THE MODEL ELEMENTARY ARITHMETIC: INCLUDING ORAL AND WRITTEN EXERCISES

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BY

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PREFACE.

THIS book is designed both as an introduction to the Model Arithmetic, and as a text-book of sufficient comprehensiveness for those who do not complete the full grammar-school course. It has been the aim of the authors to present in it the accuracy of statement, clearness in discussion, and fullness of illustration, which are believed to characterize their larger work. The matter, aside from definitions, etc., is new, and has been tested in the school-room.
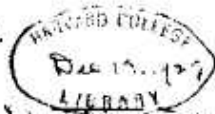
The introduction will be found of great use, not only in developing the idea of number, but in affording material for constant drill in fundamental operations.

Among the features which distinguish the book from many of its class, will be noticed the absence of pictures of common objects. No space is wasted in representing, by the engraver's art, that which every teacher presents to the eye of the pupil. Teachers every-where recognize the fact that the object itself is better than the picture of it; that, for instance, the actual division of an apple into halves, quarters, etc., in the presence of a class, produces a clearer and more lasting conception of the idea of a fraction, than is secured by any picture, however perfect.

The work, though elementary, is not designed as a plaything, but is an earnest attempt to assist in training the child's mind, and in fitting him for active life. As such, it is commended to the public.

K. & B.

Chicago, April, 1876.

CONTENTS.

SUGGESTIONS TO TEACHERS.

The eight lessons that immediately follow have been arranged and introduced at the beginning of this book for the purpose of giving pupils a thorough drill in the use of the digits from 2 to 9 inclusive. Though for convenience of presentation the limit of the processes is confined to 12 times —, the teacher may extend the operations of addition and subtraction at will. The limit of 100, however, is all that is desirable with numbers less than 9.

The treatment of each number includes the four processes of addition, subtraction, multiplication and division, and recognizes the fact that they are intimately and naturally connected, and that one operation may be said to include all the others, for all the operations are only the comparison of numbers, one with another. They are, in fact, different methods of reading the same general relation of numbers, thus: $4+4=8$ is read 4 *and* 4 equals 8; $2\times4=8$ is read 2 *times* 4 equals 8; $4-2=2$ is read 4 *less* 2 *equals* 2; and $4÷2=2$ is read 2 is contained in 4, twice, or 2 can be taken twice from 4, or 2 is one-half of 4.

The consideration of these processes does not contemplate the use of the *terms add, subtract, multiply* or *divide*, as these terms will be more profitably discussed hereafter, but it is designed to make pupils familiar first with the processes themselves, and with the use of terms easily understood. It is assumed that pupils know how to count, and are familiar with the forms, names and values of the significant figures. While the teacher will be greatly assisted in this instruction by the use of lines or dots upon the board, or by a numeral frame, or small objects, such as grains of corn, beans, etc., it must not be forgotten that the memory should be made an important factor in the mastery of these relations. Constant appeals must be made to the pupil's power to gather and retain through frequent repetition.

Immediately succeeding the treatment of the abstract number, a variety of exercises, both abstract and denominate, is given as models for the teacher. These exercises may be variously diversified and extended, according to the skill of the teacher and the necessities of the pupils. The lessons should be used as follows: as for instance, Lesson I; (1) reads 2, 4, 6, 8, etc., 24; (2) 1, 3, 5, etc., 23; (3) 2, 4, 6, etc., 24; (4) 24, 22, etc., 2; (5) 23, 21, etc., 1; (6) once, twice, 8 times, etc., 12 times.

ADDITION TABLE.

1+1	1+2	1+3	1+4	1+5	1+6	1+7	1+8	1+9
2	2+1	2+2	2+3	2+4	2+5	2+6	2+7	2+8
2+9	**3**	3+1	3+2	3+3	3+4	3+5	3+6	3+7
3+8	3+9	**4**	4+1	4+2	4+3	4+4	4+5	4+6
4+7	4+8	4+9	**5**	5+1	5+2	5+3	5+4	5+5
5+6	5+7	5+8	5+9	**6**	6+1	6+2	6+3	6+4
6+5	6+6	6+7	6+8	6+9	**7**	7+1	7+2	7+3
7+4	7+5	7+6	7+7	7+8	7+9	**8**	8+1	8+2
8+3	8+4	8+5	8+6	8+7	8+8	8+9	**9**	9+1
9+2	9+3	9+4	9+5	9+6	9+7	9+8	9+9	**10**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	

MULTIPLICATION TABLE.

	1's	2's	3's	4's	5's	6's	7's	8's	9's	10's	11's	12's	
1	1	2	3	4	5	6	7	8	9	10	11	12	1
2	2	4	6	8	10	12	14	16	18	20	22	24	2
3	3	6	9	12	15	18	21	24	27	30	33	36	3
4	4	8	12	16	20	24	28	32	36	40	44	48	4
5	5	10	15	20	25	30	35	40	45	50	55	60	5
6	6	12	18	24	30	36	42	48	54	60	66	72	6
7	7	14	21	28	35	42	49	56	63	70	77	84	7
8	8	16	24	32	40	48	56	64	72	80	88	96	8
9	9	18	27	36	45	54	63	72	81	90	99	108	9
10	10	20	30	40	50	60	70	80	90	100	110	120	10
11	11	22	33	44	55	66	77	88	99	110	121	132	11
12	12	24	36	48	60	72	84	96	108	120	132	144	12

PRACTICE TABLE.

A	B	C	D	E	F	G	H	I	J
1	9	12	8	4	7	5	3	6	2
3	5	1	4	12	6	12	7	12	9
5	3	3	1	8	12	8	9	1	3
7	1	9	7	1	9	3	12	10	7
9	7	8	3	11	1	7	4	8	4
11	2	5	9	9	11	1	8	4	10
2	11	7	12	7	8	4	11	2	6
4	8	10	5	5	4	11	1	5	12
6	4	6	11	3	10	6	5	3	1
8	12	4	6	2	5	2	10	7	11
10	6	8	10	10	2	10	6	9	8
12	10	11	2	6	3	9	2	11	5

The above table is to be used as follows:

1. ADDITION. Let the pupil add to each number in a given column a number announced by the teacher, the pupil stating the successive *sums* only. Thus, the teacher will say, "Column A, add 5;" the pupil selected answers *as rapidly as possible*, "6, 8, 10, 12, 14," etc.

2. SUBTRACTION. Let the pupil subtract from a given number each number in a given column. Thus, the teacher announces "Column B, subtract from 17." The pupil subtracts each number, mentally, and states the result only, "8, 12, 14, 16," etc.

3. MULTIPLICATION. The teacher selects a column and a multiplier. The pupil announces the product, using each number as a multiplicand. Thus, "C by 5," results in 60, 5, 15, 45, etc.

4. DIVISION. The teacher selects a column and announces a dividend; the pupil states the quotient, using each number as a divisor. It is not necessary that the dividend selected be a multiple of any of the divisors. Thus, the teacher may announce "D, dividend 20;" the pupil responds 2½, 5, 20, 2½, 6½, etc.

In all of these exercises *accuracy* should be insisted upon from the beginning; rapidity should not be expected at first, but will result from constant practice. (5)

MODEL

ELEMENTARY ARITHMETIC.

INTRODUCTION.

LESSON I.

DEVELOPMENT OF NUMBERS BY 2's.

1. $2+2+2+2+2+2+2+2+2+2+2+2=?$

2. $1+2+2+2+2+2+2+2+2+2+2=?$

3. $1\times2=?$ $2\times2=?$ $3\times2=?$ $4\times2=?$ $5\times2=?$
   $6\times2=?$ $7\times2=?$ $8\times2=?$ $9\times2=?$ $10\times2=?$
   $11\times2=?$ $12\times2=?$

4. $24-2-2-2-2-2-2-2-2-2-2-2=?$

5. $23-2-2-2-2-2-2-2-3-3-2-2=?$

6. $2\div2=?$ $4\div2=?$ $6\div2=?$ $8\div2=?$ $10\div2=?$
   $12\div2=?$ $14\div2=?$ $16\div2=?$ $18\div2=?$ $20\div2=?$
   $22\div2=?$ $24\div2=?$

7. 4 is 2 more than what number? 2 less than what number?

8. 15 is 2 more than what number? 2 less than what number?

9. 12 is twice what number? 22 is twice what number?

10. What number should be doubled to obtain 24? What number is contained in 18 twice?

11. What number is 2 more than 18? 2 less than 16?

12. What number should be added to 12 to obtain 14? 2 can be taken from 6 how many times?