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AUTHORS

Maths the Write Way, Teacher Guide Level 8

Dr Brian E. Enright is an author and a national mathematics education consultant.

Dr Robert Gyles is the deputy superintendent for Community School District #4 in New York City.

Maxine Leonescu is the director of mathematics for Community School District #11 in New York City.

Fred I. Remer is the director of mathematics, science, and technology for Community School District #9 in New York City.

★ TO THE TEACHER ★

One of the most important aspects of teaching Mathematics is communication. Writing, speaking, explaining or drawing can help your students internalise what they have learned and clarify their own thinking. Communication can also act as a powerful tool for you to assess the thinking of your students.

Your students should be encouraged to use strategies that foster communication. We have incorporated the following strategies for your students in *Maths the Write Way.*

★ Write your own problems

★ Communicate orally

★ Identify key words and explain their importance

★ Create your own game, puzzle, picture, poem or rap

★ Summarise your work

★ Investigate to find other ways to solve a problem

★ Make predictions and draw conclusions

★ Work cooperatively to create and assess your work

Maths the Write Way contains seven lessons. Each lesson includes four Investigations and two Extensions to the Investigations. Hints are included to provide clues to the solutions. Each lesson also has four Assessments, two with open-ended responses and two with a multiple-choice format. Vocabulary activities, following Lessons 3 and 7, emphasise the importance of mathematical language. Finally, two mini reviews and a Final Review will help you assess the work of your students.

In *Maths the Write Way,* we have provided a forum for you to instruct as well as assess. We encourage students to look for a variety of ways to solve problems. The process—not just the solution—must be emphasised. Working and sharing ideas with cooperative groups will enhance understanding and communication.

The Teacher Guide includes:

★ Listing of lesson objectives and necessary materials

★ Key vocabulary and concepts for the lesson

★ Suggestions for discussing key mathematical concepts

★ Sample solutions to all Investigations, Extensions and Assessments

★ Suggested strategies for solving problems

★ Reproducible pages for use with selected activities

We are sure that you will find *Maths the Write Way* a valuable resource that will supplement and enhance your mathematics instructional program.

Brian E. Enright
Robert Gyles
Maxine Leonescu
Fred I. Remer

Pages 2–5

Objectives

★ To understand the importance of using scientific notation

★ To express standard numbers using scientific notation

★ To develop rules for rounding numbers to the nearest billion

★ To compare fractions, decimals and per cents

Materials

★ Reproducible 1: *Grid Paper*

Vocabulary

Before beginning the lesson, you may wish to review the following maths terms: *decimal, exponent, fraction, per cent, scientific notation.*

By examining real data, students will realise the importance of being able to read large numbers. They will also see how scientific notation is an efficient way to express large numbers. You may wish to point out that the foreign-born population in the United States varies from year to year. The figures in Investigation 1 are the U.S. Census Bureau estimates for 1994. The numbers in Investigation 2 also vary over time. The oil-reserve figures given are from estimates as of August 1994.

Many students tend to use rules to compare fractions, decimals and per cents without having a clear grasp of the concepts involved. These students need ample time to investigate the relationship between fractions and other fractions and among fractions, decimals and per cents. The activity in Investigation 4 will help students conjecture, draw reasonable conclusions and find ways to support their findings.

For Part A Extension, distribute copies of Reproducible 1.

Answers to Investigations, Extensions and Assessments will vary. Sample solutions are provided.

Part A
Pages 2–3

Investigation 1

| Given Numbers	Scientific Notation
3,600,000	3.6×10^6
250,000,000	2.5×10^8
6,264,000	6.264×10^6
718,000	7.18×10^5
4,003,000	4.003×10^6

To express a number using scientific notation, write the number as the product of a number greater than or equal to 1 and less than 10 and a power of ten.

Investigation 2

When rounding any number to the nearest billion, look at the digit to the right of the billions place (hundred millions place). If this digit is 5 or greater, round up. The digit in the billions place becomes one billion greater and is followed by zeroes in the millions, thousands, hundreds, tens and ones places. If the digit in the hundred millions place is less than 5, round down. The digit in the billions place stays the same and is followed by zeroes in the millions, thousands, hundreds, tens and ones places.

For example: 7,523,458,360 = 8,000,000,000 rounded to the nearest billion, and 4,378,955,873 = 4,000,000,000 rounded to the nearest billion.

Extension

Crude Oil Reserves (Mid-1990's)
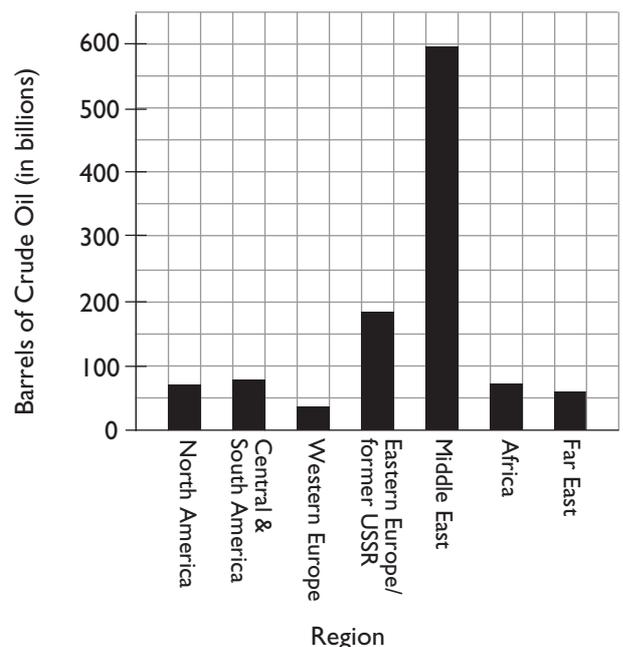
Most of these regions have less than 100 billion barrels of crude oil in reserves. The Middle East has the greatest number of barrels of crude oil in reserves. This is more than 6 times more than all other regions, except Eastern Europe/former USSR.
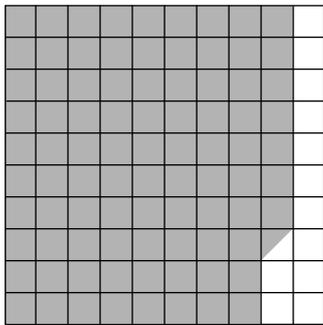
Assessment 1
C

Assessment 2
Since 10^7 is 10,000,000, multiply 9.296 by 10 million to find a product of 92,960,000 kilometres.
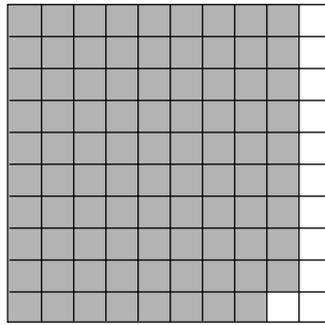
Part B
Pages 4–5

Investigation 3

Driver 1   Driver 2

$\frac{7}{8} = \frac{87.5}{100} = 87.5\%$ $89\% = \frac{89}{100}$

89% > 87.5%. Therefore, Driver 2 went the greater distance.

Compare the two figures using 10 × 10 grids to represent the mileage each driver completed. Shade each amount; 87.5% of the grid is less than 89% of the grid.

Compare the percentages; 89% is greater than 87.5%.

Driver 2 went the greater distance.

Investigation 4
After three months, the sample four students had completed an average of about 50% of the 30 books:

Jennifer	75%
Michael	30%
Lakesha	30%
Jamal	+60%
	195%

Divide by 4 to find the average—48.75%, which is about 50%.

At this rate, the group above could reach their goal in the next three months.

Extension
The chart might include comparisons of fractions, decimals and/or per cents with topics such as school attendance, test scores, athletic events and so on. Example:

A	B	C	D	E
$\frac{42}{50}$	82%	$\frac{38}{50}$	0.88	72%

This data could represent test scores on a test with 50 items.

Assessment 1
A

Assessment 2
Two fractions in the box are less than 50%—$\frac{2}{5}$ and $\frac{6}{13}$. To find the answer, change each fraction to a per cent.

LESSON 2 *Data Analysis*

Pages 6–9

Objectives

★ To explore arrangements through problem solving

★ To understand the use of factorials

★ To develop estimation skills through interpretation of data

★ To explore the use of histograms as a way of representing data

Materials

★ Standard decks of playing cards (or a substitute)

Vocabulary
Before beginning the lesson, you may wish to review the following maths terms: *arrangements/permutations, factorial, frequency distribution, histogram, probability.*

The arrangement or permutation, investigation is an ideal way to guide students to explore the use of factorials. You may find it helpful to give students opportunities to create their own permutation problems.

In Investigation 2, students interpret data and draw their own conclusions. This type of problem can heighten reasoning and thinking skills. Encourage students to reinforce these skills by drawing conclusions from the data they encounter every day.

You may want to use a deck of playing cards to review probability concepts. Probability experiments provide a good opportunity to explore mutually inclusive, as well as mutually exclusive, events. Through Investigation 3, students will have the opportunity to develop a formula in order to solve a problem.

In the histogram activity, students interpret data and find multiple contexts in which the data can be used.

Answers to Investigations, Extensions and Assessments will vary. Sample solutions are provided.

Part A
Pages 6–7

Investigation 1
Caesar is correct. There are 24 different ways the children can be seated. To find this answer, make an organised list.

LRBC	RLBC	BLRC	CLRB
LRCB	RLCB	BLCR	CLBR
LBCR	RCBL	BRLC	CBLR
LBRC	RCLB	BRCL	CBRL
LCBR	RBCL	BCLR	CRLB
LCRB	RBLC	BCRL	CRBL

Lucy (L)   Rachel (R)   Bob (B)   Caesar (C)

Investigation 2
In three years (1991 to 1994), the domestic car sales increased by 815,827 or an average of about 271,942 per year. The imported car sales decreased by 302,719 or an average of about 100,906 per year.

To estimate the domestic and imported car sales in the year 2000, find the difference between the year 2000 and 1994 (6 years), then multiply by the two averages (increase for domestic and decrease for imported).

Domestic	Imported
6 × 271,942 = 1,631,652	6 × 100,906 = 605,436
Add 1,631,652 to 8,990,483	Subtract 605,436 from 1,735,180
(2000 figure) = 10,622,135	(2000 figure) = 1,129,744

Estimates for the year 2000:
Domestic Car Sales—10,662,135
Imported Car Sales—1,129,744

Extension
1. Make an organised list.

LR	RL	BL	CL
LB	RB	BR	CR
LC	RC	BC	CB

There are 12 different ways that 2 of the 4 children can be seated in the 2 seats.

2. Use the permutation formula.

The permutation of 4 things, taken 2 at a time, is 4 × 3 = 12.

Assessment 1
D

Assessment 2
Sample Problem: How many ways can 5 different books be arranged next to each other on a shelf?
Answer: 5!, which is 5 × 4 × 3 × 2 × 1 = 120

Part B
Pages 8–9

Investigation 3
Both students are incorrect. The answer is $\frac{16}{52}$ or $\frac{4}{13}$.

There are 13 clubs in a deck ($\frac{13}{52}$ or $\frac{1}{4}$) and 4 aces ($\frac{4}{52}$ or $\frac{1}{13}$) in a deck. There is 1 card ($\frac{1}{52}$) in the deck that is both a club and an ace.

To find the probability:
$\frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52}$, or $\frac{4}{13}$

Investigation 4

On a 16-question maths quiz,
   3 students got 0–4 questions correct.
   5 students got 5–8 questions correct.
   14 students got 9–12 questions correct.
   4 students got 13–16 questions correct.

Label for horizontal axis: Number of Questions Correct (This axis includes ranges of numbers that show the number of questions answered correctly on a test.)

Label for vertical axis: Number of Students (This axis shows how many students belong in each interval.)

Title of histogram: *Maths Quiz Results for Class 8-301* (The title is a summary of the data shown in the histogram.)

Extension

Find the probability of Charles's pulling a club and an ace from a standard deck of playing cards. (The solution is $\frac{1}{52}$, since only 1 card in the deck is both a club and an ace.) To find the probability:

$\frac{13}{52} \times \frac{4}{52} = \frac{1}{52}$ or $\frac{1}{4} \times \frac{1}{13} = \frac{1}{52}$

Assessment 1
D

Assessment 2
p (spade) = $\frac{13}{52}$

p (picture card) = $\frac{12}{52}$

p (spade or picture card) = p (spade) + p (picture card) − p (spade picture card)

p (spade or picture card) = $\frac{13}{52} + \frac{12}{52} - \frac{3}{52} = \frac{22}{52}$, or $\frac{11}{26}$

LESSON 3 — Operations

Pages 10–13

Objectives

★ To use patterns to improve mental maths skills with integers

★ To gain greater understanding of multiplication and division of integers through the use of patterns

★ To understand per cent of increase and decrease in the context of real-world mathematics

★ To explore the use of order of operations involving exponents

Materials

★ Calculators

Vocabulary
Before beginning the lesson, you may wish to review the following maths terms: *integers, per cent of decrease (per cent discount), per cent of increase.*

Looking for patterns is an important and widely used problem-solving strategy. Calculators can help students find patterns in operations with integers. You may want to consider having students use calculators to help with Investigations 1 and 2.

Per cent of increase and decrease are concepts used frequently in daily life. Encourage students to discuss places where knowledge of them would be valuable.

Order of operations often causes confusion for students. Continual practice in the use of parentheses and exponents can be helpful. You may wish to present problems in steps. Example:

$$13 + 8 - 5 \times 2^2 = \square$$
$$13 + 8 - 5 \times 4 = \square$$
$$13 + 8 - 20 = \square$$
$$21 - 20 = 1$$

To stress the importance of following the order of operations, provide a few examples of problems with the operations completed in different order. This exercise illustrates that the answers will not be consistent.

Answers to Investigations, Extensions, and Assessments will vary. Sample solutions are provided.