

MA 101 Final Exam

Tuesday, May 5, 2009 10:30 a.m. – 12:30 p.m.

Review your notes, quizzes, and assigned work over the topics below.

Chapter 1 Expectations: Getting Started in Learning Mathematics via Problem Solving

You will be expected to:

1. give a general definition of problem solving in mathematics and distinguish between *exercises* and *problems*
2. explain, illustrate, and use Polya's 4-step problem solving process (Activity 1.7):
 - understand the problem
 - devise a plan
 - carry out the plan
 - look back
3. explain, illustrate, apply the following strategies:
 - guess and test (What's My Number?, Poison)
 - use a variable (pigs and hens, Poison, Cereal Boxes and Patio Tiles)
 - draw a picture (pigs and hens, Die Hard, Cereal Boxes and Patio Tiles /Tournament/ Triangular Numbers)
 - look for a pattern (pigs and hens, Cereal Boxes and Patio Tiles, how many squares)
 - make a list (What's My Number?, pigs and hens, Census taker, Constructing Numbers)
 - solve a simpler problem (how many squares)
4. understand why it is important to learn how to solve mathematics problems (Activity 1.7)

Chapter 2 Expectations: Numeration

You will be expected to:

5. work with a numeration system different than our own (Activity 2.1-2.4), i.e., Tally, Egyptian, Babylonian, Chinese-Japanese, and Roman.
6. compare the characteristics and properties of the Hindu-Arabic numeration system with other systems (2.1-2.4)
7. distinguish between a number, a numeral, and the name of a number (2.2)
8. understand the ideas of face value, place value, a number base, a minimal collection, and the concepts of grouping, trading, and decomposing (i.e., a flat into a long) in any number base.
9. be able to count in another base.
10. explain how to use a number grid to add or subtract whole number and why it works.
11. represent addition or subtraction of whole numbers using base pieces.
12. convert a numeral from any base to base ten and vice versa.
13. write a numeral given in any base in expanded form and understand the place value and face value of any digit.
14. determine the base of a given numeral if you know the number it represents.
15. explain, illustrate, and use the following thinking strategies for learning basic addition and subtraction facts in base 10 (or equivalent ideas in another base):


commutativity (turn around facts)	combinations to 10 (10's complement)
counting on by 1 and 2	doubles
adding zero	doubles plus 1, doubles plus 2, doubles minus 1, doubles minus 2
adding 10	fact families

Chapter 3 Expectations:

You will be expected to:

1. Determine if a number is a natural number, whole number, or integer and know the relationship between these sets of numbers.
See **Activity 3.1** - 2 through 5 and p. 93ff 10, 30
2. Determine if a given set under a specified operation is
 - a. closed;
 - b. commutative;
 - c. associative;
 - d. has an element which is an identity;
 - e. has an element which is an inverse of another given element.See **Activity 3.1** - 6-21 and p.93ff 3, 4, 26, 27, 37 and **QUIZ 3** # 1-2, 5

Note: The operation may be specified many different ways:

- a. as addition, subtraction, multiplication, or division on a specific set.
See **Activity 3.1** - 6-11 and p.93ff 37 and **QUIZ 3 # 4**
 - b. as a table See **Activity 3.2** - 1 and p.93ff 3, 4 and **QUIZ 3 # 1-2**
 - c. as a procedure See **Activity 3.2** - 2 and p.93ff 2 and **QUIZ 3 # 5**
3. Given a mathematical number sentence (equation), identify the correct property used (or if it used correctly).
See **Activity 3.1** - 1 and p.93ff 38 and **QUIZ 3 # 3**
Given the property, use numbers to illustrate. See p.93ff 1, 5
 4. Identify and use the distributive property of multiplication over addition and the distributive property of multiplication over subtraction. See **Activity 3.1** - 1 and p.93ff – 5 and **QUIZ 3 # 3**
 5. Classify word problems as
 - a. addition, subtraction, multiplication, or division.
 - b. conceptual approaches such as See **Activity 3.3** and p.93ff 7, 8, 9, 41 and **QUIZ 4**
 3. Be able to construct a word problem for each conceptual approach.
 4. Use the number line to illustrate
 - a. integer addition or subtraction
 - b. subtractionSee **Activity 3.4** and p.93ff 11 and **QUIZ 5 # 1**
 6. Use the charge model to illustrate
 - a. integer addition or subtraction
 - b. integer multiplication or division.See **QUIZ 5 # 2, 3, 4** and supplementary handout
 7. Demonstrate the correct use of **addition** in *any* base using these algorithms:
 - a. scratch addition. See p.93ff 12, 31 and **QUIZ 5 # 5**
 - b. partial sums. See supplementary handout
 - c. lattice addition. See supplementary handout
 8. Demonstrate the correct use of **multiplication** in *any* base using these algorithms:
 - a. a grid. See supplementary handout
 - b. partial products. See supplementary handout
 - c. lattice multiplication. See p.93ff 13, 32 and supplementary handout
 9. Demonstrate the correct use of **subtraction** in *any* base using these algorithms:
 - a. expanded form regrouping. See supplementary handout
 - b. expanded form Austrian subtraction (or equal additions)See p.93ff 15 and supplementary handout
 10. Use algorithms to solve problems. See **Activity 3.11** 1-3 and p.93ff 33, 34.
 11. Show how to use compatible numbers for mental arithmetic. See supplementary handout.
 12. Demonstrate the correct use of **division** in any base using scaffolding. See supplementary handout
 13. Be able to explain why particular algorithms work.

Comparison Approach (Subtraction)
Take Away Model (Subtraction)
Missing Addend Model (Subtraction)
Repeated Addition Approach (Multiplication)
Rectangular Array Approach (Multiplication)
Cartesian Product or Cross Product Approach (Multiplication)
Rectangular Array Approach (Multiplication)
Repeated Subtraction Approach (Division)
Sharing (Division)
Missing Factor (Division)

Chapter 4 Expectations

1. Identify if a number is prime or composite. See p. 127ff 4, 25
2. Write the prime factorization of a number. See p. 127ff 1, 2, 3, 24
3. Know the divisibility rules in base 10 for 2, 3, 4, 5, 8, 10 and why they work. See p. 127ff 6, 14, 36, 37
4. Correctly use the words *factor, multiple, is divisible by, divides* See p. 127ff 10, 63
5. Find how many factors a number has and be able to list these factors. See p. 127ff 8, 9, 11, 23, 29, 39, 62
6. Classify numbers according to their number of factors. See p. 127ff 8, 9
7. Find the least common multiple of a set of two or more numbers. See p. 127ff 16, 38, 41 and **Activity 4.9**
8. Find the greatest common divisor (also called the greatest common divisor) of a set of two or more numbers. See p. 127ff 7, 15 and Activity 4.9
9. Be able to devise a divisibility test for numbers in another base. See p. 127ff 80 and **Activity 4.8**