

ONTARIO  
PUBLIC SCHOOL  
ARITHMETIC



AUTHORIZED BY  
THE MINISTER OF EDUCATION  
FOR ONTARIO

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PRICE 10 CENTS

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THE ROBERT SIMPSON COMPANY LIMITED  
TORONTO



Magellan was an explorer  
 who started to sail  
 around the earth after  
 Columbus returned  
 safely. He was killed  
 when he reached the  
 Philippine Islands. his  
 ship went on and  
 completed the journey.

$$\begin{array}{r} 85' \\ 25' \\ \hline 110' \end{array} \quad \begin{array}{r} 26' \\ 26' \\ \hline 52' \end{array} = 626'$$

Ema Ransom

224.

F. Higgins

114  
 Can you find the  
 square root of an  
 oak tree?

$$\begin{array}{r} 35'' \\ 15 \\ \hline 50'' \end{array} \quad \begin{array}{r} 15 \\ 15 \\ \hline 30 \\ 15 \\ \hline 45'' \end{array}$$

36  
 35  
 184



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## THE PUBLIC SCHOOL ARITHMETIC

## MEASUREMENT

In each of such terms as: 5 inches, 3 quarts, 7 pounds, \$4, three things are named. For example, in 5 inches we have:

- (a) A **quantity** measured or to be measured, namely, 5 inches.
- (b) The **unit** used in measuring, namely, one inch.
- (c) The **number** obtained by counting how many times the unit is found in the quantity, namely, five—the symbol for which is 5.

Number comes from measuring some quantity by a unit.

The unit used is not always the same. It may be one pound, one foot, one dollar, one dozen, one ten, but it is always a part of the quantity measured.

## EXERCISE 1

1. Name some quantities you have measured. What unit did you use in each case?
2. What unit would you use to measure: milk? cheese? potatoes? eggs? time?
3. Name some articles which are measured by the peck, the foot, the pair, the head, the twelve, the hundred, the thousand.
4. Measure a quantity of water, using a pint and a quart. What number do you get in each case? How many quarts are there in a gallon?
5. Measure a quantity of sand by the pint and by the gallon. What number do you get in each case? How many pints are there in a gallon, and in a quart?



6. Using the length of your pencil as unit, measure the length of your desk, of the teacher's table, of the black-board.
7. Measure a piece of paper three inches long. Use this as unit and find a quantity of six units. How many two-inch units would there be? How many one-inch units?
8. Name the number and the unit in each of these: 7 cents, 24 couples, 8 two's, 4 ten-dollar bills, 6 groups of five.
9. By measuring, find how many ounces in one pound; how many pounds in 32 ounces. What unit do you use in each case?
10. Measure a peck, using as unit a pint, a gallon, a quart.
11. Measure one yard, using as unit one inch, one foot.
12. Measure these two lines:  
 (a) \_\_\_\_\_  
 (b) \_\_\_\_\_
13. Measure the long line, using the short one as unit.
14. If the short line stands for 3 feet, for what will the long one stand?
15. Use objects and measure 12 of them by taking 4 of them as unit; 30 of them by taking 6 as unit.

## NOTATION AND NUMERATION.

The expression of numbers by figures is called **notation**.

The reading of numbers which have been expressed in figures is called **numeration**.

## EXERCISE 2

1. What name do you give to 10 tens?
2. How many naughts are used in writing one thousand in figures? Where are the naughts written? In what place from the right is the one put?

3. Write in figures three thousand; five thousand; nine thousand.
4. Write in figures ten thousand. How many naughts are used in expressing ten thousand? In what place from the right is the 1 put? What separates the 10 from the three ciphers or naughts?
5. Write in figures fifty thousand; seventy thousand; 20 thousand; 80 thousand.
6. How many ciphers must be placed to the right of 15 to make it mean fifteen thousand?
7. Express in figures the following numbers: fourteen thousand, forty-five thousand, nine thousand and two, eight thousand and fifteen, seventy-two thousand and two, twenty-one thousand four hundred and four, four hundred and eight thousand and eighteen, twenty-two thousand seven hundred and ninety-nine, two hundred thousand and four.
8. Read aloud these numbers: 1427, 2341, 4004, 99999, 10010, 334627, 451601, 400400, 33303, 880880, 60062, 205030, 84084, 501010, 304070.

The symbols (1, 2, 3, etc.) which we have been using to express numbers are called **Arabic** numerals, and from the fact that, at first, people counted on their fingers or digits, these symbols are called **digits**.

Each of the first 9 digits has a value of its own, while the cipher, or naught, or zero (0) has no value. It is merely used to keep the other digits in their proper places.

To make easier the reading of a large number written in figures we separate the digits beginning at the right into groups of threes. Each group is called a **period**. Thus, 65437 is written 65,437.

What mark is used to separate the periods?

## EXERCISE 3

1. Divide the following into periods: 6274, 92075, 824567, 1000426, 3900457.



2. In 456 what place is occupied by the 6? by the 5? by the 4?

The digit in the *first* place, from the right, is 6 **units** or 6 ones; the digit in the *second* place is 5 **tens**; and the figure in the *third* place is 4 **hundreds**.

In 893,345,617 the first period from the right is called units; the second period, thousands; the third, millions. This is shown in the following table:

| Periods .....         | Third    | Second    | First |
|-----------------------|----------|-----------|-------|
| Names of groups ....  | Millions | Thousands | Units |
| Numbers to be read. { | 893      | 345       | 617   |
|                       | 495      | 673       | 480   |
|                       | 327      | 705       | 070   |
|                       | 463      | 020       | 005   |

3. What is the general name for the three digits in the first period? in the second period? in the third period?
4. Divide the number 543212789 into periods, and then read it. Read the second period from the right giving it its name. Read the first. Read the third.
5. Express the following numbers in figures: nine hundred and four thousand six hundred and eighty, eighty million fifty thousand seven hundred and nine, forty thousand and ten, three hundred and three thousand five hundred and twenty-eight, two hundred and three million seven hundred thousand and eighty-seven.
6. How many thousands in 46825? in 289704?
7. Commence at the right and read the number: 3640992, digit by digit.
8. How many tens in 870? in 565? How many hundreds in 436? in 815? in 8852? What is left in each case?
9. In 4444444 which of the 4's has the greatest value? How many times as great in value is the second 4 compared

with the first? the third with the second? the fourth with the third? the seventh with the fifth? What is the value of the second 4? of the fifth? Read the second period, the first, the third.

The value of a period or of a figure depends upon the **place** it occupies. Each has, therefore, a **local** value.

10. What is the local value of each *period* in 55555555? of each *digit*?

11. What is the greatest number you can make from the digits 3, 0, 5? from 4, 6, 0? from 8, 2, 9? What is the least?

12. Copy and point off into periods: 3245, 26070, 396281, 900025, 3087650, 11870368.

13. Arrange the following numbers in order, the largest first, then the next, and so on: 39, 405, 550, 4050, 6, 305005, 6203, 471.

14. What is the largest whole number which can be expressed by two figures? What is the smallest?

15. What is the largest number expressed by three figures? the smallest?

16. Write all the three-figure numbers in which one of the two left-hand digits is 7 and the other 3.

17. Write those in which one of the two right-hand figures is 4 and the other 0.

18. Divide into periods, and then write in words, the following: 300001, 50000, 20480, 234888.

19. How many units are there in 12 tens? in 3 tens?

20. How many hundreds are there in 67 tens? in 142 tens? in 1000 tens?

21. How many thousands in 54 hundreds? in 340 tens?

### ROMAN NOTATION

What name is given to the symbols 1, 2, 3, 4, 5, 6, 7, 8, 9, 0?



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There are other symbols which are sometimes used. These are the capital letters I, V, X, L, C, D, M, and they are called **Roman numerals**.

NOTE: The sign = means *equal* or *equals*.

Their values are: I=1, V=5, X=10, L=50, C=100, D=500, M=1000.

Now, to express the *units'* digit of any number the numerals I, V, or X are used, thus: 1=I, 2=II, 3=III, 4=IV, 5=V, 6=VI, 7=VII, 8=VIII, 9=IX.

To express the *tens'* digit of any number the numerals X, L, and C are used, thus: 10=X, 20=XX, 30=XXX, 40=XL, 50=L, 60=LX, 70=LXX, 80=LXXX, 90=XC.

To express the *hundreds'* digit of any number the numerals C, D, and M are used, thus: 100=C, 200=CC, 300=CCC, 400=CD, 500=D, 600=DC, 700=DCC, 800=DCCC, 900=CM.

To express the *thousands'* digit of any number M is used, thus: 1000=M, 2000=MM, 3000=MMM.

From this it may be seen that when I is placed *before* V or X its value is subtracted from the value of the V or the X. Thus IV=one less than 5, or 4 is one *before* 5. So also 9 is one *before* 10, XL is ten *before* 50, XC is ten *before* 100, CD is 100 *before* 500, and CM is 100 *before* 1000.

Also, when I, or X, or C, or M is repeated its value is repeated. Thus LXXX=50 and 10 and 10 and 10.

How often may these numerals be repeated?

To express 389 in Roman numerals we have 300=CCC, 80=LXXX, and 9=IX, and thus 389=CCCLXXXIX. So 2542=MMDXLII.

## ADDITION

## EXERCISE 4

1. Read the following and write them in Arabic numerals and in words: XII, XIV, XVIII, XIX, XXIV, XXVI, XXIX, XXXIV, XXXIX, XL, XLIV, LIX, LVI, LXIV, XCVIII, CIX, CXXVII, CXLVI, DC, CD, MCM, MCMX, MMCDLIX, MMMCMLIV.

2. Write in Roman numerals: 18, 24, 36, 48, 49, 54, 58, 66, 69, 74, 79, 86, 89, 94, 96, 99, 119, 133, 134, 139, 187, 236, 475, 523, 684, 739, 815, 936, 998, 1005, 1487, 1896, 2054, 3865.

3. Write in Arabic numerals: XCI, MCDXLIV, LXIX, CCXIX, XXXVIII, MMMI, XVI, DCCCXCIX, CDIV, MMCMXCIX, XXIV, CXVI, DCXLI, CMX.

4. Write in Roman numerals the number of the year in which the following events took place: Queen Victoria began to reign; George V began to reign; you were born.

5. Have you ever seen 4 written IIII? where?

## ADDITION

The sign +, called **plus**, is used to indicate that the numbers between which it is placed are to be added. Thus  $27 + 5 = 32$  means "27 and 5 equals 32," and  $34 = 29 + 5$  means "34 equals 29 and 5."

What kind of numbers can be added? 5 dollars and 8 dollars can be added and the sum will be 13 dollars. 8 days and 9 peas cannot be added, because the sum would be neither days nor peas.

Only **like** numbers, that is, numbers having the same name, can be added.

The numbers to be added are called **addends** and the number got from their addition is called their **sum**. The sum must have the same name or **denomination** as the addends.



## ORAL EXERCISE

Name the sums of the following numbers from left to right, and practise naming them until you can name each the moment your eye rests upon the numbers to be added:

|      |      |      |      |      |
|------|------|------|------|------|
| 1+1= | 2+1= | 2+2= | 3+1= | 3+2= |
| 4+1= | 3+3= | 4+2= | 5+1= | 4+3= |
| 5+2= | 6+1= | 4+4= | 5+3= | 6+2= |
| 7+1= | 5+4= | 6+3= | 7+2= | 8+1= |
| 5+5= | 6+4= | 7+3= | 8+2= | 9+1= |
| 6+5= | 7+4= | 8+3= | 9+2= | 6+6= |
| 7+5= | 8+4= | 9+3= | 7+6= | 8+5= |
| 9+4= | 7+7= | 8+6= | 9+5= | 8+7= |
| 9+6= | 8+8= | 9+7= | 9+8= | 9+9= |

These are the 45 primary "facts" of addition. The "facts" underlined should receive special attention.

There are other "facts" which may be learned from these: for instance, that 8 and 7 make 15; also that 7 taken away from 15 leaves 8; and that 15 less 8 is 7.

When 9 is added to another number in what easy way may the sum be remembered?

All these facts should be thoroughly mastered.

## ORAL EXERCISE

Practise the following additions until you can name the results as rapidly as you can count 1, 2, 3, 4, 5, etc.

Add by *twos*, by *threes*, by *fours*, by *fives*, by *sixes*, by *sevens*, by *eights*, by *nines*, and by *tens*, beginning first at 0, then at 1, then at 2, and so on up to 10, until the sum in each case is greater than 100.

In written problems in addition, *units* are usually written under *units*, *tens* under *tens*, *hundreds* under *hundreds*, and so on. This is done in the following:

## ADDITION

|          |           |               |
|----------|-----------|---------------|
| (1) 3754 | (2) 20234 | (3) 275 acres |
| 2862     | 683       | 146 "         |
| 1457     | 4965      | 27 "          |
|          | 68        |               |

In Example 1, what digits represent tens? hundreds?

In Example 2, what figures represent thousands? units? ten thousands?

## EXERCISE 5

1. Add 3465, 3279, 6534, 5131, 4268.
2. Add 5732, 6721, 3466, 4269, 6535.
3. Add 2768, 5329, 4605, 475, 16.
4. Add 4671, 272, 45, 7, 625.
5. Add 375, 506, 258, 327, 580, 647, 846.
6. Add 436, 47, 449, 498, 736, 274, 888.
7. Add 625, 494, 742, 673, 574, 654, 638.
8. Add 564, 683, 684, 502, 376, 726, 877.
9. Find the sum of the eight sums of the eight Questions.

NOTE: Addition is usually *checked* or proved by adding the columns from the top down.

The importance of accuracy should never be forgotten. One figure wrong in one out of ten problems is a failure. In actual business life accuracy is insisted on. Inaccuracy frequently comes from imperfectly formed figures, and the lack of neatness and of proper arrangement.

## EXERCISE 6

1. A man bought a sleigh for \$142, a carriage for \$1290, and a pair of horses for \$476. What was the cost of all?
2. A lady paid \$192 for a piano, \$342 for furniture, \$187 for linen, and \$46 for silver. What did she pay for all?
3. A man owns four houses; the first is worth \$47,050, the second \$9,106, the third \$1,492, the fourth \$512. What is the value of them all?



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4. What length of fencing will be needed to inclose a lot the four sides of which are 129 feet, 319 feet, 125 feet and 197 feet?

5. A farmer sold a farm for \$6579 and by so doing lost \$1724. What did his farm cost him at first?

6. The first three cars of a freight train contained 32,427 pounds each, the next two cars 30,649 pounds each, and the last four cars, 26,427 pounds each. How many pounds of freight were there in the nine cars?

7. The first of five numbers is 6,239, the second is greater than the first by 373, the third is equal to the sum of the first and second, and the fourth is equal to the sum of the second and third. Find the sum of the four numbers.

8. John Brown, James Jones, and Robert Robinson together went into business. Mr. Brown invested \$7,937, Mr. Jones \$3,987 more than Mr. Brown, and Mr. Robinson \$687 more than both. What was the total capital put into the business?

9. On the first day of July, 1907, there were in the County of Bruce 26,409 horses; in Grey, 31,751; in Haliburton, 1,929; in the District of Rainy River, 991; in Thunder Bay District, 568; in York, 25,417; in Wellington, 24,469; in Simcoe, 33,894; in Halton, 9,113; and in Middlesex, 35,075. How many horses were there in all these counties and districts?

10. The value of horses in these counties and districts was as follows: Bruce, \$3,221,898; Grey, \$3,841,871; Haliburton, \$204,474; Rainy River, \$128,830; Thunder Bay, \$79,520; York, \$3,380,461; Wellington, \$2,911,811; Simcoe, \$4,338,432; Halton, \$1,120,899; Middlesex, \$4,068,700. What was their total value?

11. In 1906, the value of cheese made in the County of Dundas was \$1,189,811; in Dufferin, the value was \$44,932; in Essex, \$8,200; in Frontenac, \$1,123,030; in Peel, \$15,022; in Hastings, \$1,153,494; in Leeds, \$1,164,421; in Muskoka and Nipissing, \$4,365; in Welland, \$26,203; in Oxford, \$1,412,574; and in Lincoln, \$68,669. What was the total value of the cheese?

## CROP RETURNS OF ONTARIO, 1903-1907.

| Year    | WHEAT   |            | OATS      |             | BARLEY  |            |
|---------|---------|------------|-----------|-------------|---------|------------|
|         | Acres   | Bushels    | Acres     | Bushels     | Acres   | Bushels    |
| 1903... | 913,546 | 21,893,470 | 2,638,665 | 109,874,053 | 709,839 | 24,378,817 |
| 1904... | 830,485 | 12,631,726 | 2,654,936 | 102,173,443 | 772,434 | 24,567,825 |
| 1905 .. | 986,329 | 21,516,588 | 2,668,416 | 105,536,572 | 772,633 | 24,265,394 |
| 1906... | 959,032 | 22,108,774 | 2,716,711 | 108,341,455 | 756,163 | 25,253,011 |
| 1907... | 820,678 | 18,019,142 | 2,932,509 | 83,524,301  | 766,891 | 21,718,332 |

12. Examine the table above the line and then find answers to the following questions:

- How many acres were under wheat during the five years?
- What was the total amount of wheat (in bushels) grown during the same time?
- How many acres of oats were there?
- How many bushels of oats were there?
- What was the acreage (the whole number of acres) under barley?
- What was the total yield (in bushels) of barley?

13. The number of children who attended the Public Schools in Ontario during 1907 was as follows: In rural schools, two hundred and thirty-two thousand three hundred and thirty-two; in cities, seventy-three thousand four hundred and ninety-five; in towns, sixty-six thousand three hundred and fifteen; in villages, twenty-six thousand and forty-two. How many children attended the Public Schools of the whole Province?

## EXERCISE 7

The following are intended for rapid drill work. To save the time used in copying you may have a slip of paper below the line, at the bottom of each set of addends, and write on that paper the sums as you find them.