Addition Mistakes (Forensic Accountancy)

This test follows on from the Addition Mistakes project on page 82 of *Proof: Interesting activities in conjecture and mathematical proof*

Name:

1. [6 marks] Total marks = 60

The number 34567 is written in expanded form as $3 \times 10\,000 + 4 \times 1000 + 5 \times 100 + 6 \times 10 + 7$

The number 6789 is written in expanded form as $6 \times 1000 + 7 \times 100 + 8 \times 10 + 9$

The number 10203 is written in expanded form as $1 \times 10\,000 + 2 \times 100 + 3$

Write these numbers in expanded form:

(a) 234

(b) 67 089

(c) 65

2. [8 marks] In this question each letter stands for a digit, for example if $a = 3$, $b = 4$, $c = 5$ and $d = 7$ "*abcd*" = 3457. The speech marks mean it's not algebra, so do not multiply them all together.

Examples

Write this number in expanded form: "87*a*2" Answer is $8 \times 1000 + 7 \times 100 + a \times 10 + 2$

Write this number in expanded form: "6*b*370" Answer is $6 \times 10\,000 + b \times 1000 + 3 \times 100 + 7 \times 10$

(a) Write this number in expanded form: "4*a*2"

(b) Write this number in expanded form: "8*b*12"

(c) Write this number in expanded form: "*cd*042"

(d) Write this number in expanded form: "*pqrs*"

3. [3 marks] To add numbers manually it is helpful to rewrite them in columns.

Example: 456 + 78 + 112 + 50 becomes

thousands	hundreds	tens	units
	4	5	6
		7	8
	1	1	2
		5	0

Example: 3125 + 3 + 1101 + 72 becomes

thousands	hundreds	tens	units
3	1	2	5
			3
1	1	0	1
		7	2

(a) Complete the columns for

53 + 741 + 3007 + 4

thousands	hundreds	tens	units

(b) Complete the columns for

3000 + 3026 + 8 + 54

thousands	hundreds	tens	units

(c) Complete the columns for

940 + 28 + 1010 + "*abc*"

where in "*abc*" each letter stands for a digit (as in Question 2).

thousands	hundreds	tens	units

4. [15 marks] These additions are wrong! For each one, find the correct total and also the difference between the correct total and the wrong total that is given.

			15	
			468	
			295	
			771	
		391	28	20944751
542	28519	6084	623	67201912
106	667426	277	192	6829103
702	695765	7292	2356	95038766

Correct:

Difference:

In each addition, highlight the two digits that were transposed to cause the mistake.
Circle them or use a highlighter.

5. [3 marks] If you were doing a problem like the ones in question 1 and the difference between the correct total and the wrong total was 45, where would you look for transposed digits and what digits might they be? Explain, giving an example if that helps.

6. [3 marks] If you were doing a problem like the ones in question 1 and the difference between the correct total and the wrong total was 720, where would you look for transposed digits and what digits might they be? Explain, giving an example if that helps.

7. [10 marks] Simplify these algebraic expressions.

Example: $5x - 2x = 3x$

Example: $100y - 20y = 80y$

Example: $4x - 7x = -3x$

(a) $6x - 4x$

(b) $10x - 3x$

(c) $50x - x$

(d) $2y - y$

(e) $6y - 8y$

(f) $10y - 100y$

(g) $100y - 10y$

(h) $x - 10x$

(i) $1000x - 100x$

(j) $1000y - 10\,000y$

8. [2 marks] Complete this table. (If necessary, divide the numbers by 9 on your calculator.)

		It is a multiple of 9	It is not a multiple of 9
Example	36	✓	
Example	51		✓
Example	900	✓	
	18		
	270		
	458		
	90 000		
	77		
	63		
	9		
	1		

9. [2 marks] In this question each letter stands for a digit. Simplify these algebraic expressions, and indicate if your answer is a multiple of 9 or not.

	Expression	Simplified	It is a multiple of 9	It is not a multiple of 9
Example	$28a - a$	$27a$	✓	
Example	$11b - 5b$	$6b$		✓
Example	$95c - 5c$	$90c$	✓	
	$19d - d$			
	$48e - 3e$			
	$60f - 4f$			
	$901g - g$			
	$100h - 3h$			
	$50i - 5i$			
	$3000j - 3j$			
	$1000k - 100k$			
	$12m - 30m$			
	$600n - 700n$			
	$10p - 100p$			

10. [8 marks] Complete these tables. In this question each letter stands for a digit.

Example	Decimal Form	Expanded form
Number	65432	$6 \times 10\,000 + 5 \times 1000 + 4 \times 100 + 3 \times 10 + 2$
Number with two digits transposed	65342	$6 \times 10\,000 + 5 \times 1000 + 3 \times 100 + 4 \times 10 + 2$
Difference	90	$430 - 340 = 90$

Example	Decimal Form	Expanded form
Number	"861*a*"	$8 \times 1000 + 6 \times 100 + 1 \times 10 + a$
Number with two digits transposed	"681*a*"	$6 \times 1000 + 8 \times 100 + 1 \times 10 + a$
Difference	1800	$8600 - 6800 = 1800$

	Decimal Form	Expanded form
Number	963*b*	
Number with two digits transposed	936*b*	
Difference		

	Decimal Form	Expanded form
Number	4*c*27	
Number with two digits transposed	42*c*7	
Difference		

	Decimal Form	Expanded form
Number	3*def*	
Number with two digits transposed	3*edf*	
Difference		

	Decimal Form	Expanded form
Number	*ghij*	
Number with two digits transposed	*ghji*	
Difference		