AC
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Addition and Subtraction Strategies
Having fun with the vertical algorithm

We are learning to adapt the vertical algorithm to solve harder subtractions.

Exercise 1

What to do

1) Use the vertical algorithm to solve the following problems. Set out each problem properly in your book.
2) In solving these problems, you may spot a pattern. If you do, formally write up your investigation and findings, then use your 'short-cut' to complete the exercise. (If you find any that you not sure will work with your short-cut – go back to using the vertical algorithm to check if it still works.)
3) When finished, check your answers, especially your shortcut answers, using a calculator

1)	1000 -123	(2)	1000 -345	(3)	1000 -567
4)	1000 -222	(5)	1000 -555	(6)	1000 -777
7)	1000 -521	(8)	1000 -413	(9)	1000 -434
10)	1000 -248	(11)	1000 -357	(12)	1000 -825
13)	1000 -649	(14)	1000 -854	(15)	1000 -687
16)	1000 -759	(17)	1000 -839	(18)	1000 -517
19)	1000 -398	(20)	1000 -599	(21)	1000 -999
22)	1000 -605	(23)	1000 -307	(24)	1000 -490
25)	1000 - 65	(26)	1000 - 47	(27)	1000 - 50

28) If you have not worked out a shortcut by now, discuss what other people in your group have discovered, or ask your teacher about it.
If you have discovered a short cut, make up 5 subtractions from 10000 (like 10000 – 4758) and test your method on these.

Exercise 2

What to do

1) Experiment with your strategy with these problems. Does it still work or does it need a little adapting? If it needs adapting, add an additional explanation to your investigation write-up from exercise 1.

1)	2000 - 1234	(2)	4000 -2345	(3)	6000 - 4567
4)	7000 - 3549	(5)	8000 -2678	(6)	9000 - 4539
7)	4000 - 1351	(8)	2000 -1349	(9)	9000 -6235
10)	8000 -1605	(11)	8000 -3504	(12)	5000 - 2708
13)	2000 - 457	(14)	4000 - 389	(15)	3000 - 477
16)	8000 - 2350	(17)	9000 -3007	(18)	2000 - 1060
19)	20,000 -12,345	(20)	30,000 -15,574	(21)	60,000 -43,007

Something to think about

3454 can be thought of as 3000 + 454, so 3454 – 1679 and be split into 2 pieces

3000	1321
- 1679	+454
1321	1775

Which does not involve any messy borrowing, and is easier as it is an addition.

Exercise 3

What to do

1) Use this strategy to answer the following subtractions
2) When finished, check you answers with a calculator

1)	3457 - 1568	(2)	3215 -1555	(3)	5257 - 2369
4)	6342 - 3574	(5)	3827 -1948	(6)	5111 - 2659
7)	6181 -2534	(8)	5355 -3267	(9)	4618 - 2389
10)	3471 -1269	(11)	5735 -4729	(12)	6769 - 4475
13)	5207 -3087	(14)	4056 -2906	(15)	8230 - 3619

16) By reviewing the strategy at work over the last 15 questions, you should notice that at times the additions created have no 'carries' in them, while at other times they do. Work out how you can tell if there will be any 'carries' in the addition, and if so, how many.

Exercise 4

What to do

1) Examine each of the following problems, and decide if this strategy is a good one to use on the problem. If it is not a good strategy, explain why not, a give the alternative strategy that you would use

1)	6000 - 5000	(2)	6457 - 2576	(3)	4001 - 3999
4)	4371 - 1629	(5)	3099 - 1347	(6)	3125 - 1786
7)	6500 - 459	(8)	3567 - 1234	(9)	6907 - 3846
10)	5280 - 671	(11)	8845 - 6249	(12)	5678 - 4136

13) With longer additions and subtractions, is it easier to work with the numbers written side by side or lined up in columns. Explain your answer and be prepared to debate this with other members of your group and the teacher.
14) Discuss with your teacher what name you could give to this method of subtracting

Exercise 5: working with decimals

What to do

1) In this exercise you are to investigate whether or not this strategy works for decimals as well. Try a range of the problems below using an alternative method, then use your short cut to see if it works

1)	1.00 -0.89	(2)	1.000 -0.669	(3)	1.000 -0.324
4)	3.00 -1.67	(5)	4.00 -2.81	(6)	7.00 -4.79
7)	4.15 -0.67	(8)	3.65 -2.96	(9)	4.113 -2.759
10)	6.209 -3.514	(11)	7.41 -3.29	(12)	1.54 - 0.78
13)	17.40 - 6.59	(14)	226.1 - 8.43	(15)	12.5 - 0.64
16)	6 – 1.451	(17)	14 – 2.698	(18)	22 – 17.84
19)	6.9 – 1.451	(20)	14.8 – 2.698	(21)	3.45 – 1.613

22) If there are extra things that you need to do to use this method with decimals instead of whole numbers, explain what they are. Make up 3 questions of your own on which this strategy is useful, and show how you answer them.

Exercise 6

The strategy of using complementary numbers is very useful in a number of situations. For example, when displaying the results of a survey in a data table, common practice is to show both the original figures and percentages – but the percentages have to add up to exactly 100%, which they don't do very often

1) What percentage is needed for the percentages in this table to add to 100%?

Question 1: favourite rugby team						
All Blacks	Crusaders	Hurricanes	South Africa	Highlanders	Other	Total
65/77 (%)	4/77 (5.2%)	2/77 (2.6%)	2/77 (2.6%)	2/77 (2.6%)	2/77 (2.6%)	77/77 (100%)

Add numbers to these percentages to make 100%

2)	34%	(3)	48.8%	(4)	75.4%
5)	56.1%	(6)	88.9%	(7)	40.75%
8)	77.4%	(9)	6.9%	(10)	6.37%

Exercise 7

Create a poster for the wall to explain to someone who has never seen it how the ‘complementary numbers’ strategy works. Make up some problems for people to try, and have them on your poster. Also make sure you explain when it is worthwhile to use this strategy, and how you can tell by looking at the numbers in a problem that it is worth using.

Challenge

Why does this method work? Investigate on the web. See if you can make an easy explanation that everyone in the class (and your parents) can follow.

Having fun with the vertical algorithm
Answers

Exercise 1

1)	877	(2)	655	(3)	433	(4)	778
5)	445	(6)	223	(7)	479	(8)	587
9)	566	(10)	752	(11)	643	(12)	175
13)	351	(14)	146	(15)	313	(16)	241
17)	161	(18)	483	(19)	602	(20)	401
21)	1	(22)	395	(23)	693	(24)	510
25)	935	(26)	953	(27)	950		

28) self-created problems – to be checked with a calculator

Exercise 2

1)	766	(2)	1655	(3)	1433	(4)	3451
5)	5322	(6)	4461	(7)	2649	(8)	651
9)	2765	(10)	6395	(11)	4496	(12)	2292
13)	1543	(14)	3611	(15)	2523	(16)	5650
17)	5993	(18)	940	(19)	7655	(20)	14426
21)	16993						

Exercise 3

1)	1889	(2)	1660	(3)	2888	(4)	2768
5)	1879	(6)	2452	(7)	3647	(8)	2088
9)	2229	(10)	2202	(11)	1006	(12)	2294
13)	2120	(14)	1150	(15)	4611		

16) Ones with ‘no carries’ in the additions have all but the first number ‘bigger than the number above’

For example
$$\begin{array}{r} 3457 \\ \underline{-\ 1568} \end{array}$$

Exercise 4

1)	1000	basic fact			
2)	3881				
3)	2	obvious from looking at it!			
4)	2742				
5)	1752	(6)	1339		
7)	6041	no harder than a three digit problem			
8)	2333	place value – all subtracting digits smaller than the one above			
9)	3061	(10)	4609	(11)	2596
12)	1542	place value – all subtracting digits smaller than the one above			

13) I find that they are easier to do when lined up - as in the vertical form. You may not.

14) This method is often described as using complementary numbers

Exercise 5

1)	0.11	(2)	0.334	(3)	0.674	(4)	2.33
5)	1.19	(6)	2.21	(7)	3.48	(8)	0.69
9)	1.354	(10)	2.695	(11)	4.12	(12)	0.76
13)	10.81	(14)	217.67	(15)	12.436	(16)	4.549
17)	11.302	(18)	4.16	(19)	5.449	(20)	12.102
21)	1.837						

22) The main thing is to remember to use zeros as ‘space-fillers’ for empty columns

Exercise 6

1)	84.4%	(2)	64%	(3)	51.2%	(4)	24.6%
5)	43.9%	(6)	11.1%	(7)	59.25%	(8)	22.6%
9)	93.1%	(10)	93.63%				

Exercise 7

Poster. Get a peer-marking schedule from your teacher to mark the posters made by the class

Exercise 8

You won’t get any clues here! Explain your answer to your teacher!