Autumn Block 2

Addition and subtraction

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Small steps

Step 1	Mental strategies
Step 2	Add integers
Step 3	Subtract integers
Step 4	Inverse operations and missing numbers
Step 5	Reason from known facts

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Mental strategies

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Notes and guidance

In this small step, children recap and build on their learning from previous years to mentally calculate sums and differences using a range of different strategies. They use their knowledge of number bonds and place value to add and subtract multiples of powers of 10. Children unitise to help them complete a calculation. For example, if they know that 3 + 6 = 9, then 3 thousands + 6 thousands = 9 thousands and 3,000 + 6,000 = 9,000

Children also count forwards and backwards in multiples of powers of 10 to answer questions such as 2,050 – 100 without using a formal written method.

Children explore strategies such as compensation and adjustment to mentally calculate the answers to questions such as 12,147 + 999 or 12,147 – 999. Allow Year 6 children plenty of opportunities to consider the most efficient strategy.

Things to look out for

- Children need to be fluent in their knowledge of number bonds to support the mental strategies.

- Children may opt to use a formal method even when this is time consuming and/or inappropriate.

Key questions

- How does knowing that 3 + 4 = 7 help you to work out 3,000 + 4,000?

- How does partitioning/reordering the number(s) help?

- What number is 999 close to? How does this help you to add/subtract 999 to/from another number?

Possible sentence stems

- The sum of _____ ones and _____ ones is _____ ones, so the sum of _____ thousands and _____ thousands is _____ thousands.

Single age small step links

- Mental strategies (Y5)
- Mental calculations and estimation (Y6)

National Curriculum links

- Add and subtract numbers mentally with increasingly large numbers (Y5)
- Perform mental calculations, including with mixed operations and large numbers (Y6)

Mental strategies

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Key learning

- Use the fact that 7 + 5 = 12 to work out the additions.

  ▶ 7,000 + 5,000   ▶ 70,000 + 50,000

  ▶ 700 + 500   ▶ 7,000,000 + 5,000,000

- Use the place value chart to help you work out the subtractions.
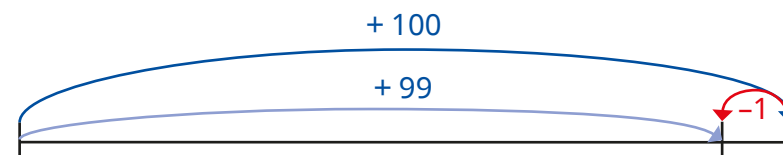
TTh	Th	H	T	O

  ▶ 48,650 – 6,000   ▶ 48,650 – 400   ▶ 48,650 – 20

  ▶ 48,650 – 1,200   ▶ 48,650 – 7,500   ▶ 48,650 – 5,040

- What strategies would you use to work out the calculations?

  52,400 – 300   4,200,493 + 300   27,353 – 7,000

  2,431,345 + 6,000   39,421 – 5,000

  Compare answers with a partner.

- The number line shows a method for adding 99 mentally.

  + 100

  + 99

  –1

  Use the number line to help you add 99 to 486

  Use a similar number line to help you subtract 99 from 486

- Work out the calculations.

  2,724 + 999   2,724 – 999

  424,498 + 99   424,498 – 99

- Work out the calculations.

  54 + 39   540 + 390   540 + 299

  6,999 + 9,500   8,204 – 6,999   5,999 + 6,999

  What mental strategy did you use for each one? Why?
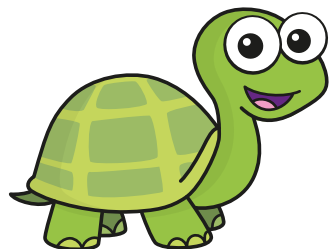
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Mental strategies

Reasoning and problem solving

Tiny is using mental strategies to add numbers.

> I know that
> 600 + 500 = 1,100,
> so 3,679 + 500 = 31,179

Explain why Tiny is wrong.

Find the correct answer to
3,679 + 500

4,179

Rosie is working out a subtraction.

> 1,000 − 567 = 999 − 566

Explain why Rosie is correct.

Work out the answer to
1,000 − 567

Use this strategy to work out the subtractions.

1,000 − 625

10,000 − 6,832

100,000 − 47,356

433

375

3,168

52,644

Add integers

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Notes and guidance

In this small step, children revisit the use of the column method for addition and apply this method to numbers with any number of digits. For this step, the numbers will be kept to integers, as addition with decimal numbers will be explored in a later block.

Concrete manipulatives or pictorial representations can be used for support in this step, including place value counters and place value charts. These representations are particularly useful when performing calculations that require an exchange. Year 5 children may spend more time practising the column addition method, whereas Year 6 children could focus more on solving problems involving adding integers.

If appropriate, children could practise their rounding skills to estimate the answer before working out the calculation, and then use it as a sense-check for their solution.

Things to look out for

- Children may not line up the numbers in the columns correctly.
- Children who are not secure in their number bonds may make numerical errors within columns.

Key questions

- Will you need to make an exchange? Which columns will be affected if you do? How do you know?
- How can you check your answer to the calculation?
- How do you know which digits to line up in the calculation?

Possible sentence stems

- The _____ is in the _____ column. It represents _____

Single age small step links

- Add whole numbers with more than four digits (Y5)
- Add and subtract integers (Y6)

National Curriculum links

- Add and subtract whole numbers with more than four digits, including using formal written methods (columnar addition and subtraction) (Y5)
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why (Y5 and Y6)
- Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy (Y6)

Add integers

Key learning

- Dexter uses place value counters to work out 5,228 + 335

Use Dexter's method to work out the additions.
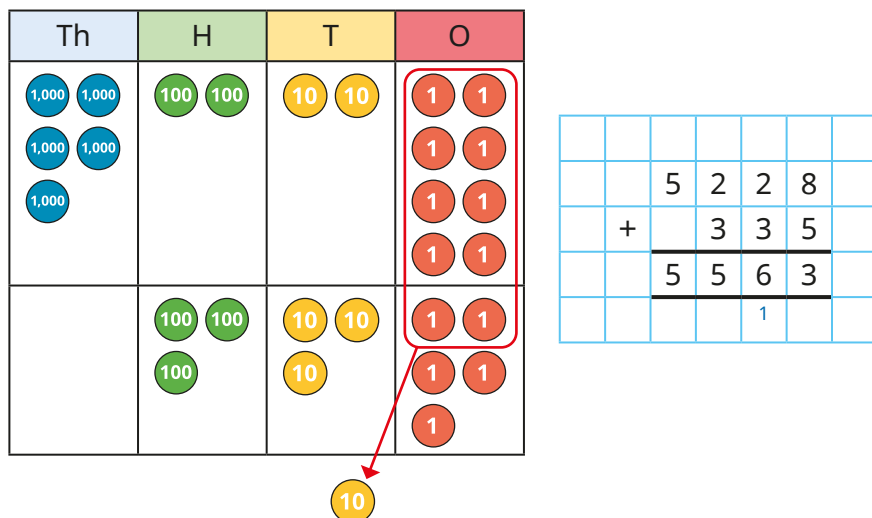
| 45,352 + 3,804 | | 37,603 + 8,198 |

- Use the column method to work out the additions.

- Find the sum of twenty-five thousand, six hundred and eight and nine thousand and thirteen.

- Which calculations would you work out mentally, and which would you work out using the column method?

| 15,480 + 7,605 | | 414,673 + 399,999 |

| 2,480,506 + 78,935 | | the sum of five million and six and a half million |

Work out the answers to the calculations.

- Teddy, Amir and Dora are playing a computer game.

  - Teddy has 6,025 points.

  - Amir has 11,250 points.

  - Dora has 9,570 points.

How many points do Teddy and Amir have altogether?

How many points do Amir and Dora have altogether?

How many points do Teddy and Dora have altogether?

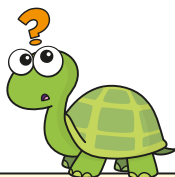How many points do Teddy, Amir and Dora have altogether?

Add integers

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Reasoning and problem solving

Work out the missing numbers.

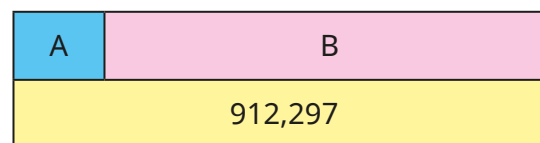|		8	6		5
+	2	3		9	7
	6		8	0	

$$38,605$$
$$+ 23,197$$
$$61,802$$

What mistake has Tiny made?

14,641 + 2,072 = 14,913

The 2 in the thousands column of the second number has been added to the hundreds instead of the thousands.

Here is a bar model.

A	B
	912,297

- A is an even integer that rounds to 100,000 to the nearest 10,000

- The sum of the digits of A is 32

- B is an odd integer that rounds to 800,000 to the nearest 100,000

- The sum of the digits of B is half the sum of the digits of A.

What could be the values of A and B?

Explain your reasoning to a partner.

multiple possible answers, e.g.

A = 98,276

B = 814,021

Subtract integers

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Notes and guidance

In this small step, children revisit the use of the column method for subtraction and learn to apply this to numbers with more than four digits.

Children use the formal column method for numbers with the same and different numbers of digits, including both questions and answers where zero appears as a placeholder. They also practise mental strategies with both large and small numbers, using their understanding of place value.

Representations that can be used for support include place value counters and place value charts. These are particularly useful for calculations that require an exchange. Year 5 children may spend more time practising the column subtraction method, whereas Year 6 children could focus more on solving problems involving subtracting integers.

Things to look out for

- Children may always subtract the smaller digit from the larger digit, instead of making an exchange when needed.
- Children may struggle with subtractions that require repeated exchanges.

Key questions

- Will you need to make an exchange? Which columns will be affected if you do? How do you know?
- How do you know which digits to line up in the calculation?

Possible sentence stems

- There are not enough _____ , so I need to exchange 1 _____ for 10 _____

Single age small step links

- Subtract whole numbers with more than four digits (Y5)
- Add and subtract integers (Y6)

National Curriculum links

- Add and subtract whole numbers with more than four digits, including using formal written methods (columnar addition and subtraction) (Y5)
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why (Y5 and Y6)
- Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy (Y6)
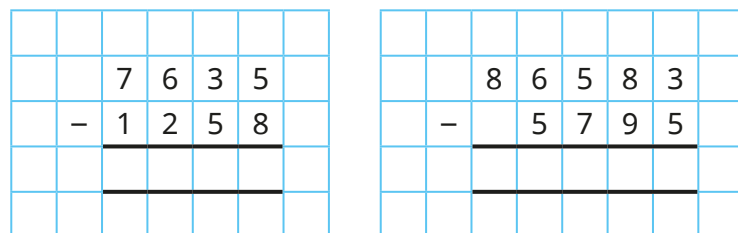
Subtract integers

Key learning

- Work out the subtraction.

  Use the place value chart and the column method to help you.

Tth	Th	H	T	O

  ```
      3  1  8  5  3
  −   1  7  6  3  2
  ```
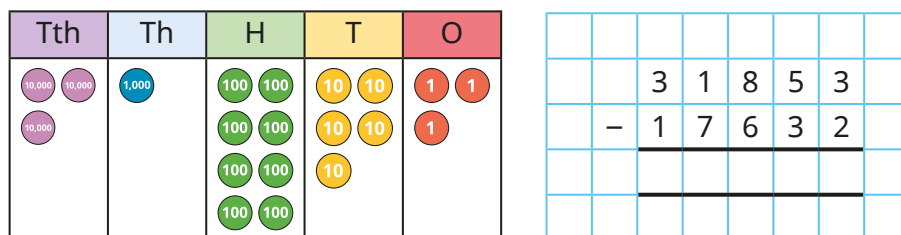
- Use the column method to work out the subtractions.

  ```
         7  6  3  5
      −  1  2  5  8
  ```

  ```
      8  6  5  8  3
      −     5  7  9  5
  ```

- There are 68,465 fans at a football match.

  49,129 of the fans are adults.

  How many of the fans are not adults?

- Mr Trent has £15,116

  He spends £3,074 in October.

  He spends £2,126 in November.

  How much money does Mr Trent have left?

- Round the numbers to find an estimated answer to
  189,765 − 61,999

  189,765 rounded to the nearest 10,000 is _____

  61,999 rounded to the nearest 10,000 is _____

  The estimated answer is _____ − _____ = _____

- Find the answers to the calculations.

  In each case, decide whether a mental method or written method is more appropriate.

15,000 − 5	674,282 − 381,849
485,187 − 10,007	680,000 − 145,843

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Subtract integers

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Reasoning and problem solving

Work out the missing numbers.

	5	4		7	6	8
−	1	5	6	1	4	
	3	8	5	6	1	

$$
\begin{array}{r}
54\mathbf{1},768 \\
-\ 156,14\mathbf{9} \\
\hline
385,61\mathbf{9}
\end{array}
$$

Tiny is working out a subtraction.

467,195 − 259,637 = 212,562

What mistake has Tiny made?

Instead of making exchanges, Tiny has found the difference between the digits in each place value column.

Find the difference between A and B.

A

6,000   13,000

B

93,500   103,500
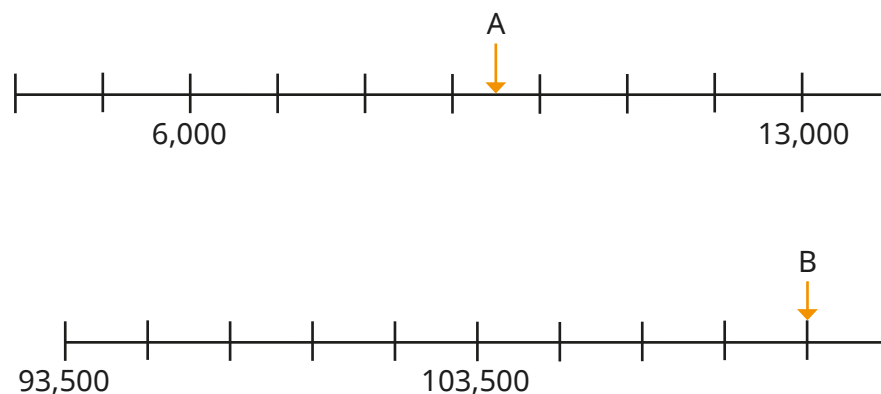
Explain your method to a partner.

102,000

Inverse operations and missing numbers

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Notes and guidance

Children should know that addition and subtraction are inverse operations, and they should already be aware that addition is commutative, but subtraction is not.

In this small step, Year 5 children begin by using bar models to establish families of facts that can be found from one calculation and then use inverse operations to check the accuracy of their calculations.

Children need to understand that when two numbers are increased by the same amount, the difference remains the same, and that the total of two numbers remains the same if one number is increased by an amount and the other decreased by the same amount. Number lines can be used to illustrate these and other related concepts.

Year 6 children may focus more on using inverse operations to find unknown numbers, solving problems such as "I think of a number and add/subtract _____".

Things to look out for

- When solving "think of a number" problems, children may use the given operation instead of the inverse operation.

Key questions

- What does an inverse operation do?
- If you increase/decrease the first number by _____, what do you need to do to the second number for the total/difference to stay the same?

Possible sentence stems

- To check that I have added/subtracted _____ correctly, I need to _____

Single age small step links

- Inverse operations (addition and subtraction) (Y5)
- Find missing numbers (Y5)

- N/A

National Curriculum links

- Add and subtract whole numbers with more than four digits, including using formal written methods (columnar addition and subtraction) (Y5)
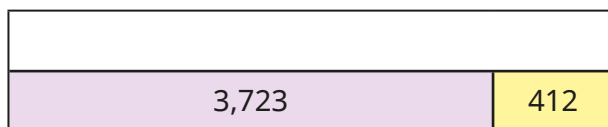- Add and subtract numbers mentally with increasingly large numbers (Y5)

Inverse operations and missing numbers

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Key learning

- Write two additions and two subtractions shown by the bar model.

6,470	
2,890	3,580
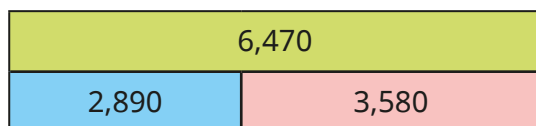
- Complete the bar model.

3,723	412

  Use a subtraction to check your answer.

- Aisha works out an addition.

  52,963 + 17,044 = 70,007

  Which subtractions can Aisha use to check her answer?

70,007 − 52,963	70,007 − 17,044
52,963 − 17,044	52,963 − 70,007

- Dexter thinks of a number.

  - He adds 1,001 to his number.
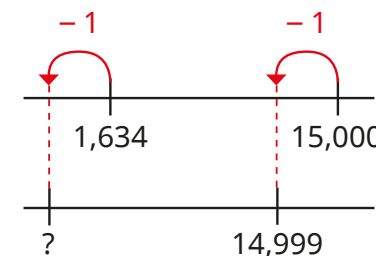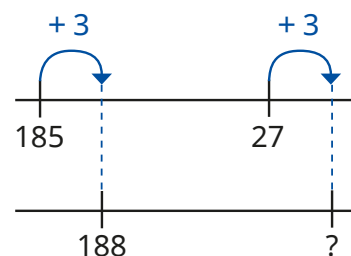
  - He then subtracts 697

  - He now has the number 9,282

  What number was Dexter thinking of?

- Complete the calculations.

  Use the number lines to help you.

  185 − 27 = 188 − _____   15,000 − 1,634 = 14,999 − _____

- Find the missing numbers.

  ▶ 1,343 + 566 = 1,333 + _____   ▶ 1,343 − 566 = 1,333 − _____

  ▶ 23,003 − 747 = _____ − 743   ▶ 9,994 + _____ = 10,003 + 542

Inverse operations and missing numbers

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Reasoning and problem solving

384 + 766 > 284 + △

Give an example of what △ **could** be.

Give an example of what △ **could not** be.

What **must** be true about △ ?

any number less than 866

---

any number greater than or equal to 866

It must be less than 866

Write the missing digits to make the calculations correct.

_4_ + _4 = 400

_4_ − _4 = 400

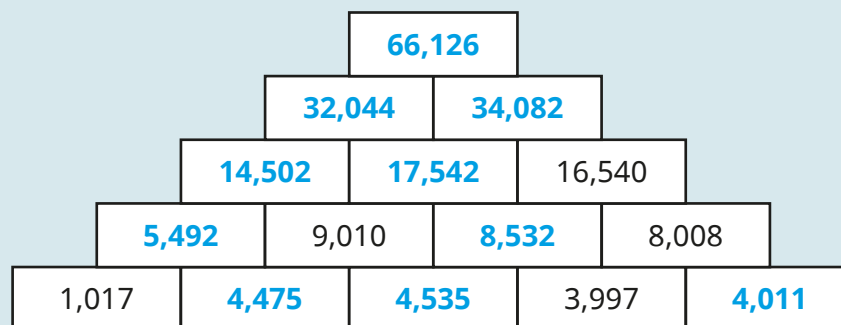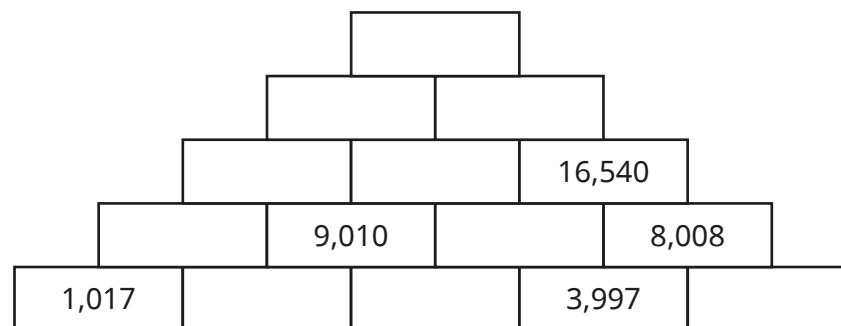How many possible solutions are there for each of the calculations?

346 + **54** = 400

444 − **44** = 400

Both calculations have only one possible solution.

In the number pyramid, each number is the sum of the two numbers below.

Use addition and subtraction to complete the pyramid.

		16,540		
	9,010		8,008	
1,017		3,997		

		66,126		
	32,044	**34,082**		
	14,502	**17,542**	16,540	
5,492	9,010	**8,532**	8,008	
1,017	**4,475**	**4,535**	3,997	**4,011**

Reason from known facts

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Notes and guidance

In this small step, children work out other facts from a given fact, using their knowledge of place value, inverse operations and commutativity.

The focus is on identifying the connections between related calculations by exploring their structure, rather than completing them. Children should understand the effect that adding to or subtracting from numbers in a calculation has on the answer to that calculation.

Representations such as bar models and number lines are useful to help children see connections between calculations. Year 5 children may require greater exposure to these representations to further support their understanding.

Things to look out for

- When given calculations, children may automatically start to work out the answers, rather than use strategies to make comparisons.

- Children may overgeneralise and use addition strategies that do not work for subtraction, and vice versa.

- Children may need support to see connections between a given fact and an adjusted calculation.

Key questions

- How can you use an inverse operation to find related facts?

- How will the answer change if you increase/decrease one of the numbers by _____?

- What is the same and what is different about the numbers in the two calculations?

Possible sentence stems

- If I add/subtract _____ to/from one/both of the numbers in the calculation, then the answer will change by _____

Single age small step links

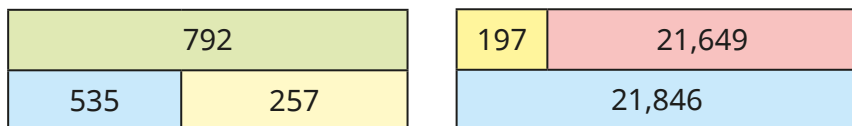- Compare calculations (Y5)

- Reason from known facts (Y6)

National Curriculum links

- Add and subtract numbers mentally with increasingly large numbers (Y5)

- Perform mental calculations, including with mixed operations and large numbers (Y6)

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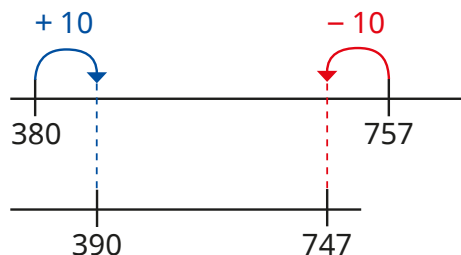# Reason from known facts

Key learning

- Write four facts shown by each bar model.

792	
535	257

197	21,649
21,846	

- Which calculation has the greater answer?

| 757 − 380 | | 747 − 390 |

Use the number lines to explain how you know.

- Use the fact that 814 − 686 = 128 to work out the answers to the calculations.

| 804 − 128 | 129 + 686 | 704 − 686 |

| 1,014 − 886 | 676 + 108 | 1,280 + 6,860 |

- Write >, < or = to complete the calculations.

173 + 401 ◯ 173 + 501

1,042 − 999 ◯ 1,043 − 1,002

245 + 11 + 755 ◯ 908 + 100 + 3

- Which calculation has the greatest answer?

| 3,593 + 878 | 881 + 3,594 | 4,093 + 377 |

Explain how you know, without working it out.

- Work out the missing numbers.

  ▶ 533 + 444 = 450 + _____   ▶ 1,952 + _____ = 1,955 + 300

  ▶ 825 − 397 = _____ − 400   ▶ _____ + 89 = 100 + 11

  ▶ _____ − 100 = 16,043 + 57   ▶ 9,341 − _____ = 8,230 − 1

Reason from known facts

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Reasoning and problem solving
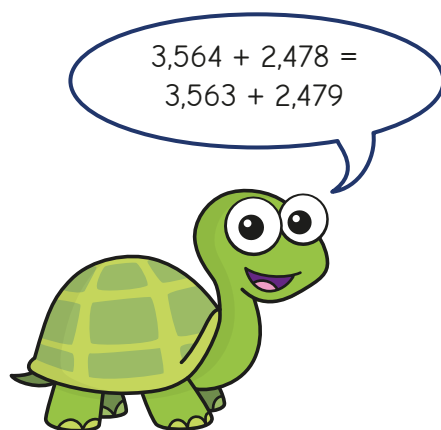
3,564 + 2,478 =
3,563 + 2,479

3,563 is 1 less than 3,564 and 2,479 is 1 more than 2,478, so the total does not change.

3,565 − 2,479

3,563 − 2,477

Explain why Tiny is correct.

Which of the calculations have the same answer as 3,564 − 2,478?

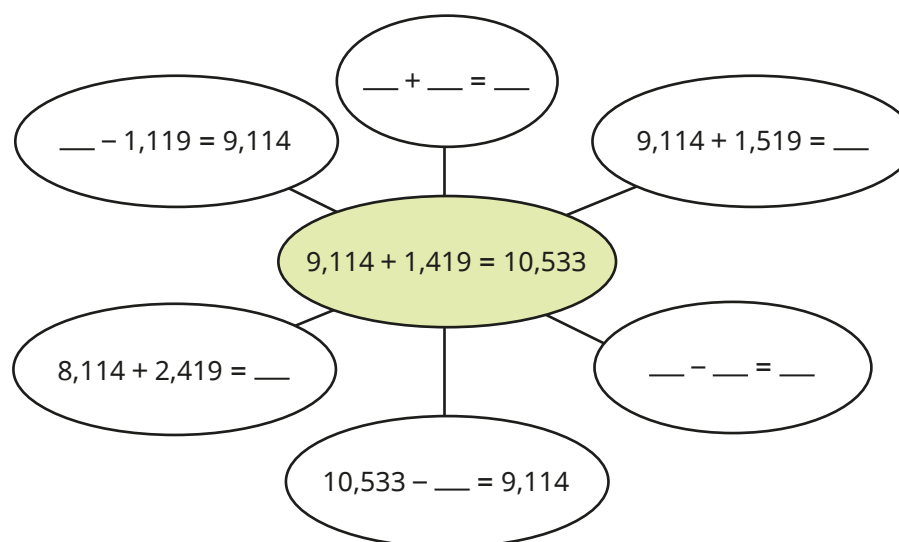| 3,565 − 2,479 | 3,563 − 2,479 |
| 3,565 − 2,477 | 3,563 − 2,477 |

Complete the spider diagram.

___ + ___ = ___

___ − 1,119 = 9,114

9,114 + 1,519 = ___

9,114 + 1,419 = 10,533

8,114 + 2,419 = ___

___ − ___ = ___

10,533 − ___ = 9,114

Compare methods with a partner.

1,419 + **9,114** = **10,533**   10,533 − **1,419** = 9,114

9,114 + 1,519 = **10,633**   8,114 + 2,419 = **10,533**

10,533 − **9,114** = **1,419** or   **10,233** − 1,119 = 9,114
10,533 − **1,419** = **9,114**