

INDUSTRIAL ARITHMETIC

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Industrial arithmetic by C. G. White & P. P. Colgrove

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C. G. WHITE & P. P. COLGROVE

**INDUSTRIAL
ARITHMETIC**

E.W.

Industrial Arithmetic

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PREFACE

This book is complete in itself for the upper grades and first year of high school. It gives a review of notation and numeration, common and decimal fractions, percentage, interest, denominate numbers, square and cube root, ratio and proportion and other subjects usually taught in the grades. It gives the fundamental principles of algebra, the use of equations, ratio, proportion and percentage as stepping stones to the future school work in algebra, physics, etc., and as working tools for manual and vocational training.

Evidence is abundant that there is a place in the school curriculum for an arithmetic leading up to the mathematics of manual training and the sciences and to the problems in vocational fields.

The pupil from the school of to-day finds himself sadly deficient in ability to apply his arithmetical knowledge to the mechanical operations in this vocational age. If he enters any of the trades or industries of to-day, he finds the same inability to apply or make practical use of his grade arithmetic.

This is a very opportune time for an arithmetic such as this book purports to be. We are all giving more attention than ever before to the mechanical application of the power of air, water, heat, light, and electricity.

The informational side of this book in these branches is extremely interesting and valuable. The mathematical side is certainly as useful and instructive. The table of contents shows the subjects treated.

THE AUTHORS.

July, 1916.

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INDUSTRIAL ARITHMETIC

DEFINITIONS AND NUMBERING

1. A **unit** is one thing; as, one man, one pupil, etc.
2. A **number** is a unit or a collection of units; as, 1, 5, 276, etc.
3. **Notation** is the art of writing numbers by figures or letters.
4. **Numeration** is the art of reading numbers expressed by figures or letters.
5. In the Arabic or decimal system of notation ten figures are used in writing numbers. These are 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.
6. **Write in figures:**
 1. Five hundred twenty thousand eighty-five.
 2. Two hundred seventy-five thousand one hundred twenty-five.
 3. Nine hundred one thousand seven hundred two.
 4. Six hundred twenty-eight and twenty-five hundredths.
 5. Seventy-four hundred and twenty-eight hundredths.
 6. Two hundred twenty million seventy thousand, four hundred six.
 7. Nine hundred eight million sixteen thousand four hundred seven.
 8. Four hundred ninety-nine million seven hundred eighty-seven.

9. Seven hundred eighty million, four hundred seventy-three thousand.

10. Thirteen million four hundred fifty thousand, five hundred nine.

7. Write the following in words:

1. 8,111,100. 2. 5,070,606. 3. 466,000,405.

4. 7,890,124,002. 5. 8,074,016,050. 6. 902,705,612.

7. 6,010,100,700. 8. 8,503,004,234.

8. In the Roman system of notation seven letters are used in writing numbers. These are: I, V, X, L, C, D, M. Their values are: 1, 5, 10, 50, 100, 500, 1,000.

The numbers from one to twenty are the following:

1. I	2. II	3. III	4. IV	5. V
6. VI	7. VII	8. VIII	9. IX	10. X
11. XI	12. XII	13. XIII	14. XIV	15. XV
16. XVI	17. XVII	18. XVIII	19. XIX	20. XX

The tens and hundreds are the following:

30. XXX	40. XL	50. L	60. LX
70. LXX	80. LXXX	90. XC	100. C
200. CC	300. CCC	400. CD	500. D
600. DC	700. DCC	800. DCCC	900. CM
1,000. M	2,000. MM	3,000. MMM	4,000. M̄V

When one letter is followed by another of the same value, or by a letter of less value, their values are added. As, XX = 20; XV = 15.

When one letter is followed by another of greater value, its value is subtracted from the value of the greater. As, IX = 9; XL = 40.

When a letter is between two letters each of greater value, its value is subtracted from their sum. As, XIV = 14; XIX = 19; CVL = 145.

A dash over a letter multiplies its value by 1,000, \bar{V} = 5,000; \bar{C} = 100,000; \bar{M} = 1,000,000; \bar{L} = 50,000.

9. Write in Roman notation:

1. 87	11. 1269	21. 1916	31. 4326
2. 500	12. 2146	22. 1875	32. 3427
3. 177	13. 1870	23. 2472	33. 1089
4. 76	14. 2768	24. 3472	34. 1189
5. 1907	15. 1254	25. 2349	35. 1287
6. 276	16. 2456	26. 1210	36. 1376
7. 4567	17. 8532	27. 1311	37. 1456
8. 1917	18. 3459	28. 1412	38. 1525
9. 5673	19. 2378	29. 1513	39. 1600
10. 8902	20. 2436	30. 1618	40. 1700

ADDITION

10. Addition is the process of uniting two or more numbers into one number. The resulting number in addition is called the *sum*. *Like* numbers are numbers that express the same kind of units, as 4 miles and 7 miles, or 17 bushels and 9 bushels. *Unlike* numbers are numbers that express different kinds of units, as 7 pounds and 5 years, or 6 men and \$14.

Only like numbers can be added.

Facility in addition depends upon a thorough mastery of the forty-five combinations given below. These should become so familiar that the sight of any combination should bring the sum to mind instantly.

11. Memorize so that you can give results as fast as you can talk:

1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 4 4 4 4 4 4
1 2 3 4 5 6 7 8 9 2 3 4 5 6 7 8 9 3 4 5 6 7 8 9 4 5 6 7 8 9

5 5 5 5 5 6 6 6 6 7 7 7 8 8 9
5 6 7 8 9 6 7 8 9 7 8 9 8 9 9

(The teacher should make "flash cards" with these combinations to develop speed on the part of pupils in giving results. See Figure 1.)

$$\begin{array}{r} 12. \text{ Add: } 36 \quad 84 \quad 29 \quad 56 \quad 37 \quad 69 \quad 25 \quad 89 \\ \quad \quad \quad \underline{7} \quad \underline{8} \quad \underline{3} \quad \underline{4} \quad \underline{14} \quad \underline{18} \quad \underline{16} \quad \underline{16} \end{array}$$

13. When we have a column of numbers to add, the quickest way is to look for combinations which will make 10 and so count up by 10's. By practice you will be able to make combinations of tens by taking numbers out of their regular order, always being careful not to omit any number entirely. The following column will serve to illustrate:

$$\begin{array}{r} 5612 \} 65 \\ 6434 \} 60 \\ 4372 \} \\ 3429 \} 50 \\ 1638 \} \\ 4365 \} \\ 8291 \} 40 \\ 2584 \} \\ 1266 \} 30 \\ 9377 \} 20 \\ 4297 \} \\ 8651 \} \\ 2263 \} 10 \\ 5046 \} \end{array} \quad \begin{array}{c} 9 \\ 2 \\ \left. \begin{array}{c} 4 \\ 3 \\ 5 \\ 6 \end{array} \right\} \end{array}$$

14. Practice until you can add the following in one minute or less:

(1)	(2)	(3)	(4)	(5)	(6)
4926	3429	5897	4116	9824	1106
3478	1406	3462	8429	3224	1359
5220	5320	9876	3414	946	8429
9651	9427	294	1029	8651	7295
4827	3800	4420	3042	397	8276
5916	8086	8046	9664	4829	5842
1324	5231	9274	537	1463	9463
5265	4097	3812	5863	1892	7006
4931	6403	5621	2974	1892	5731
2114	1265	9046	5114	297	9426
4632	4324	3092	9870	1069	4863
5976	9896	5563	2942	437	9204
1072	4142	2497	3792	8499	3046
<u>5008</u>	<u>1658</u>	<u>124</u>	<u>4863</u>	<u>5455</u>	<u>1994</u>