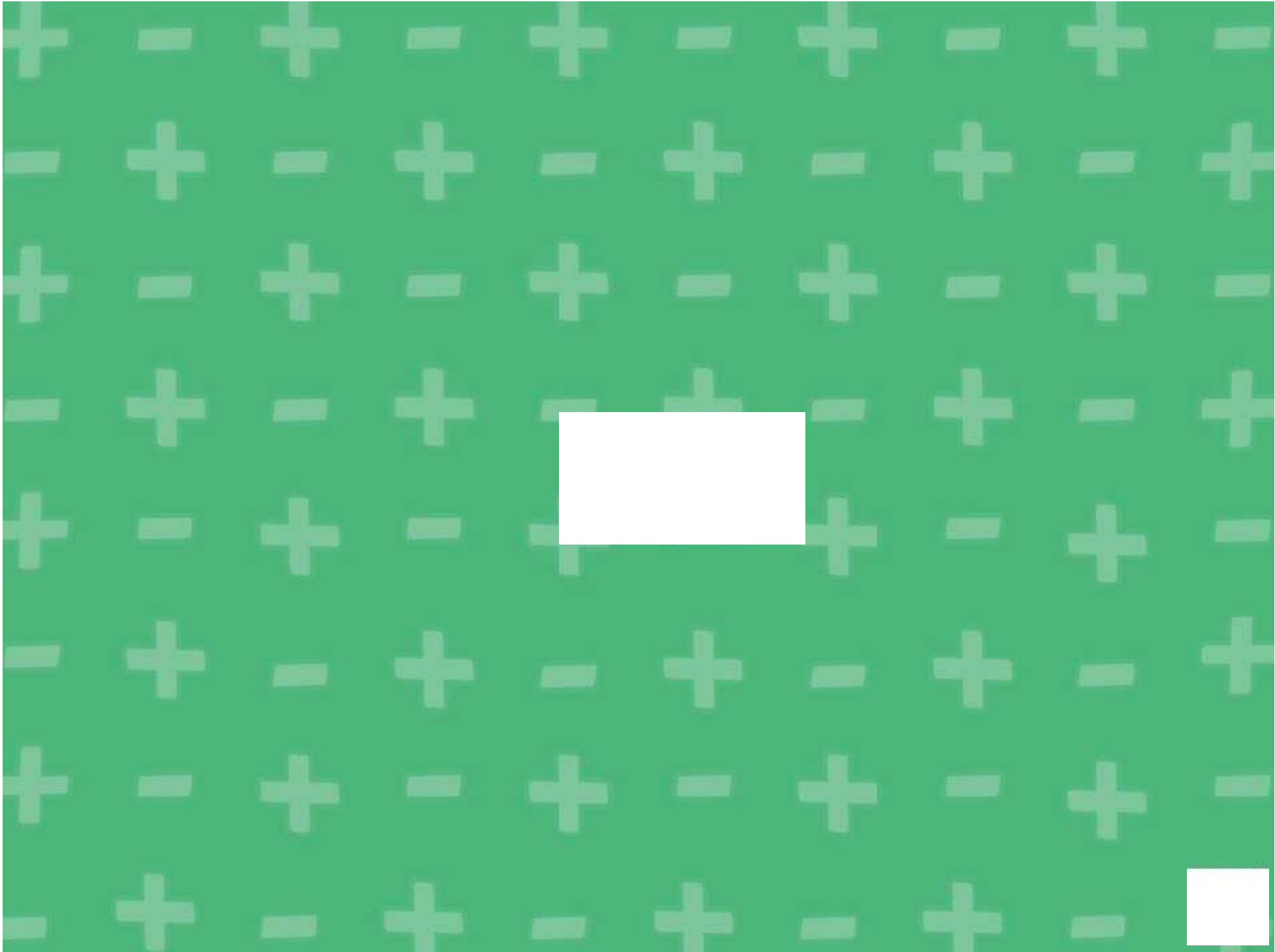
# Aim



- To calculate using inverse operations.

# Success Criteria

- I can add and subtract numbers with more than four digits using formal written methods.
- I can use different representations to show how the inverse works.
- I can use inverse operations to check answers to calculations.



Aim: To calculate using inverse operations.				Date:					
				Delivered By:			Support:		
Success Criteria	Me	Friend	Teacher	T	PPA	S	I	AL	GP
I can add and subtract numbers with more than four digits using formal written methods.				Notes/Evidence					
I can use different representations to show how the inverse works.									
I can use inverse operations to check answers to calculations.									
Next Steps									
) _____									
) _____									

<b>T</b>	Teacher	<b>I</b>	Independent
<b>PPA</b>	Planning, Preparation and Assessment	<b>AL</b>	Adult Led
<b>S</b>	Supply	<b>GP</b>	Guided Practice

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<b>PPA</b>	Planning, Preparation and Assessment	<b>AL</b>	Adult Led
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# 100 Square

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100





- 1) a)  $6142 - 4085 = 2057$   
 b)  $8756 - 5877 = 2879$   
 c)  $7291 - 6534 = 757$   
 d)  $5352 - 4867 = 485$

2) a)

6233	
4285	<b>1948</b>

b)

14 492	
6006	<b>8485</b>

c)

50 000	
<b>24 991</b>	25 009

d)

<b>182 564</b>	
94 626	87 938

e)

116 798		
87 938	<b>19 003</b>	9857

- 1) The missing number can be found by carrying out two calculations:

$683\,774 + 1007 = 684\,781$   
 $684\,781 - 600\,000 = 84\,781$   
 Peter was correct.



- 2) We know Mark is incorrect because you would need to subtract a larger number from 724 678 than you would when subtracting from 119 938. If the same number were written in each box, the scales would not balance.
- 3) Lottie is right that addition is the inverse of subtraction, but if the missing number is the one being subtracted, we find it by subtracting the answer from the starting number. The bar model makes this concept easier to visualise.

15 530	
9821	<b>5709</b>

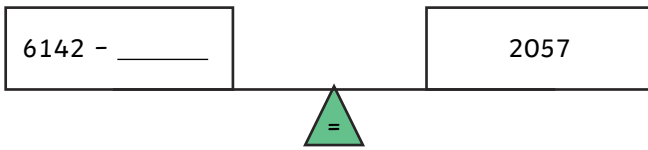
- 1) A is the odd one out because B, C and D include the numbers £23 623 and £30 672 to total £54 295, and the inverse of this.
- 2) A = 1958p; B = 3177p; C = 8438p  
 $£19.58 + £31.77 + £84.38 = £135.73$
- 3) Multiple answers possible.



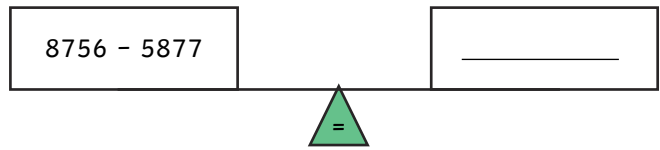


1) Solve the calculations, finding the numbers hidden on each scale.

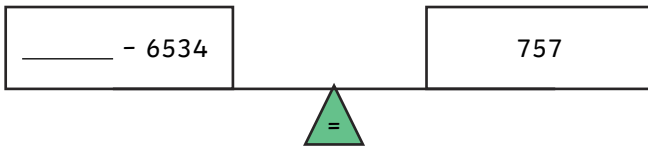
a)



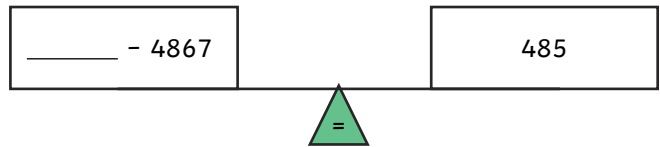
b)



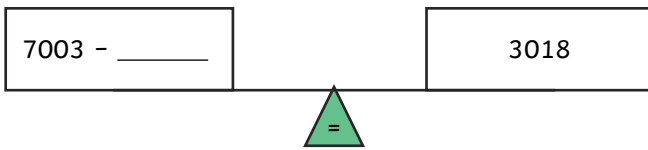
c)



d)

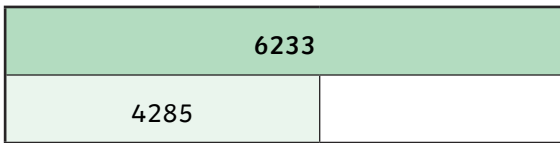


e)

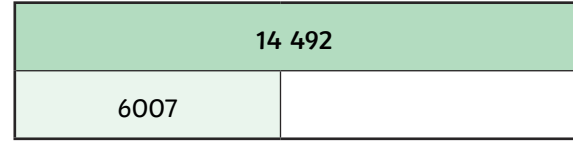


2) Complete each bar model.

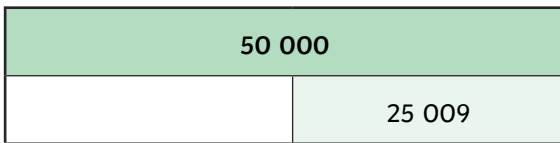
a)



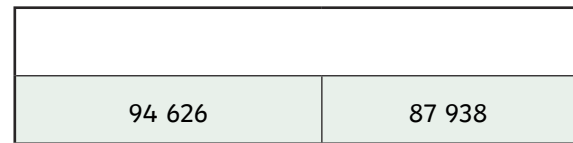
b)



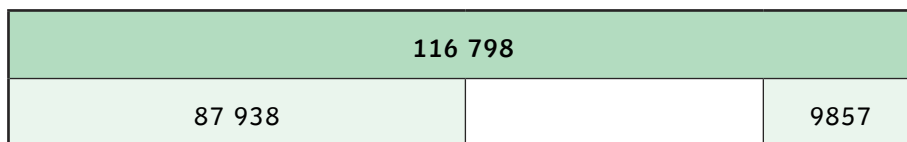
c)



d)



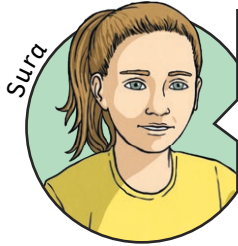
e)



1) Peter and Sura are discussing the number of calculations that are needed to complete the equation shown.



$$683\,774 + 1007 - \underline{\hspace{2cm}} = 600\,000$$



I think 3 separate calculations are needed to find the missing number, because there are 3 numbers in total.



I think the missing number can be found with 2 calculations.

Who do you agree with? Explain your answer fully.

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2) Mark says that the green boxes represent the same number within the calculation.

$724\,678 - \text{[green box]}$

$119\,938 - \text{[green box]}$

Do you agree?



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Can you prove it without doing the calculations?

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3) Look at this question:  $15\,530 - ? = 9821$



The inverse of subtraction is addition, so to find the missing number, I need to add 9821 to 15 530.

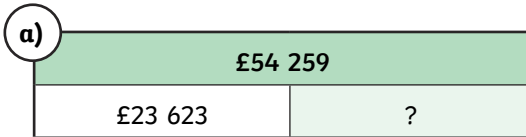
Can you help Lottie understand how to solve this calculation? It might help to draw a bar model.

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1) Spot the odd one out and give an explanation to support your thinking.

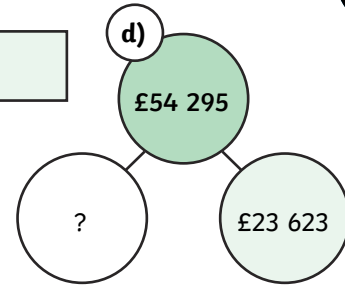


c)

$$£54\,295 - ? = £30\,672$$

b)

$$? = £23\,623 + £30\,672$$



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2) Linda went to three shops and got receipts A, B and C showing how much she spent in each transaction. She did these calculations.

Can you find out what the total cost of Linda's shopping was?

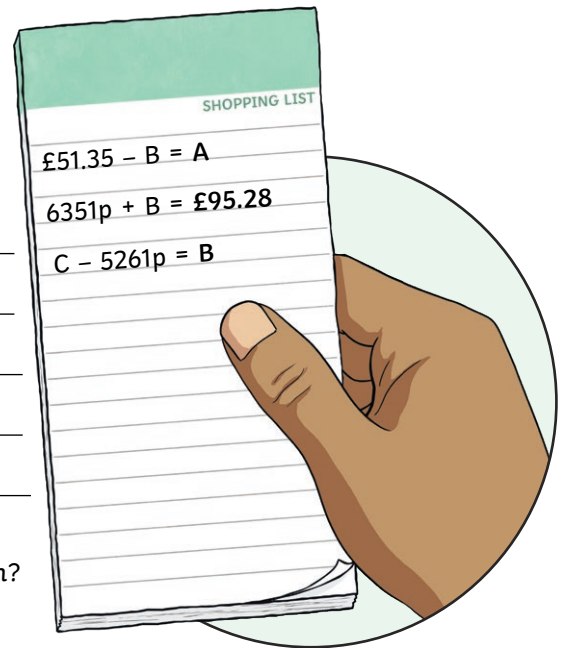
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3) Can you find 4 different pairs of numbers to satisfy the equation?

$$456\,707 - 23\,596 + ? = 456\,979 - ? + 23\,695$$

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1) Solve the calculations, finding the numbers hidden on each scale.



a)

$6142 - \underline{\hspace{2cm}}$	$2057$
$=$	

b)

$8756 - 5877$	$\underline{\hspace{2cm}}$
$=$	

c)

$\underline{\hspace{2cm}} - 6534$	$757$
$=$	

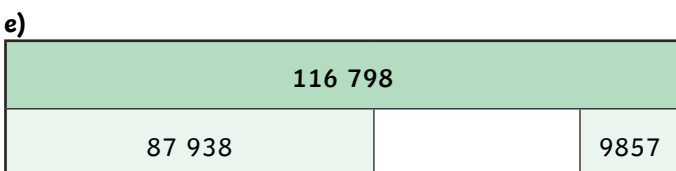
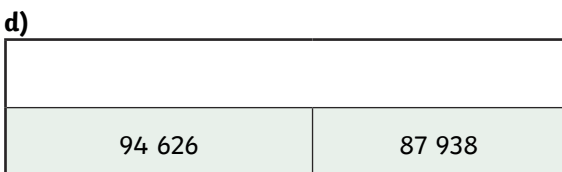
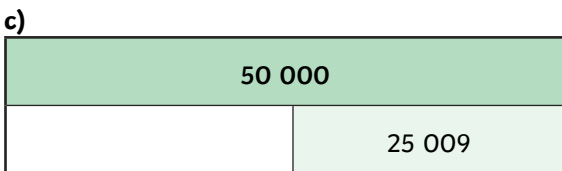
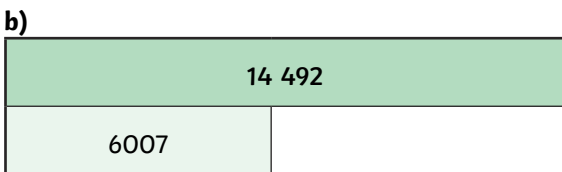
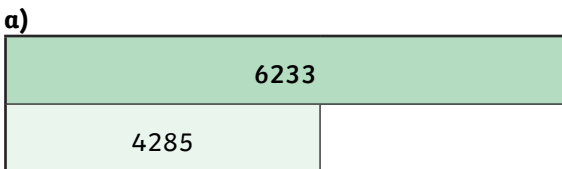
d)

$\underline{\hspace{2cm}} - 4867$	$485$
$=$	

e)

$7003 - \underline{\hspace{2cm}}$	$3018$
$=$	

2) Complete each bar model.



1) Solve the calculations, finding the numbers hidden on each scale.



a)

$6142 - \underline{\hspace{2cm}}$	$2057$
$=$	

b)

$8756 - 5877$	$\underline{\hspace{2cm}}$
$=$	

c)

$\underline{\hspace{2cm}} - 6534$	$757$
$=$	

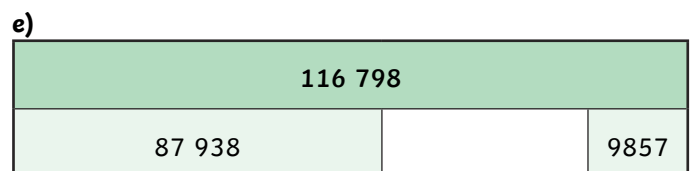
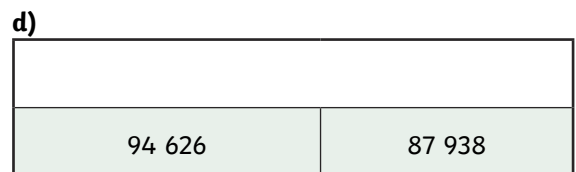
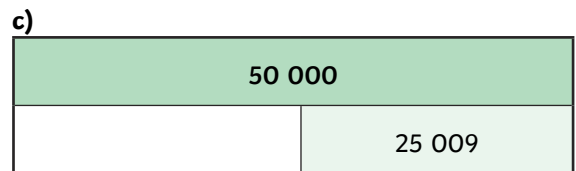
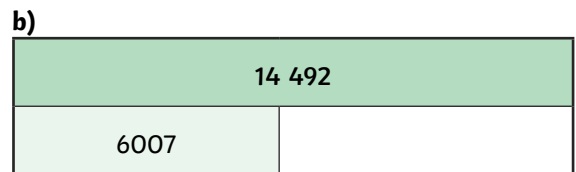
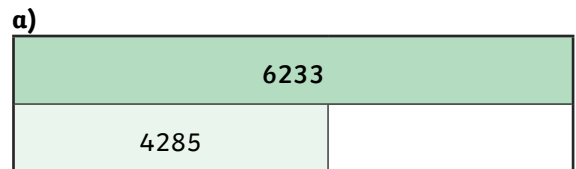
d)

$\underline{\hspace{2cm}} - 4867$	$485$
$=$	

e)

$7003 - \underline{\hspace{2cm}}$	$3018$
$=$	

2) Complete each bar model.



- 1) Peter and Sura are discussing the number of calculations that are needed to complete the equation shown.



$$683\,774 + 1007 - \underline{\hspace{2cm}} = 600\,000$$



I think 3 separate calculations are needed to find the missing number, because there are 3 numbers in total.



I think the missing number can be found with 2 calculations.

Who do you agree with?  
Explain your answer fully.

- 2) Mark says that the green boxes represent the same number within the calculation.

$$724\,678 - \boxed{\hspace{1cm}} = 119\,938 - \boxed{\hspace{1cm}}$$

Do you agree?  
Can you prove it without doing the calculations?

- 3) Look at this question:  $15\,530 - ? = 9821$



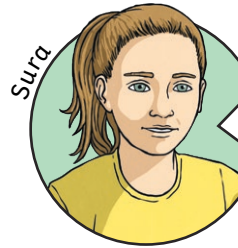
The inverse of subtraction is addition, so to find the missing number, I need to add 9821 to 15 530.

Can you help Lottie understand how to solve this calculation? It might help to draw a bar model.

- 1) Peter and Sura are discussing the number of calculations that are needed to complete the equation shown.



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- 1) Spot the odd one out and give an explanation to support your thinking.

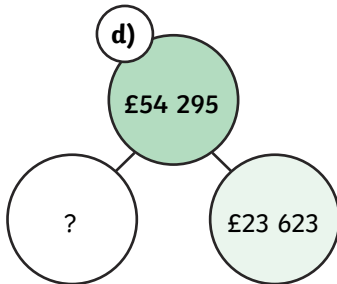


a) 

£54 259	
£23 623	?

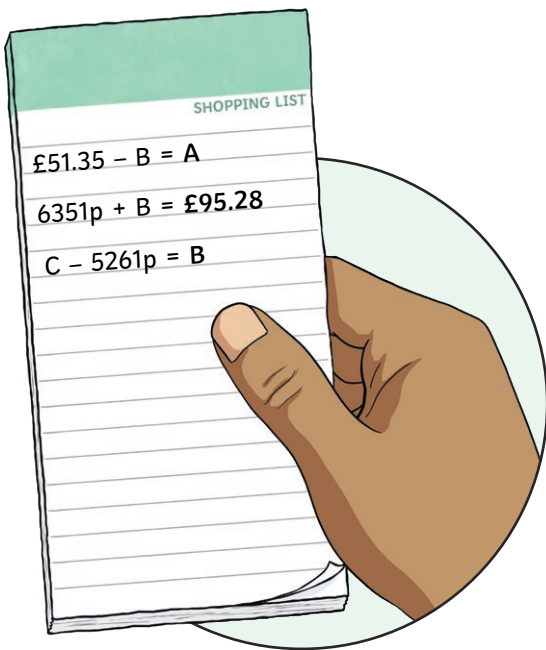
b)  $? = £23\ 623 + £30\ 672$

c)  $£54\ 295 - ? = £30\ 672$



- 2) Linda went to three shops and got receipts A, B and C showing how much she spent in each transaction. She did these calculations.

Can you find out what the total cost of Linda's shopping was?



- 3) Can you find 4 different pairs of numbers to satisfy the equation?

$$456\ 707 - 23\ 596 + ? = 456\ 979 - ? + 23\ 695$$

- 1) Spot the odd one out and give an explanation to support your thinking.

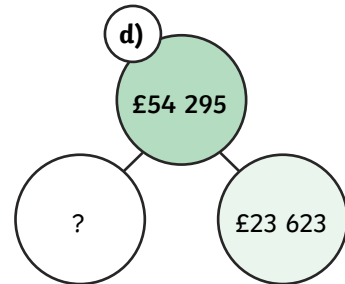


a) 

£54 259	
£23 623	?

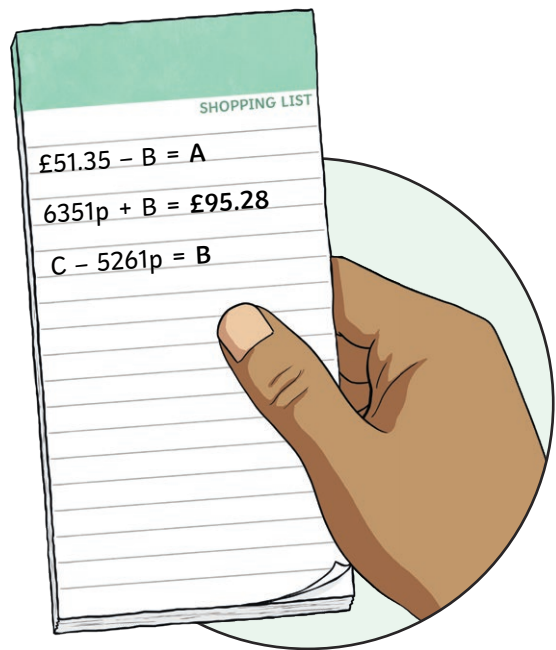
b)  $? = £23\ 623 + £30\ 672$

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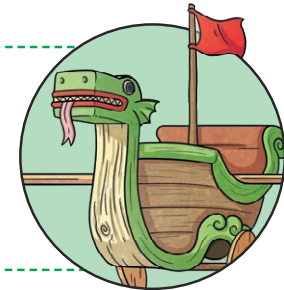



- 3) Can you find 4 different pairs of numbers to satisfy the equation?

$$456\ 707 - 23\ 596 + ? = 456\ 979 - ? + 23\ 695$$




# Playing with Numbers

You have a budget of **£50 000**. Take it in turns to roll the dice and move the required number of squares. If you land on a payment space, you must subtract that amount from your budget. If you land on a reward space, you must add that amount to your budget. The aim of the game is to complete the board without running out of money. Good luck!



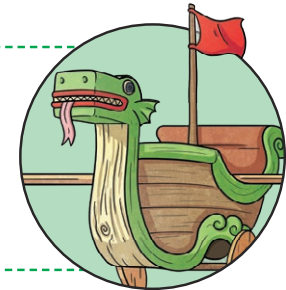
141	Sponsorship funding +£15 515	143	144	Flying machine too heavy £300	146	147	Used an engine during the contest £8509	149	Finish
140	139	Repaint £368	137	136	135	134	Purchase £154 	132	131
121	Business investment +£10 000	123	124	125	Purchase £158 	127	128	129	130
120	119	Purchase £1754 	117	116	115	114	113	Competition prize money +£7500	111
Purchase £453 	102	103	Rain damage £25 953	105	106	Purchase £231 	108	109	110
100	99	98	97	Purchase £7392 	95	94	93	92	91
81	82	83	84	85	86	Purchase £746 	88	89	Purchase £1530 



80	79	Purchase  £388	77	Race entry charge £19 925	75	74	Broken wing £3598	72	71
Shopping discount +£6999	62	63	64	65	66	67	68	69	70
60	59	58	Caught cheating £3590	56	55	54	53	52	51
41	42	43	44	Purchase  £4958	46	47	Late for race £698	49	50
40	39	38	37	36	35	34	33	32	31
21	22	Purchase  £169	24	25	Teamwork reward +£5000	27	28	29	Purchase  £4029
20	19	18	17	16	15	Purchase  £195	13	12	11
Start	2	3	Purchase  £4500	5	6	7	Purchase  £390	9	10
£50 000									

# Playing with Numbers

You have a budget of **£100 000**. Take it in turns to roll the dice and move the required number of squares. If you land on a payment space, you must subtract that amount from your budget. If you land on a reward space, you must add that amount to your budget. The aim of the game is to complete the board without running out of money. Good luck!



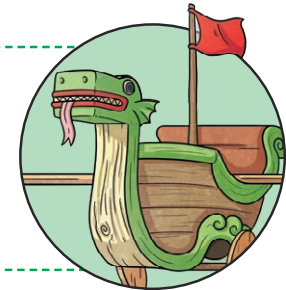
141	Sponsorship funding +£12 329	143	144	Flying machine too heavy £1300	146	147	Used an engine during the contest £18 509	149	Finish
140	139	Repaint £3680	137	136	135	134	Purchase £1540 	132	131
121	Business investment +£28 782	123	124	125	Purchase £1580 	127	128	129	130
120	119	Purchase £1754 	117	116	115	114	113	Competition prize money +£45 115	111
Purchase £4536 	102	103	Rain damage £25 953	105	106	Purchase £2315 	108	109	110
100	99	98	97	Purchase £7392 	95	94	93	92	91
81	82	83	84	85	86	Purchase £7465 	88	89	Purchase £1530 

80	79	Purchase  £3889	77	Race entry charge £19 925	75	74	Broken wing £3598	72	71
Shopping discount +£39 999	62	63	64	65	66	67	68	69	70
60	59	58	Caught cheating £13 590	56	55	54	53	52	51
41	42	43	44	Purchase  £4958	46	47	Late for race £698	49	50
40	39	38	37	36	35	34	33	32	31
21	22	Purchase  £169	24	25	Teamwork reward +£32 300	27	28	29	Purchase  £4029
20	19	18	17	16	15	Purchase  £1955	13	12	11
Start	2	3	Purchase  £4500	5	6	7	Purchase  £3900	9	10






£100 000

# Playing with Numbers

You have a budget of **£200 000**. Take it in turns to roll the dice and move the required number of squares. If you land on a payment space, you must subtract that amount from your budget. If you land on a reward space, you must add that amount to your budget. The aim of the game is to complete the board without running out of money. Good luck!

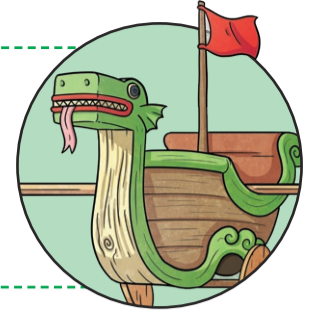


141	Sponsorship funding +£42 608	143	144	Flying machine too heavy £31 000	146	147	Used an engine during the contest £48 569	149	Finish
140	139	Repaint £36 844	137	136	135	134	Purchase £1545 	132	131
121	Business investment +£121 118	123	124	125	Purchase £1583 	127	128	129	130
120	119	Purchase £1754 	117	116	115	114	113	Competition prize money +£119 786	111
Purchase £4536 	102	103	Rain damage £25 953	105	106	Purchase £2314 	108	109	110
100	99	98	97	Purchase £7392 	95	94	93	92	91
81	82	83	84	85	86	Purchase £7465 	88	89	Purchase £15 305 

80	79	Purchase  £3887	77	Race entry charge £19 925	75	74	Broken wing £35 985	72	71
Shopping discount +£53 989	62	63	64	65	66	67	68	69	70
60	59	58	Caught cheating £135 900	56	55	54	53	52	51
41	42	43	44	Purchase  £49 587	46	47	Late for race £186 983	49	50
40	39	38	37	36	35	34	33	32	31
21	22	Purchase  £1692	24	25	Teamwork reward +£39 765	27	28	29	Purchase  £4029
20	19	18	17	16	15	Purchase  £1959	13	12	11
Start	2	3	Purchase  £34 500	5	6	7	Purchase  £3901	9	10
£200 000									

# Playing with Numbers

You have a budget of **£50 000**. Take it in turns to roll the dice and move the required number of squares. If you land on a payment space, you must subtract that amount from your budget. If you land on a reward space, you must add that amount to your budget. The aim of the game is to complete the board without running out of money. Good luck!

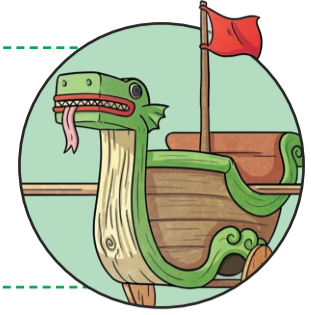


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Start	2	3	Purchase £4500	5	6	7	Purchase £390	9	10

£50 000

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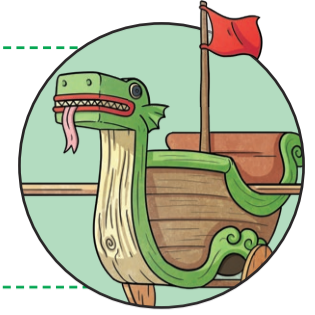


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£200 000



Addition and Subtraction | Inverse Operations (Addition and Subtraction)

To calculate using inverse operations.		
I can add and subtract numbers with more than four digits using formal written methods.		
I can use different representations to show how the inverse works.		
I can use inverse operations to check answers to calculations.		

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