MAT8002 Week 1 Complete Study Guide

Decimal Number System

Course Information

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- **Required Text:** Electronics and Computer Math 8th Ed. (Custom Edition)
- **Calculator:** Non-graphing scientific calculator only

Week 1 Overview & Learning Objectives

Class 1 Topics:

- Course administration and setup
- Sections 1-1 through 1-6 (Basic decimal concepts, fractions, percentages, rounding, significant digits)

Class 2 Topics:

- Sections 1-7 through 1-10 (Signed number operations, mathematical expressions, order of operations)

By the end of Week 1, you should be able to:

- Convert confidently between decimals, fractions, and percentages
- Round numbers to any specified place value or number of significant digits
- Perform all four operations with signed numbers
- Apply order of operations to complex expressions
- Identify and combine like terms

Mathematical Operators Reference

Understanding mathematical symbols is essential for effective communication:

Name	Symbol	Example
Decimal point	.	3.7
Addition	+	3+2
Positive sign	+	+3
Subtraction	-	3-2
Negative sign	-	-3
Multiplication	× or *	3×2 or 3*2
Division	÷ or /	3÷2 or 3/2
Equal	=	3*2=6
Absolute Value	| |	|-7| = +7, |+7| = +7
Power function	( )²	$(3)^2 = 3×3 = 9$
Square root	√	√4=2

Class 1 Preparation: Basic Decimal Concepts

1-1: Decimals and the Decimal Number System

The decimal number system (also called the place value system) is a base 10 number system where:

- 0 is the least value digit and 9 is the greatest value digit
- Each digit's position determines its value
- The decimal point separates whole numbers from fractional parts
- Counting above 9 produces a carry from the ones place to the tens place

Place Value Chart:

Millions | Hundred-Thousands | Ten-Thousands | Thousands | Hundreds | Tens | Ones . Tenths | Hundredths | Thousandths | Ten-Thousandths | Hundred-Thousandths | Millionths

Key Concepts:

- Understanding place value (ones, tens, hundreds, thousands, etc.)
- Reading and writing decimal numbers
- Converting between word form and numerical form

1-2: Decimal Fractions

In a decimal fraction, the denominator is 10 or a multiple of 10 (100, 1000...).

Example: 7/10 (seven tenths)

- The numerator is 7
- The denominator is 10
- Read as "seven tenths"

Converting Fractions to Decimals:

- Determine the value of the denominator
- Place the rightmost digit of the numerator in that decimal position
- Place remaining digits before it

Examples:

- 12/100 = 0.12
- 23/10000 = 0.0023

Converting Decimals to Fractions:

- The position of the rightmost number determines the denominator
- 0.00495 = 495/100000
- 0.0007 = 7/10000

Practice Skills:

- Converting common fractions: 1/4 = 0.25, 1/3 = 0.333..., 3/8 = 0.375
- Understanding terminating vs. repeating decimals
- Reducing fractions to lowest terms

1-3: Whole Numbers and Fractions

Mixed Numbers: Mixed numbers combine whole numbers and fractions:

- 432 658/1000 = "Four hundred thirty-two and six hundred fifty-eight thousandths"
- 57.0425 = 57 425/10000

Key Points:

- The word "and" bridges the whole number part and the fraction part
- Mixed numbers vs. improper fractions vs. proper fractions
- Converting between mixed numbers and improper fractions

Examples to Review:

- 2½ = 5/2 = 2.5
- 7/3 = 2⅓ = 2.333...

Percent and Percentage

Percent (%) originated in ancient Rome and became standard in commerce. It represents division by powers of 100.

Converting Between Forms:

- 23% = 0.23
- 134% = 1.34
- 46/100 = 0.46 = 46%
- 276/100 = 2.76 = 276%

Essential Conversions:

- 50% = 0.5 = 1/2
- 25% = 0.25 = 1/4
- 75% = 0.75 = 3/4

Key Concepts:

- Converting between decimals, fractions, and percentages
- Calculating percentages of numbers
- Finding what percent one number is of another

1-4: Rounding Whole Numbers

Rounding simplifies numbers but accuracy is lost in the process.

Rounding Algorithm:

1. Determine which place value to round to
2. Look at the number in the next place value (to the right)
3. If the number is 0-4, keep as is (round down)
4. If the number is 5-9, round up

Practice Examples:

- 72348 rounded to nearest 10 = 72350
- 72348 rounded to nearest 100 = 72300
- 72348 rounded to nearest 1000 = 72000
- 72348 rounded to nearest 10000 = 70000
- 1,247 rounded to nearest 10 = 1,250
- 1,247 rounded to nearest 100 = 1,200

1-5: Rounding Non-whole Numbers

The same algorithm applies to decimal numbers.

Practice Examples:

- 12.736 rounded to nearest hundredth = 12.74
- 3.456 rounded to nearest tenth = 3.5
- 3.456 rounded to nearest hundredth = 3.46

1-6: Significant Digits

Significant digits (significant figures) are digits in a number that are known to be accurate.

Definitions:

- **Most Significant Digit (MSD):** The leftmost nonzero digit
- **Least Significant Digit (LSD):** The rightmost digit

Rules for Determining Significance:

- All non-zero digits are significant (1-9)
- Zeros between non-zero digits are significant
  - Example: 2004 has 4 significant figures
- Leading zeros are never significant
  - Example: 00524 has 3 significant figures
- For decimal numbers, leading zeros indicate place value but are not significant
  - Example: 0.000763 has 3 significant figures
- For decimal numbers, trailing zeros are significant (they indicate accuracy)
  - Example: 53.000 has 5 significant figures

Class 2 Preparation: Operations with Signed Numbers

Signed Numbers Introduction

Numbers can be positive or negative. Relations between numbers use "less than" (<) or "greater than" (>) symbols.

Examples:

- 4 > -3 (4 is greater than -3)
- -3 < 4 (-3 is less than 4)

Number Line:

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-10 -9 -8 -7 -6 -5 -4 -3 -2 -1  0  1  2  3  4  5  6  7  8  9 10
```

1-7: Addition and Subtraction of Signed Numbers

Addition Rules:

- **Same signs:** Add the numbers, keep the sign
  - (+7) + (+3) = +10
  - (-3) + (-4) = -7
- **Different signs:** Subtract smaller from larger, use sign of larger number
  - (-6) + (+2) = -4
  - (-2) + (+5) = +3

Subtraction:

- Subtraction = Adding the opposite
- Use the same rules as addition after converting to addition

Key Terms:

- **Minuend:** The number being subtracted from
- **Subtrahend:** The number being subtracted
- **Difference:** The result

1-8: Multiplication and Division of Signed Numbers

Sign Rules for Multiplication and Division:

- Positive × Positive = Positive
- Negative × Negative = Positive
- Positive × Negative = Negative
- Negative × Positive = Negative
- Same rules apply for division

Key Terms:

- **Multiplication:** 6 × 7 = 42
  - Multiplicand × Multiplier = Product
- **Division:** 15 ÷ 3 = 5
  - Dividend ÷ Divisor = Quotient

1-9: Mathematical Expressions and Terms

Vocabulary:

- **Terms:** Quantities separated by + and/or -
- **Factors:** Quantities separated by × and/or ÷
- **Expressions:** Quantities denoted by one or more terms and/or factors
- **Coefficient:** The numerical part of a term
- **Like terms:** Terms with same variable parts

Examples:

- In the expression 3x + 2y - 5x:
  - Terms: 3x, 2y, -5x
  - Like terms: 3x and -5x
  - Coefficients: 3, 2, -5

1-10: Order of Operations

BEDMAS/PEMDAS Rules:

1. **B**rackets/Parentheses [ ], { }, ( ), | | (highest priority)
2. **E**xponents, Roots and Radicals
3. **D**ivision and **M**ultiplication (left to right)
4. **A**ddition and **S**ubtraction (left to right - lowest priority)

Worked Example: -3 - [2 + 4 × (-6+3)] = -3 - [2 + 4 × (-3)] [Brackets first: -6+3 = -3] = -3 - [2 + (-12)] [Multiplication: 4 × (-3) = -12] = -3 - [-10] [Addition inside brackets: 2 + (-12) = -10] = -3 + 10 [Subtracting negative = adding positive] = 7

Important: When confronted with nested terms, always start with the innermost brackets first and work outwards.

Practice Problems

Review Questions Set 1

1. Round 8563.843 to the nearest hundred **Answer:** 8600

2. Round 0.0874756 to the nearest ten-thousandth **Answer:** 0.0875

3. How many significant figures in 052003.09? **Answer:** 7 significant figures (leading zeros don't count, but zeros between non-zero digits and trailing zeros in decimals do count)

4. How many significant figures in 0.004329? **Answer:** 4 significant figures (leading zeros don't count)

5. Simplify the following expression:

$$\frac{-3^3[8-1\times\sqrt{4}-(-18\div3)]}{(-27\div3)\times-4\times\sqrt{25}-2^3}$$

Solution: Numerator: $-3^3[8-1\times\sqrt{4}-(-18\div3)] = -27[8-1\times2-(-6)] = -27[8-2-(-6)] = -27[8-2+6] = -27[12] = -324$

Denominator: $(-27\div3)\times-4\times\sqrt{25}-2^3$
$= (-9)\times(-4)\times5-8$
$= 36\times5-8$
$= 180-8$
$= 172$

Final answer: -324/172 = -1.88 (approximately)

6. Compute 4576 × 13 with correct significant figures **Answer:** 4576 has 4 sig figs, 13 has 2 sig figs, so answer should have 2 sig figs 4576 × 13 = 59,488 ≈ 59,000 (2 sig figs)

Study Tips for Success

Before Class:

- [ ] Review basic arithmetic operations
- [ ] Practice converting between fractions, decimals, and percentages
- [ ] Refresh knowledge of place value
- [ ] Bring non-graphing scientific calculator
- [ ] Have textbook and note-taking materials ready

During Class:

- [ ] Take detailed notes on examples worked in class
- [ ] Ask questions if concepts aren't clear
- [ ] Practice problems as they're presented
- [ ] Note any specific methods the professor emphasizes

After Class:

- [ ] Review notes within 24 hours
- [ ] Work through textbook examples
- [ ] Practice additional problems from each section
- [ ] Identify areas needing more practice

Key Success Strategies:

1. **Practice Daily:** Work a few problems from each section every day
2. **Show All Work:** Develop good problem-solving habits early
3. **Check Answers:** Use your calculator to verify manual calculations
4. **Ask Questions:** Don't let confusion build up - address it immediately

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Assessment Information

- **HWK Quiz #1:** Due Week 3, worth 2.5% - covers this material
- **Assignment #1:** Due Week 4, worth 3.75% - covers this material
- **Test #1:** Week 4, worth 7.5% - covers this material plus Powers of Ten and Units/Prefixes

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Common Student Challenges & Solutions

Challenge: Mixing up rounding rules **Solution:** Always remember - look to the right, 5 or higher rounds up

Challenge: Sign errors with negative numbers **Solution:** Practice the sign rules until they're automatic

Challenge: Forgetting order of operations **Solution:** Use BEDMAS acronym and work step-by-step

Challenge: Significant digits identification **Solution:** Memorize the rules and practice with various examples

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Online Resources for Extra Practice

Comprehensive Learning Platforms

- **Khan Academy (Free):** Arithmetic basics, decimals, fractions, negative numbers
- **Professor Leonard (YouTube):** Basic Math Review Playlist with step-by-step explanations

Topic-Specific Resources

- **Math is Fun:** Decimal number system, rounding numbers, positive/negative numbers
- **Purplemath:** Place value, adding/subtracting integers
- **Calculator Soup:** Fraction calculators, rounding calculators, significant figures calculators

Practice Tools

- **IXL Math:** Interactive practice problems
- **Math Papa:** Practice problems with solutions
- **Wolfram Alpha:** Step-by-step solutions (free basic version)

Mobile Apps

- **Khan Academy** (iOS/Android)
- **Photomath** (iOS/Android)
- **Microsoft Math Solver** (iOS/Android)

Pro Tips for Using This Guide

1. **Work through examples:** Don't just read - practice each type of problem
2. **Use multiple methods:** Try different approaches to reinforce understanding
3. **Time yourself:** Practice problems under time pressure for tests
4. **Form study groups:** Discuss concepts with classmates
5. **Visit office hours:** Get help from Professor Borok when needed

Remember: This foundation material is crucial for success in the rest of the course, so invest the time to master these concepts thoroughly!