Middle School Mathematics
A Guide to the Connected Mathematics™ Series

Data Around Us

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1 Introduction

Number Sense is the ability to reason about numbers and arithmetic relations and operations on those numbers. It includes a complex set of skills and understandings encompassing the abilities to read and write numbers in various ways; to order numbers; to use numbers as measurements; to choose operations on numbers that will help to answer important questions.

This unit, ***Data Around Us*** , is part of the **Number and Operations** strand. It develops specific mathematical skills and understandings that comprise **number sense**. It offers students the opportunity to pull together many ideas and skills about proportional reasoning, area and volume, and algebra.

2 Goals/Objectives

This unit will help students:

- Choose sensible units for measuring.
- Build a repertoire of benchmarks to relate unfamiliar things to things that are personally meaningful.
- Read, write, and interpret the large numbers that occur in real-life measurements using standard, scientific, and calculator notation.
- Review the concept of place value as it relates to reading, writing, and using large numbers.
- Review and extend the use of exponents.
- Use estimates and rounded values for describing and comparing objects and events.
- Assess the accuracy and reliability of numbers used to export information.
- Choose sensible ways of comparing counts and measurements, including using differences, rates, and ratios.
- Understand that a measurement has two components, a unit of measure and a count.

3 Vocabulary

The following words and concepts are used in this unit. The concepts in the left column are those essential for student understanding in this and future units. The Descriptive Glossary in the student text gives definitions for many of these words.

Essential Terms	Terms developed in previous units
Customary system	Benchmark
Metric system, international system of	Compare
Measurement, SI system	Rank
Million, billion, trillion	Unit of measure
Scientific notation	
Standard notation	

4 Summary of Investigations

4.1 Investigation 1 – Interpreting Disaster Reports (pp 5-11)

- Students are challenged to think about ways that numbers can be used to describe and compare important events.
- Read and think about large numbers.
- Decide which numbers are accurate and which are estimates and hypothesize about how such numbers are determined.

4.2 Investigation 2 – Measuring Oil Spills (pp 12-22)

- Students are reminded that measurements consist of a unit and a count and review some units of measure in the customary and metric measurement systems.
- Students begin to acquire a repertoire of personally meaningful ***measurement benchmarks***, and they choose appropriate units for various magnitudes being measured.
- They develop two strategies for making sense of large numbers:
  - Finding other, more familiar objects of the same size and
  - Selecting a smaller familiar object and determining how many copies of it would be needed to equal the larger object.

4.3 Investigation 3 – Comparing Large Numbers (pp 23-37)

- Review and refine technical reading skills in reading, writing, ordering and interpreting large numbers.
- Think about appropriate degrees of accuracy in rounding of large numbers.
- Estimate numbers and interpret estimated numbers.

4.4 Investigation 4 – How Many in a Million? (pp 38-50)

- Reason about and interpret realistic information involving large numbers, quantities in millions, billions and trillions.

- Work with scientific notation and calculator notation for expressing large numbers.

4.5 Investigation 5 – Every Litter Bit Hurts (pp 51-60)

- Work with data expressed as wholes and as rates, and use rates or ratios to explore large numbers.
- Review ideas, which were presented in the ***Comparing and Scaling*** unit.

4.6 Investigation 6 – On an Average Day (pp 61-69)

- Further develop operations sense, that is, the ability to choose an appropriate operation to combine two or more numbers to produce new information.
- Work with large data sets and compare rates per person or rates over a short time.
- Explore the important issue of how two measurements can reasonably be compared. By contrasting difference, multiple, and rate comparisons, students build on review ideas from the ***Comparing and Scaling*** unit.

5 Sample Problems and Solutions

This section provides solutions for selected ACE questions for each investigation.

5.1 Investigation 1

ACE Question 1 page 9

ANSWER
The dates, numbers of deaths (except for the blizzard), and the snow depth are probably accurate; the dollars of damage and the numbers of homeless are probably rough estimates.

5.2 Investigation 2

ACE question 1 page 19.

ANSWER
1a. 90,000 feet, 1313 feet, 9677 feet.
1b. 150,000 acres
1c. 4 billion cubic yards
1d. None
1e. $970 million
1f. 17,600 feet per minute

1g. None
1h. 60 people

5.3 Investigation 3

ACE Question 1 page 31

ANSWER
1. Sixteen million, three hundred fifty-three thousand, six hundred fifty-nine.

5.4 Investigation 4

ACE Question 1 page 44

ANSWER
1a. Yes; A person who is 1 million minutes old is about 1.9 years old: 1,000,000/ 60 min/hour is about 16,667 hours; 16,667 hours / 24 hours/day is about 694 days; 694 days / 365 days/year is about 1.9 years.

5.5 Investigation 5

ACE Question 4 page 56.

ANSWER
4a. The median amount used per week is 236 gallons, the average of 241 and 231. This can be used to estiamte the weekly use by Americans as about 236 gallons per person x 260 million people is about 6.14×10^{10} gallons.

4b. The mean amount used per week is approximately 246 gallons. This can be used to estimate the weekly use by Americans as about 246 x 260,000,000 = 6.40×10^{10} gallons.

4c. The mean is 10 gallons greater that the median. This difference is due to the few large values in the data, which pull the mean up. The estimate for water use when the mean is used is 2.6 10^9 gallons or about 2.6 billion gallons, greater than when the median is used.

5.6 Investigation 6

ACE Question 10, page 66.

ANSWER
10. 3 million x 18 = 54 million cigarettes.