

ECLECTIC EDUCATION SERIES

Ray's Elementary Arithmetic

By using this book you agree to be bound by the "Terms of Use" found at:

<http://www.dollarhomeschool.com/Terms.html>

Which prohibit, among other things, the duplication for resale or redistribution of this book as well as posting it on any public forum such as the Internet.

www.dollarhomeschool.com



ECLECTIC EDUCATIONAL SERIES.

RAY'S
ELEMENTARY
ARITHMETIC,

EMBRACING

MENTAL AND WRITTEN EXERCISES.

FOR BEGINNERS.



NEW-YORK ❖ CINCINNATI ❖ CHICAGO
AMERICAN BOOK COMPANY

SPECIAL NOTICE.

Ray's Arithmetics have recently been thoroughly revised, and issued as—

Ray's New Arithmetics.

Ray's New Primary Arithmetic, . . .	\$0 15
Ray's New Intellectual Arithmetic, . .	25
Ray's New Practical Arithmetic, . . .	50

Ray's Two-Book Series.

Ray's New Elementary Arithmetic, . .	35
Ray's New Practical Arithmetic, . . .	50

For High Schools and Colleges.

Ray's New Higher Arithmetic, . . .	85
------------------------------------	----

The many changes in business transactions, as well as the advance in methods of instruction, have made such revision necessary. The New Arithmetics are sold for the *same low prices* as the old editions, notwithstanding the paper, printing, binding, and general appearance are far superior. Special terms, for the exchange of the new series for the old, can be had by application to the publishers.

COPYRIGHT,

1879,

BY VAN ANTWERP, BRAGG & Co.

. ELE.

Printed at
The Eclectic Press
Cincinnati, U. S. A.

PREFACE.

IN the preparation of this book, the publishers have kept constantly in view the necessities of the schools and the demand for economical school books. The ELEMENTARY is intended to serve as a sufficient introduction to RAY'S NEW PRACTICAL ARITHMETIC, and with that book forms a two-book series.

Teachers who have used Ray's Rudiments of Arithmetic will perceive that large portions of that book have been incorporated in this work. The mental exercises, which were a feature of the Rudiments, have been much enlarged and extended. Such other changes have been made as seemed necessary to adapt the book more closely to the present methods of instruction.

It will be found best to drill constantly on such combinations of numbers as are given in the first lessons, until the class has thoroughly mastered them. This drill should be kept up with the use of objects until each member of the class can answer without a moment's hesitation.

To avoid the confusion that often arises in the minds of pupils from the presentation of a variety of methods, explanations, solutions, rules, remarks, etc., it has been

the constant aim, in the preparation of this book, to present each subject in one form only—and that the most concise and simple, if consistent with clearness.

In the treatment of each subject, a model solution is given, and a full and lucid explanation is furnished. These are intended to be studied carefully by the pupil. Succeeding examples are to be solved similarly, and the pupil should be examined with reference to the reasons for his work.

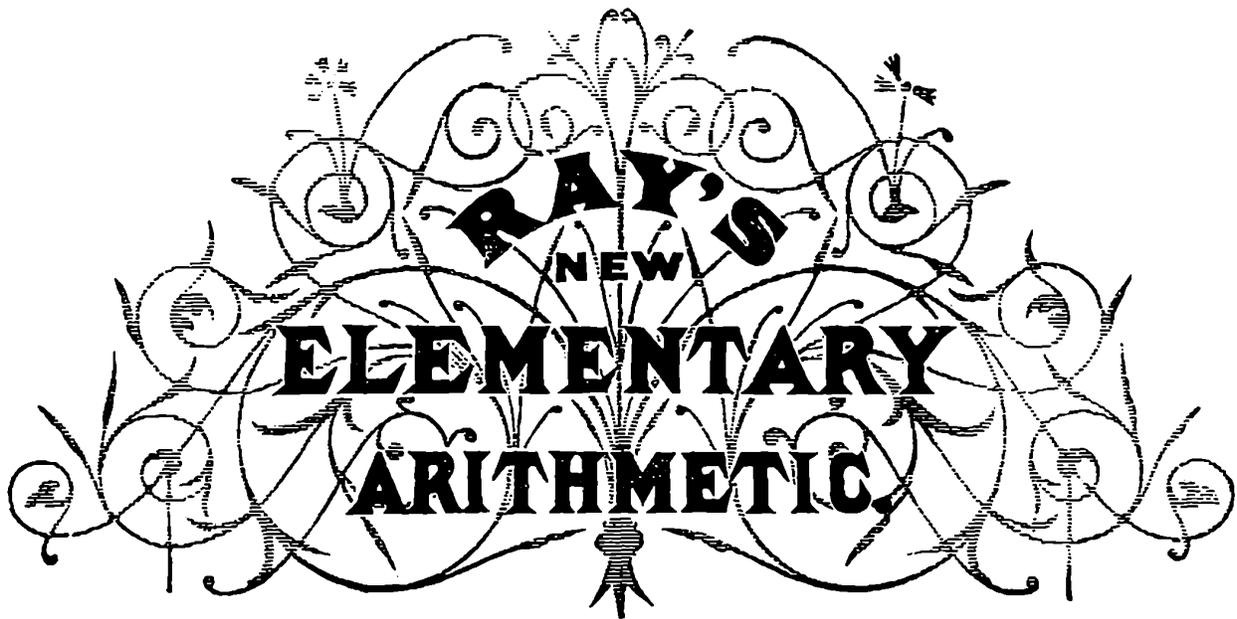
Care should be taken that *drill* work does not become *machine* work. It is not expected that these solutions and explanations will in all cases preclude the necessity of additional explanation on the part of the teacher. No book can present a subject so fully as to make it clear to every mind, and it should be the constant endeavor of the teacher to ascertain just what part the pupil fails to understand, and to aid him by suggestion rather than by an attempt at exhaustive explanation.

This book is not intended to be a complete arithmetic. With proper drill, it is hoped that pupils may gain from it a thorough knowledge of the fundamental rules, with some knowledge of fractions and the common tables.



	PAGE
OBJECT LESSONS	7-9
DEFINITIONS	9
NOTATION AND NUMERATION	10
Rules	12
Roman Notation	18
THE FUNDAMENTAL RULES	19
ADDITION	21
SUBTRACTION	35
MULTIPLICATION	46
DIVISION	59
Short Division	65
Long Division	70
COMPOUND NUMBERS	78
United States Money	79
Reduction	82
Addition of U. S. Money	86
Subtraction of U. S. Money	88
Multiplication of U. S. Money	90
Division of U. S. Money	92
Bills and Accounts	95
Dry Measure	99
Avoirdupois Weight	103
Long Measure	105
Square Measure	107
Cubic Measure	110
Liquid Measure	113
Time Measure	115
Troy Weight	117
Apothecaries' Weight	118

	PAGE.
Other Measures of Length	118
•Circular Measure	118
Miscellaneous Table	119
Addition of Compound Numbers	122
Subtraction of Compound Numbers	125
Multiplication of Compound Numbers	128
Division of Compound Numbers	130
PROPERTIES OF NUMBERS	135
CANCELLATION	137
GREATEST COMMON DIVISOR	139
LEAST COMMON MULTIPLE	140
FRACTIONS	143
Value of Fractions	145
Reduction of Fractions	146
Addition of Fractions	151
Subtraction of Fractions	152
Multiplication of Fractions	154
Division of Fractions	157
DECIMAL FRACTIONS	163
Addition of Decimals	166
Subtraction of Decimals	167
Multiplication of Decimals	168
Division of Decimals	170
Reduction of Decimals	171
THE METRIC SYSTEM	176
Measures of Length	177
Land or Square Measure	179
Measures of Capacity	179
Measures of Weight	180
Table of Values	181
REVIEW EXAMPLES	185



LESSON I.

NOTE.—These exercises are intended for use with the Numeral Frame or with counters of some kind,—marbles, pebbles, kernels of corn, beans, or bits of pasteboard. The objects should be arranged in distinct groups, to represent each number indicated.

1. How many counters have we here? (1)
2. How many are 1 and 1? One taken away from 2 leaves how many? How many ones in 2? How many are two times 1?
3. How many are 2 and 1? How many are 1 and 1 and 1? How many are three times 1?
4. One taken away from 3 leaves how many? Two taken away from 3 leaves how many? How many ones in 3?
5. How many are 3 and 1? How many are 2 and 2? How many are 1 and 1 and 1 and 1? How many are four times 1? How many are two times 2?
6. One taken from 4 leaves how many? Two from 4

leaves how many? Three from 4 leaves how many? How many ones in 4? How many twos in 4?

7. How many are 4 and 1? How many are 3 and 2? How many are 1 and 1 and 1 and 1 and 1? How many are five times 1?

8. One from 5 leaves how many? Two from 5 leaves how many? Three from 5 leaves how many? Four from 5 leaves how many? How many ones in 5?

LESSON II.

1. How many are 5 and 1. How many are 4 and 2? How many are 3 and 3? How many are six times 1? How many are three times 2? How many are two times 3?

2. One from 6 leaves how many? Two from 6? Three from 6? Four from 6? Five from 6? How many ones in 6? How many twos in 6? How many threes in 6?

3. How many are 6 and 1? How many are 5 and 2? How many are 4 and 3? How many are 3 and 4? How many are seven times 1?

4. One from 7 leaves how many? Two from 7? Three from 7? Four from 7? Five from 7? Six from 7? How many ones in 7?

5. How many are 7 and 1? How many are 6 and 2? How many are 5 and 3? How many are 4 and 4? How many are 3 and 5? How many are 2 and 6?

6. How many are eight times 1? How many are four times 2? How many are two times 4?

7. One from 8 leaves how many? Two from 8? Three from 8? Four from 8? Five from 8? Six from 8? Seven from 8?

8. How many ones in 8? How many twos in 8? How many fours in 8?

LESSON III.

1. How many are 8 and 1? How many are 7 and 2? How many are 6 and 3? How many are 5 and 4? How many are 4 and 5? How many are 3 and 6? How many are 2 and 7?

2. How many are nine times 1? How many are three times 3?

3. One from 9 leaves how many? Two from 9? Three from 9? Four from 9? Five from 9? Six from 9? Seven from 9? Eight from 9?

4. How many ones in 9? How many threes in 9?

5. How many are 9 and 1? How many are 8 and 2? How many are 7 and 3? How many are 6 and 4? How many are 5 and 5?

6. How many are 2 and 8? How many are 3 and 7? How many are 4 and 6?

7. How many are ten times 1? How many are five times 2? How many are two times 5?

8. One from 10 leaves how many? Two from 10? Three from 10? Four from 10? Five from 10? Six from 10? Seven from 10? Eight from 10? Nine from 10?

9. How many ones in 10? How many twos in 10? How many fives in 10?

DEFINITIONS.

1. A **Unit** is a single thing; as one, one book, one slate, one day.

2. A **Number** consists of one or more units.

3. **Arithmetic** treats of numbers, and is the art of computing by them.

4. Notation is the art of expressing numbers, by means of figures.

5. Figures are characters used to represent numbers. The following figures are used :

1	2	3	4	5	6	7	8	9	0
One	two	three	four	five	six	seven	eight	nine	naught.

The first nine are called *digits*, or *significant figures*.

The *cipher*, or *naught*, expresses no value of itself, but is used to give different values to the significant figures by changing their location.

All numbers can be expressed by these figures, or by combinations of them.

6. Numeration is the art of reading numbers.

Any number less than ten is read by naming the figure representing it; all other numbers, by naming the figures, the places they occupy, and the period in which they stand.

Nine (9) is the largest number that can be represented by one figure; ninety-nine (99), by two figures; nine hundred and ninety-nine (999), by three.

7. A Period may consist of three figures.

In every period, the *right-hand* figure represents *units*, and occupies the *first* place in the period.

The *middle* figure represents *tens*, and occupies the *second* place in the period.

The *left-hand* figure represents *hundreds*, and occupies the *third* place in the period.

Here, 5 in the first place is 5 units; in the second place, 5 tens or fifty units; in the third place, five hundreds, or fifty tens, or five hundred units.

A PERIOD.

Hundreds.	Tens.	Units.
5	5	5

NOTE.—It is deemed unnecessary to present, in an elementary work, exercises extending beyond the sixth period, or quadrillions. For exercises upon the higher periods, see Ray's New Practical Arithmetic.

12. Each period contains three places or orders.

If any *order* is wanting, fill its place with a cipher; if a whole *period* is wanting, fill its place with three ciphers.

For convenience, a comma is used to separate the different periods.

NOTE.—Pupils should learn the correct form of the figures for blackboard or slate work.

1 2 3 4 5 6 7 8 9 0

Rule for Notation.—*Begin at the left, write the highest period first, then the lower periods in their order, filling all vacant periods and places with ciphers.*

Rule for Numeration.—*Begin at the right, and separate the given number into periods of three figures each.*

Begin at the left, and read each period as if it stood alone, then give the name of the period.

NUMBERS TO BE WRITTEN.

1. Write one; ten; eleven; one hundred; one hundred and one; one hundred and eleven.

2. Write all the numbers between one and thirty; between thirty and seventy; between seventy and one hundred.

3. Write two; twenty; twenty-two; two hundred; two hundred and two; two hundred and twenty-two.

hundreds; 6 hundreds and 6 tens; 6 hundreds and 6 units; 6 hundreds, 6 tens, and 6 units.

17. Write 7 units; 7 tens; 7 tens and 7 units; 7 hundreds; 7 hundreds and 7 tens; 7 hundreds and 7 units; 7 hundreds, 7 tens, and 7 units.

18. Write 8 units; 8 tens; 8 tens and 8 units; 8 hundreds; 8 hundreds and 8 tens; 8 hundreds and 8 units; 8 hundreds, 8 tens, and 8 units.

19. Write 9 units; 9 tens; 9 tens and 9 units; 9 hundreds; 9 hundreds and 9 tens; 9 hundreds and 9 units; 9 hundreds, 9 tens, and 9 units.

REMARK.—Remember that numbers are read by periods, that each period contains three places, and that in writing numbers all vacant places and periods are filled with ciphers.

20. Write four *units* in the first period; 4 units in the second period; 4 units in the third period; 4 units in the fourth period; 4 units in the fifth period; 4 units in the sixth period.

21. Write 4 *tens* in the first period; 4 tens in the second period; 4 tens in the third period; 4 tens in the fourth period; 4 tens in the fifth period; 4 tens in the sixth period.

22. Write 4 *hundreds* in the first period; 4 hundreds in the second period; in the third period; in the fourth; in the fifth; in the sixth.

23. Write 4 hundreds and 4 units in the first period; 4 hundreds and 4 units in the second period; in the third period; in the fourth; in the fifth; in the sixth.

24. Write four hundreds, 4 tens, and 4 units in the first period; in the second period; in the third period; in the fourth; in the fifth; in the sixth.

25. Write 4 tens and 4 units in the fourth period; 4

4. Write three; thirty; thirty-three; three hundred; three hundred and three; three hundred and thirty-three.

5. Write four; forty; forty-four; four hundred; four hundred and four; four hundred and forty-four.

6. Write five; fifty; fifty-five; five hundred; five hundred and five; five hundred and fifty-five.

7. Write six; sixty; sixty-six; six hundred; six hundred and six; six hundred and sixty-six.

8. Write seven; seventy; seventy-seven; seven hundred; seven hundred and seven; seven hundred and seventy-seven.

9. Write eight; eighty; eighty-eight; eight hundred; eight hundred and eight; eight hundred and eighty-eight.

10. Write nine; ninety; ninety-nine; nine hundred; nine hundred and nine; nine hundred and ninety-nine.

II. Write 1 unit; 1 ten; 1 ten and 1 unit; 1 hundred; 1 hundred and 1 ten; 1 hundred and 1 unit; 1 hundred, 1 ten, and 1 unit.

12. Write 2 units; 2 tens; 2 tens and 2 units; 2 hundreds; 2 hundreds and 2 tens; 2 hundreds and 2 units; 2 hundreds, 2 tens, and 2 units.

13. Write 3 units; 3 tens; 3 tens and 3 units; 3 hundreds; 3 hundreds and 3 tens; 3 hundreds and 3 units; 3 hundreds, 3 tens, and 3 units.

14. Write four units; 4 tens; 4 tens and 4 units; 4 hundreds; 4 hundreds and 4 tens; 4 hundreds and 4 units; 4 hundreds, 4 tens, and 4 units.

15. Write 5 units; 5 tens; 5 tens and 5 units; 5 hundreds; 5 hundreds and 5 tens; 5 hundreds and 5 units; 5 hundreds, 5 tens, and 5 units.

16. Write 6 units; 6 tens; 6 tens and 6 units; 6

hundreds in the third period ; 4 hundreds and 4 units in the second period ; and 4 hundreds, 4 tens, and 4 units in the first period.

26. Write 4 hundreds and 4 units in the sixth period ; 4 tens in the fifth period ; 4 hundreds and 4 tens in the fourth period ; 4 tens and 4 units in the third period ; 4 units in the second period ; and 4 tens in the first period.

27. Write 4 tens and 4 units in the sixth period ; 4 hundreds and 4 units in the fourth period ; 4 units in the second period ; 4 hundreds and 4 tens in the first period.

28. Write 604 millions, 50 thousands, and 196 units.

29. Write 640 billions, 9 millions, 807 thousands, and 27 units.

30. Write 79 trillions, 6 billions, 840 millions, 206 thousands, and 10 units.

31. Write 100 quadrillions, 10 trillions, 1 billion, 110 millions, 101 thousands, and 111 units.

32. Write 47 quadrillions, 74 billions, 407 thousands, and 500 units.

33. Write 903 quadrillions, 9 trillions, 90 millions, and 90 units.

NUMBERS TO BE WRITTEN.

Write the following in figures, and read them :

34. Ninety-three. Thirty-nine. Ninety.

35. Seven hundred and eighty-four.

36. Six hundred and five.

37. Two thousand, seven hundred and four.

38. Eight thousand, and one.

39. Five thousand, and ten.

40. Fourteen thousand, nine hundred and nine.

41. Twenty thousand, and two.

42. Twenty-two thousand, and two hundred.
43. Eleven thousand, and eleven.
44. Thirty-seven thousand, eight hundred and thirteen.
45. Seventy-three thousand, and thirty-one.
46. Ninety thousand, and seventy.
47. Nine hundred and sixty-two thousand.
48. Seven hundred and one thousand.
49. One hundred thousand, and seven hundred.
50. Eight hundred thousand, and seventy-three.
51. Three hundred and one thousand, and twenty-one.
52. Five hundred thousand, and four.
53. Six hundred and twenty thousand, and forty.
54. Four million, seven hundred and fifty-two thousand, four hundred and fifty-eight.
55. Seven million. Seven million, and seven.
56. Three million, thirty thousand, and twelve.
57. Nineteen million, six hundred thousand, five hundred and thirty.
58. Thirty million, ten thousand, one hundred and one.
59. Ninety million, nine thousand, and nine.
60. Seven hundred million, and seventy.
61. Six hundred and eighty-three million, four hundred and seventeen thousand, nine hundred and ninety-eight.
62. Eight hundred and seven million, five hundred and three thousand, and nine.
63. Five hundred million, twenty thousand, and three hundred.
64. Four hundred and twenty million, six thousand, and twenty-six.
65. Seven billion, eight hundred and forty-six million, seven hundred and ninety-two thousand, two hundred and thirty-four.
66. Three billion, thirty million, seven hundred and eight thousand, and five.

67. Twenty-one billion, six hundred and three million, four hundred thousand, and twenty.

68. Sixty-eight billion, five million, twenty thousand, and forty.

69. Three hundred and twenty-five billion, six hundred million, four thousand, and two hundred.

70. Seven hundred and one billion, and two.

71. Two hundred and nine billion, sixty thousand, and five hundred.

72. Three trillion, four hundred and ninety-three billion, eight hundred and sixty-seven million, four hundred and eighty-two thousand, nine hundred and eighty-nine.

73. Eighty trillion, sixty million, and two hundred.

74. Five hundred and nine trillion, ninety-nine billion, forty thousand, and forty-four.

75. Fourteen quadrillion, two hundred billion, five million, one hundred and six thousand, and ninety-six.

76. One hundred and nine quadrillion, three hundred and sixty trillion, eight billion, five hundred million, twenty-four thousand, seven hundred and one.

77. Write 107 million, 17 thousand, and 17.

78. Write 509 thousand, and ninety.

79. Write 1 trillion, 10 billion, 100 million, and 1 thousand.

80. Write 59 quadrillion, 7 trillion, 50 billion, 909 million, and 101 thousand.

81. Write 200 million, 666 thousand, and 905.

82. Write 99 trillion, and 40 thousand.

83. Write 769 billion, 101 million, 40 thousand, and 20.

84. Write 120 million, 1 thousand, and 10.

85. Write 5 trillion, 606 billion, 16 million, 5 thousand, and 9.

86. Write 14 quadrillion, 12 trillion, 3 billion, 13 million, and 1.

ROMAN NOTATION.

13. The **Roman Notation** employs seven letters to express numbers; these are I, V, X, L, C, D, M.

NOTE.—The Roman System of Notation is so called because it was used by the ancient Romans. It is now used to number chapters and divisions of books, etc.

I denotes one; V, five; X, ten; L, fifty; C, one hundred; D, five hundred; and M, one thousand.

Repeating a letter repeats its value; thus, II denotes two; XXX, thirty; CCCC, four hundred.

If a letter is placed *before* one of greater value, the less is taken from the greater; but if placed *after*, its value is added to the greater; thus, IV denotes four, while VI denotes six.

TABLE OF ROMAN NOTATION.

I	One.	XXI	Twenty-one.
II	Two.	XXX	Thirty.
III	Three.	XL	Forty.
IV	Four.	L	Fifty.
V	Five.	LX	Sixty.
VI	Six.	XC	Ninety.
IX	Nine.	C	One hundred.
X	Ten.	CCCC	Four hundred.
XI	Eleven.	D	Five hundred.
XIV	Fourteen.	DC	Six hundred.
XV	Fifteen.	DCC	Seven hundred.
XVI	Sixteen.	DCCC	Eight hundred.
XVIII	Eighteen.	DCCCC	Nine hundred.
XIX	Nineteen.	M	One thousand.
XX	Twenty.	MM	Two thousand.

Read the following numbers :

- | | |
|------------|-----------------|
| 1. XXXVII. | 7. DCCCXI. |
| 2. XLIX. | 8. MDLXXIV. |
| 3. XCVIII. | 9. MDCCXXII. |
| 4. CXVI. | 10. MDCCXLIV. |
| 5. CCXIX. | 11. MDCCLXXVI. |
| 6. DCXXIV. | 12. MDCCCLXXIX. |

Write the following in Roman Notation :

- | | |
|------------------|-------------------------------------|
| 1. Thirteen. | 8. One hundred and fifty. |
| 2. Seventeen. | 9. Two hundred and eighty. |
| 3. Nineteen. | 10. Seven hundred and thirty-eight. |
| 4. Twenty-six. | 11. Eight hundred and forty-four. |
| 5. Thirty-eight. | |
| 6. Forty-four. | |
| 7. Ninety-seven. | |

THE FUNDAMENTAL RULES.

DEFINITIONS.

14. An **Integer** is a whole number. Numbers are either *abstract* or *concrete*.

15. An **Abstract** number is a number simply; as 5, 12, 20.

16. A **Concrete** number is a number applied to one or more objects; as 1 book, 5 yards, 12 men.

17. The name of the object of a concrete number is its *denomination*. Thus in 5 yards, the denomination is *yards*.

Numbers are either *simple* or *compound*.

18. A **Compound** number is a concrete number made up of different denominations; as 4 bushels, 3 pecks, 1 quart.

19. There are four primary operations of Arithmetic; namely, *Addition*, *Subtraction*, *Multiplication*, and *Division*; these are called the *Fundamental Rules*.

QUESTIONS FOR REVIEW.

What is a unit? Of what does a number consist? What is Arithmetic? Define Notation. What are figures? Name the figures in use. What are the first nine called? Of what value and use is the cipher (0)? Define Numeration. How do you read numbers less than ten? Greater than ten? What is the largest number that can be expressed by one figure? By two figures? Three figures? What is a period? What does the right-hand figure of a period represent? The middle figure? The left-hand figure? What is the *simple* value of a figure? The *local* value? In what direction and in what ratio does the value of a figure increase?

How many orders in a period? If an order, or any part of it, is wanting, how is its place filled? How are periods separated?

Give the Rule for Notation. The Rule for Numeration.

What characters are employed in the Roman system of Notation? State what each of the seven letters denotes. What is the effect of repeating a letter? Of placing a letter *before* one of greater value? *After* one of greater value? (Let the teacher drill the class on the table of Roman Notation.)

What is an integer? What is an abstract number? A concrete number? What is meant by the denomination of a number? Have abstract numbers a denomination? What is a compound number? What are the Fundamental Rules of arithmetic?