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DIGIT CARDS – CREATIVE ACTIVITY IN WHOLE TENS

Different people solve the same assignment in different individual ways. This harks back the feeling that mathematics is not just a rigid subject but has also a wide view. Developing original solution methods enables control over the calculating process and enhances learners' self-confidence in math skills.

Numerical insight is manifested by an intuitive view of mathematical constructs and their link to the four rules of mathematics, being that there is a connection between things, an ability to mobilize knowledge and trigger previous experience in order to develop various solution strategies, by understanding different solution methods and openness to new ways (Ministry of Education, 2006).

One of the duties of the good teacher is to foster creativity among his students. Although teachers are expected to devote time, thought and preparation, the daily routine does not allow this (Beghetto, 2006). Therefore, students do not always have the right to enjoy interesting and challenging activities that develop creativity. Teachers often find that this is a waste of valuable time and not appreciated as the achievements of students according to the routine and familiar plan (Levav-Waynberg, Leikin, 2012).

The numerical insight relates to general mathematical orientation rather than solely on a certain mathematical chapter. It encompasses various aspects, such as: examination of the variety and effectiveness of different solution methods; solution of a new exercise based on a known and familiar exercise; decomposition of an arithmetic numerical construct into its components and composition of the elements into more complex units; oral calculations, effective calculation; estimation of

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various measurements; comprehension of the necessity for control; examination of the probability of results; identification of errors; acquaintance with control methods; perception of concepts; and presentation of hypotheses at an intuitive level.

The activity described below is meant to engage learners in a directed assignment of exploring the addition of two numbers whose smallest sum is in whole tens (Patkin & Bassan-Cincinatus, 2014; Bassan-Cincinatus & Patkin, 2018). It aims to encourage development of numerical insight while integrating all the above-mentioned areas with which pupils should deal.

The objectives of the activity are the following:

1. Revision of the table of multiplication.
2. Expansion of pupils' acquaintance with numbers which sum is in whole tens: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100.
3. Informed application of the table of hundreds and the table of thousands.
4. Systematic recording of exercises.
5. Solution of assignments in different ways.

Ten gradual assignments designed for 1st up to 6th graders.

The assignments are based on the principle of using "digit cards" on which there is the indication of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 (10-digit cards, one for each digit).

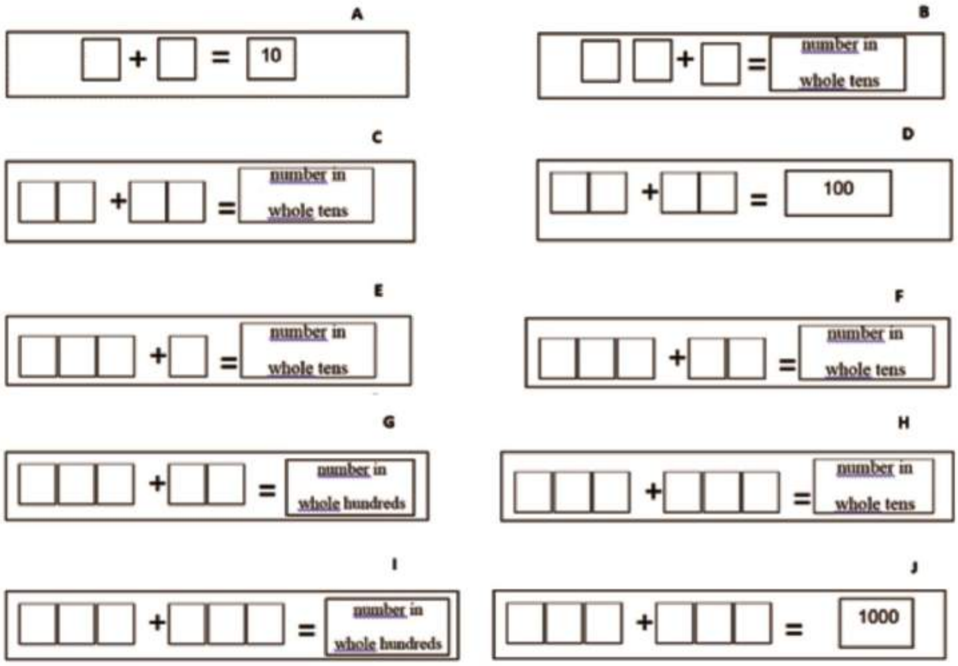
The assignment: Using digit cards, form two numbers so that their sum is in whole tens. For example, the sum can be 10, 20… 100…1000.

Teachers should point out to the pupils that they cannot use one digit more than once in each exercise. The teachers should elaborate the fact that a 1-digit number is represented by one digit and it will be written on only one-digit card, a 2-digit number is represented by two-digit cards and a 3-digit number by three-digit cards. Teachers should discuss with their pupils the difference between a digit and a number. At the beginning of the activity, teachers can ask the pupils to choose and place the digit cards with the appropriate numbers in the blanks.

The assignments are presented in ten patterns, i.e. a number of whole tens and a number of whole hundreds.

After several attempts, the teachers should ask the pupils to describe in their own words what they are required to do in the assignment or assignments presented to them, as well as explain and give reasons for their arguments. Alternately, if the pupils are endowed with a high generalization capability, there is another option, namely the one presenting the assignments to them verbally, asking them to represent it in the pattern. Only at a later stage should the learners see them as they are represented in the patterns, comparing them to their own representation (Table 1).

Table 1



Below (Table 2) is the verbal description of the ten assignments to be displayed underneath:

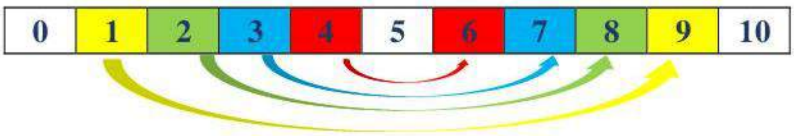
Table 2

1. The sum of a 1-digit number and a 1-digit number is 10.	2. The sum of a 2-digit number and a 1-digit number is \`in whole tens.
3. The sum of a 2-digit number and a 2-digit number is in whole tens.	4. The sum of a 2-digit number and a 2-digit number is 100.
5. The sum of a 3-digit number and a 1-digit number is in whole tens.	6. The sum of a 3-digit number and a 2-digit number is in whole tens.
7. The sum of a 3-digit number and a 2-digit number is in whole hundreds.	8. The sum of a 3-digit number and a 3-digit number is in whole tens.
9. The sum of a 3-digit number and a 3-digit number is in whole hundreds.	10. The sum of a two 3-digit numbers is 1000.

The questions arising from performing the assignments are likely to be the following ones: What are the various exercises which comply with the pattern? How many different exercises can we write for the pattern? What are the exercises which are certainly incompatible with the pattern? Is there another suitable number which complies with the pattern?

Assignment 1: The smallest sum of a 1-digit number and a 1-digit number is 10.

It is recommended to encourage children to paint (with the same colour) every two numbers whose sum is 10.



Please note: The digit cards with the digits 0 & 5 are not included in the assignment.

There is a systematic way to get four solution, for example: 1+9=**10**, 2+8=**10**, 3+7=**10**, 4+6=**10**.

Pupils should be encouraged to consider the question: Why is the presentation of the solution 1+9 identical to the presentation of the solution 9+1?

Assignment 2: The smallest sum of a 2-digit number and a 1-digit number is in whole tens.

A 2-digit number should be added to a 1-digit number so that the resulting sum is in whole tens.

These are the set of possible questions pupils should be stimulated to ask:

1. What is the smallest 2-digit number which can be formed with the digit cards?

2. Which digit card represents the smallest 1-digit number which can be added to a 2-digit number (using the remaining digit cards) in order to obtain a number in whole tens?

3. Is there a single digit which matches it?

Teachers can provide empty patterns which the pupils can complete. At a later stage, teachers can present an empty table and ask the pupils to complete it in the following way. In the first exercise the first given number is the 2-digit number which is the smallest number possible while the second number is the 1-digit number which matches it. Thus, all the exercises will be written in a sequence, while paying attention to “cover” all the options of the 2-digit numbers, from the smallest up to the biggest.

Table 3

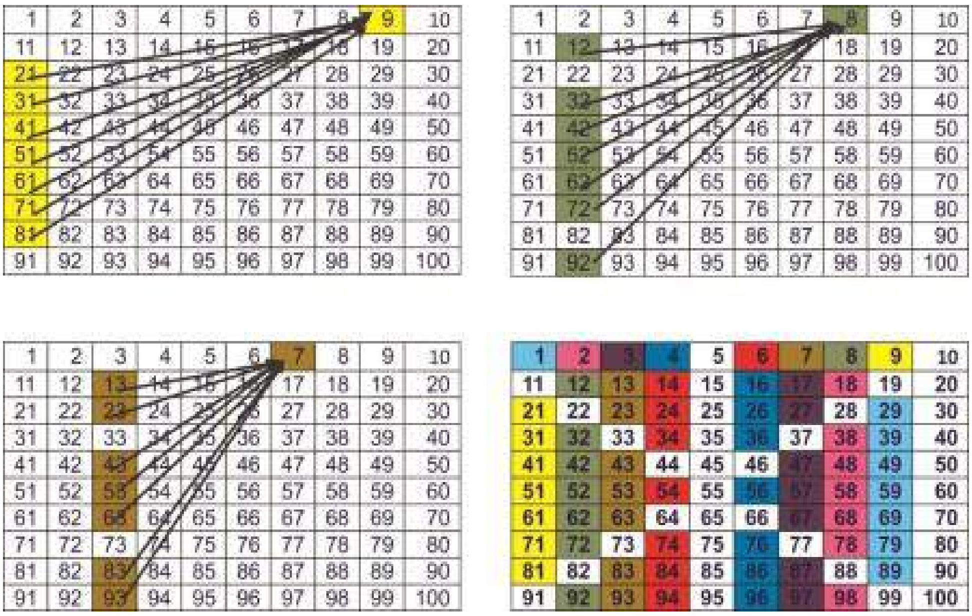
12+8=20	21+9=30	31+9=40	41+9=50	51+9=60	61+9=70	71+9=80	81+9=90	92+8=100
13+7=20	23+7=30	32+8=40	42+8=50	52+8=60	62+8=70	72+8=80	83+7=90	93+7=100
14+6=20	24+6=30	34+6=40	43+7=50	53+7=60	63+7=70	74+6=80	84+6=90	94+6=100
16+4=20	26+4=30	36+4=40	47+3=50	54+6=60	67+3=70	76+4=80	86+4=90	96+4=100
17+3=20	27+3=30	38+2=40	48+2=50	56+4=60	68+2=70	78+2=80	87+3=90	97+3=100
18+2=20	29+1=30	39+1=40	49+1=50	57+3=60	69+1=70	79+1=80	89+1=90	98+2=100
				58+2=60				
				59+1=60				

Below (Table 3) is a systematic recording in accordance with the digit of tens.

For example: 32+8=40 (we start with the 2-digit number). The following 2-digit number whose digit of tens is 3, will be 34, namely 34+6=40 (the number 33 is not applicable because the digit 3 appears twice in it). In this assignment, the digits which constitute the numbers should be different because we use the digit cards to build them).

Below (Table 4) there are four examples of coping with the assignment by means of the table of hundreds while presenting the numbers found.

Table 4



Each of the 2-digit numbers whose digit of units is 1 are inserted in the column rendered in yellow. To them one can add 1-digit number in the upper line painted in yellow, namely the digit 9 so that a sum is in whole tens: 21+9, 31+9, 41+9, 51+9, 61+9, 71+9, 81+9.

The same applies to the column of numbers whose digit of units is 2, i.e. the column whose rendered in green with the 1-digit number 8. To each column of 2-digit numbers corresponds a 1-digit number identical in colour so that the sum is in whole tens.

See Table 5-Systematic recording in accordance with the digit of units.

Table 5

21+39=60	12+38=50	13+27=40	14+26=40	16+24=40	17+23=40	18+32=50	29+31=60
31+29=60	32+18=50	23+17=40	24+16=40	26+14=40	27+13=40	38+12=50	39+21=60
41+29=70	42+18=60	43+17=60	34+16=50	36+14=50	47+13=60	48+12=60	49+21=70
51+29=80	52+18=70	53+17=70	54+16=70	56+14=70	57+13=70	58+12=70	59+21=80
61+29=90	62+18=80	63+17=80	74+16=90	76+14=90	67+13=80	68+12=80	69+21=90
71+29=100	72+18=90	83+17=100	84+16=100	86+14=100	87+13=100	78+12=90	79+21=100
81+29=110	92+18=110	93+17=110	94+16=110	96+14=110	97+13=110	98+12=110	89+21=110

Coping with the assignment by means of the table of hundreds (Table 6), while highlighting the numbers which were found incompatible, we can see even before starting the assignment that there are some numbers which are incompatible: numbers whose digit of units is 5 or 0; all the 2-digit numbers whose digits are identical and all the numbers the sum of their digits is ten.

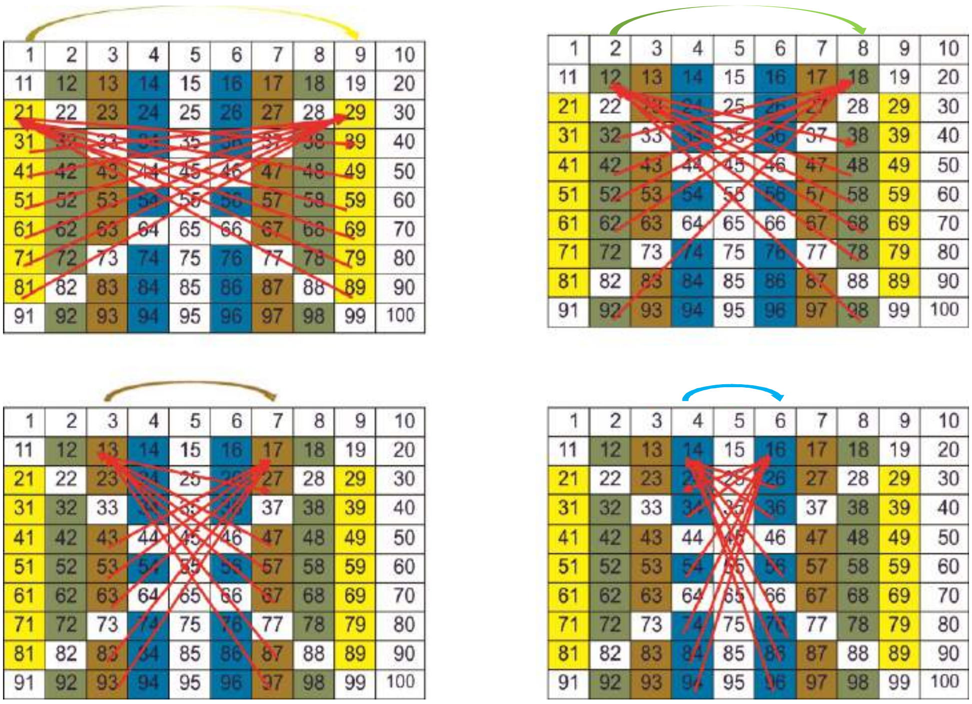
Table 6

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	9	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

Assignment 3: The smallest sum of a 2-digit number and a 2-digit number is in whole tens.

This activity is based on previous knowledge. Two 2-digit numbers should be added so that the sum is a number represented in whole tens. Pupils should look at the columns of the table of hundreds and explore the relation between the two yellow columns. In the same way, they should examine the relation between the two green columns as well as between the two brown and blue ones (Table 7).

Table 7



Please note: 12 exercises were formed between every pair of columns.

Explanation: When we try to match and add a 2-digit number to a known 2-digit number, the digit of units will be chosen similarly to what has been done in the previous assignments. That is, pupils should choose a number with a digit which together they add up to a ten. In order to complete the digit of tens they should choose among the remaining digit cards the card with the smallest number that matches.

Systematic recording in accordance with the digit of tens (Table 8)

12+38=50	21+39=60	31+29=60	41+29=70	51+29=80	61+29=90	71+29=100	81+29=110	92+18=110
13+27=40	23+17=40	32+18=50	42+18=60	52+18=70	62+18=80	72+18=90	83+17=100	93+17=110
14+26=40	24+16=40	34+16=50	43+17=60	53+17=70	63+17=80	74+16=90	84+16=100	94+16=110
16+24=40	26+14=40	36+14=50	47+13=60	54+16=70	67+13=80	76+14=90	86+14=100	96+14=110
17+23=40	27+13=40	38+12=50	48+12=60	56+14=70	68+12=80	78+12=90	87+13=100	97+13=110
18+32=50	29+31=60	39+21=60	49+21=70	57+13=70	69+21=90	79+21=100	89+21=110	98+12=110
				58+12=70				
				59+21=80				

Systematic recording in accordance with the digit of units (Table 9)

21+39=60	12+38=50	13+27=40	14+26=40	16+24=40	17+23=40	18+32=50	29+31=60
31+29=60	32+18=50	23+17=40	24+16=40	26+14=40	27+13=40	38+12=50	39+21=60
41+29=70	42+18=60	43+17=60	34+16=50	36+14=50	47+13=60	48+12=60	49+21=70
51+29=80	52+18=70	53+17=70	54+16=70	56+14=70	57+13=70	58+12=70	59+21=80
61+29=90	62+18=80	63+17=80	74+16=90	76+14=90	67+13=80	68+12=80	69+21=90
71+29=100	72+18=90	83+17=100	84+16=100	86+14=100	87+13=100	78+12=90	79+21=100
81+29=110	92+18=110	93+17=110	94+16=110	96+14=110	97+13=110	98+12=110	89+21=110

Assignment 4: The smallest sum of a 2-digit number and a 2-digit number is 100.

Please note: the sum of the digit of units in the two 2-digit numbers should be a whole ten and the sum of the digit of tens of the two 2-digit numbers should be 9. In this assignment, too, the digit 0 cannot be used. Moreover, the digit 5 cannot be used as a digit of units.

The assignment by means of the table of hundreds (Table 10)

Presenting the compatible numbers

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

Presenting the incompatible numbers

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

Solutions by means of the table of hundreds – all the sums are 100 (Table 11)

According to the digit of tens

21+79=	32+68=	13+87=	14+86=
31+69=	42+58=	43+57=	24+76=
41+59=	52+48=	53+47=	54+46=
51+49=	62+38=	83+17=	74+26=
61+39=			84+16=
71+29=			

According to the digit of units

13+87=	21+79=	31+69=	41+59=
14+86=	24+76=	32+68=	42+58=
16+84=	26+74=	36+64=	43+57=
17+83=	29+71=	38+62=	47+53=
		39+61=	48+52=
			49+51=

Assignment 5: The smallest sum of a 3-digit number and a 1-digit number is in whole tens.

In this assignment, the pupils should build a table and continue it up to 1000.

It is recommended to encourage pupils to record systematically all the exercises (or by means of an Excel file) and delete the numbers which consist of identical digits. Pupils can play the “sequence of exercises” game: the exercise is given: (259+1). What will be the next exercise in the sequence? (263+7). Teachers can present a 1-digit number and ask which 3-digit number can be added in order to obtain a smallest sum in whole tens. Moreover, they can ask the question, such as: what is the smallest 3-digit number suitable for obtaining a sum in whole tens?

Systematic recording of all the 3-digit numbers according to the digit of hundreds (Table 12)

102+8=110	132+8=140	154+6=160	176+4=180	198+2=200	217+3=220	253+7=260	274+6=280	294+6=300
103+7=110	134+6=140	156+4=160	178+2=180	201+9=210	231+9=240	254+6=260	276+4=280	296+4=300
104+6110	136+4=140	157+3=160	183+7=190	203+7=210	234+6=240	256+4=260	279+1=280	297+3=300
106+4=110	138+2=140	158+2=160	186+4=190	204+6=210	236+4=240	257+3=260	281+9=290	301+9=310
107+3=110	142+8=150	162+8=170	187+3=190	206+4=210	239+1=250	259+1=260	283+7=290	
108+2=110	143+7=150	163+7=170	192+8=200	207+3=210	241+9=250	261+9=270	284+6=290	
123+7=130	147+3=150	167+3=170	193+7=200	209+1=210	243+7=250	263+7=270	286+4=290	
124+6=130	148+2=150	168+2=170	194+6=200	213+7=220	247+3=250	267+3=270	287+3=290	
126+4=130	152+8=160	172+8=180	196+4=200	214+6=220	249+1=250	269+1=270	289+1=290	
127+3=130	153+7=160	174+6=180	197+3=200	216+4=220	251+9=260	271+9=280	293+7=300	

Assignment 6: The smallest sum of a 3-digit number and a 2-digit number is in whole tens (Table 13).

Table 13

102+38=	123+47=	136+24=	152+38=	163+27=	183+27=	197+23=
103+27=	124+36=	138+42=	153+27=	167+23=	186+24=	198+32=
104+26=	126+34=	142+38=	154+26=	168+32=	187+23=	
106+24=	127+43=	143+27=	156+24=	174+26=	192+38=	
107+23=	132+48=	147+23=	158+32=	176+24=	193+27=	
108+32=	134+26=	148+32=	162+38=	178+32=	194+26=	

Assignment 7: The smallest sum of a 3-digit number and a 2-digit number is in whole hundreds (Table 14).

Table 14

102+98=	124+76=	147+53=	162+38=
103+97=	126+74=	148+52=	168+32=
104+96=	132+68=	152+48=	174+26=
106+94=	138+62=	153+47=	176+24=
107+93=	142+58=	157+43=	
108+92=	143+57=	158+42=	

Assignment 8: The smallest sum of a 3-digit number and a 3-digit number is in whole tens (Table 15).

Table 15

102+348=	123+407=	136+204=	152+308=	162+308=	176+204=	193+207=
103+247=	124+306=	138+402=	153+207=	163+207=	178+302=	194+206=
104+236=	126+304=	142+308=	154+206=	167+203=	183+207=	
106+234=	127+403=	143+207=	156+204=	168+302=	186+204=	
107+243=	132+408=	147+203=	157+203=	172+308=	187+203=	
108+342=	134+206=	148+302=	158+302=	174+206=	192+308=	

Explanation: first, pupils complete to a ten and match the digit of units. Then they check what is the smallest digit which has not been used (the remaining digit card with the smallest number) so that it serves as the digit of hundreds. Then, pupils check which is the smallest digit having remained as the digit of tens.

Here too, pupils can play the "exercises sequence" game, present an exercise and check what the following exercise in the sequence will be.

Assignment 9: The smallest sum of a 3-digit number and a 3-digit number is in whole hundreds (Table 16).

Table 16

102+398=	124+376=	147+253=	162+438=	194+206=	
103+297=	126+374=	148+352=	168+432=	196+204=	
104+296=	132+468=	152+348=	174+326=	197+203=	
106+294=	138+462=	153+247=	176+324=	198+302=	
107+293=	142+358=	157+243=	192+308=		
108+392=	143+257=	158+342=	193+207=		

In this activity pupils should relate both to the sum of the digit of units and the digit of tens. The sum of the digit of units is 10 and the sum of the digit of tens is 9.

Assignment 10: The smallest sum of two 3-digit numbers is 1000 (Table 17).

Table 17

103+897=	127+873=	174+826=	204+796=
104+896=	143+857=	176+824=	206+794=
106+894=	147+853=	193+807=	
107+893=	153+847=	194+806=	
124+876=	157+843=	196+804=	
126+874=	168+832=	197+803=	

Please note: in this assignment the sum of the digit of units which comprise the two numbers is 10; the sum of the digit of tens is 9 and the sum of the digit of hundreds is also 9.

FINAL CONSIDERATIONS

Using inquiry and discovery activities in a task-oriented and directed way is designed as part of the strategies of the teaching/learning process in mathematics.

The above activity focused on added numbers. The learners were asked to discover a method in the structure of the table, while observing the accurate reading and writing of the numbers. Throughout the activity teachers can develop learners' generalization capability within the framework of developing a sense for numbers. This can be achieved through revision and consolidation of mathematical concepts such as numbers in whole tens, whole hundreds. This activity contributes to encouraging learners to perform "effective" oral calculation and performing estimations and approximations. This activity also acquiring a sense of a number's order of magnitude and place in the system of numbers and understanding the necessity of control, checking the probability of results, identifying errors and getting acquainted with control methods. Moreover, examining a variety of the suggested solution methods and discussing the advantages and disadvantages of each of them. Each of the activities decomposing a number into components of digit of units, digit of tens and digit of hundreds and combining numbers. The activities presenting hypotheses at an intuitive level, drawing conclusions and enhancing mathematical insights.

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KARTY CYFROWE – TWÓRCZA AKTYWNOŚĆ W CAŁYCH DZIESIĄTKACH

Streszczenie

Niektórzy ludzie rozwiązują to samo zadanie na różne „indywidualne" sposoby. Działanie „Aktywność twórcza w całych dziesiątkach" angażuje się w ukierunkowane zadanie eksploracji dodania dwóch liczb, których suma wynosi w całości dziesiątki. Obejmuje: tabelę mnożenia, tabelę setek i tabelę tysięcy. Systematyczne zapisywanie ćwiczeń, liczb, których suma jest w całych dziesiątkach, a rozwiązanie na różne sposoby. Zadania przeznaczone dla 1-szych równiarków i oparte na zasadzie używania „cyfrowych kart", na których oznaczono cyfry 0 – 9, koncentrują się na dodanych liczbach za pomocą cyfrowych kart, tworzą dwie liczby tak, że ich suma jest w całych dziesiątkach. Wkład: wykonanie „skutecznych" ustnych obliczeń, oszacowań i przybliżeń, uzyskanie poczucia rzędu wielkości i miejsca w systemie liczb, badanie różnych metod rozwiązania, dekomponowanie liczby na komponenty i łączenie liczb, wyciąganie wniosków i zwiększanie wglądów matematycznych.

Słowa kluczowe: całe dziesiątki; całe setki; dodatek; najmniejsza suma; cyfry.

DIGIT CARDS – CREATIVE ACTIVITY IN WHOLE TENS

Summary

Some people solve the same assignment in different 'individual' ways. The activity "Creative activity in whole tens" engages in a directed assignment of exploring the addition of two numbers whose sum is in whole tens. It includes: a table of multiplication, a table of hundreds and a table of thousands. A systematic recording of exercises, figures whose sum is in whole tens, and solution in different ways. The assignments were designed for 1st to 6th graders and based on the principle of using "digit cards" labelled from 0 – 9 and focused on added numbers using digit cards, form two numbers so that their sum is in whole tens. The contribution is manifold: performing "effective" oral calculations, estimations and approximations; promoting awareness of the order, sequence and place of numbers; examining a variety of the solution methods; decomposing a number into components and combining figures; drawing conclusions and enhancing mathematical insights.

Key words: whole tens; whole hundreds; addition; smallest sum; digit cards.