

2:00 Class - THURSDAY, Dec. 13, 10:30-12:30.....3:30 Class - TUESDAY, Dec. 11, 1:00-3:00.
You must take the final exam at the time scheduled for YOUR usual class.

The Final Exam is CUMULATIVE and is worth 150 points. Study this list in connection with your notes, in-class materials, reading, quizzes, assigned practice problems, Exams #1-3, and your own study guides from those exams. Solutions to this semester's graded items are on the bulletin board near my office, old exams on my website.

Problem Solving: *Assessing this topic must involve new, unfamiliar situations; don't let that scare you.*

1. State Polya's Four Steps in order. Spell his name. Know that we use them for problem solving.
2. Given a problem, name strategies that might/might NOT solve it. Tell why to choose, not how to use.
3. Fully solve a problem; explain your reasoning in terms of the math steps you chose, and why.
4. Tables/diagrams/pictures need labels; Guess and Check should explain improved guesses.
5. Be flexible - use new "tricks" (especially Work Backwards) - but prepare for VARIABLES to be forbidden.

Sequences: *Algebra/variables will not be permitted in sequence problems, except for a_n notation and work.*

1. Find the next term(s) in a given sequence of numbers or diagrams. Explain when asked.
2. Read problems carefully to distinguish between finding/using a term (value) vs. a position.
3. Recognize given sequences that are arithmetic, geometric, Fibonacci-type, or no special type.
4. Sequences may use decimals, fractions, or negative numbers in general, or as CDs and CRs.
5. Find early terms when told about difference sequence, type (above), other terms, a_n notation/formula.
6. Find distant terms for arithmetic or geometric sequences. Prepare to explain briefly.
7. You are not required to simplify expressions involving extremely large exponents.
8. Determine whether and where a given number can appear in a given arithmetic sequence; explain.

Sets: *Use and understand correct notation (roster, subsets, operations, etc.) for all work with sets.*

1. Be able to write in words exactly how to read set notation aloud; convert sentences to notation.
2. Use, read, understand listing/roster and set-builder notation for sets. Convert between these.
3. Understand, identify, or create equal or equivalent sets. Explain the difference.
4. Know, understand, and use the notation " $n()$ " for the cardinality of a set.
5. Describe what a one-to-one correspondence is. Draw one or more between two given sets
6. Correctly use, read, understand \in , \notin , \subseteq , \subsetneq notation, including in true/false or fill-in-the-blank.
7. Know, read, use definitions and correct notation for natural numbers, whole numbers, empty set.
8. List all subsets of a given set; list some with certain properties or cardinality. Use the 2^n predictor.
9. Answer Attribute Game questions when given its labels. Distinguish between circles/sets vs cells.
10. Given a labeled Venn diagram, fully describe objects in a given region or cell; list all cells where items fitting a given description could go.
11. Find, read notation, understand: complement, intersection, union, difference, Cartesian product.
12. Predict how many elements $A \times B$ should have. Be extra careful with Cartesian product notation.
13. Use correct notation to apply set operations, including several in a problem (i.e., parentheses).
14. Know, use the word disjoint. Understand universal sets. Don't repeat elements when listing.
15. Make up sets whose \cup , \cap , difference (\setminus or $-$), or \times have certain qualities. When not possible, explain.

Numeration: *Understand terms: number, numeral, digit, place value, numeration system, Hindu-Arabic, base.*

1. Correctly spell the name for our system of numeration. Answer questions like those in HW #21.
2. Convert between forms for base ten numerals: standard, word, all three types of expanded.
3. Round a given numeral to a given position. Recognize when you rounded up versus rounded down.
4. Find one or more base ten numerals - including largest/smallest - that satisfy a given set of clues.
5. Convert from other bases into base ten. Count in other bases (memorize base twelve and sixteen digits).
6. Given an equality using numerals in base ten and in an unknown base, find the value of the base.
7. For *unfamiliar* bases beyond ten, I will give you necessary extra digits or the pattern for creating them.

8. Beware creating numerals that use inappropriate digits for their bases.
9. List one or several numerals that precede or follow given numerals in a specific base.
10. Determine largest or smallest in a list of numerals, possibly in a mixture of bases. (See text HW.)
11. Tell clearly how to represent a numeral with base blocks, abacus, or place value card, as in HW #25.

W Arithmetic Scenarios, Terms, Definitions: *Memorize, spell terminology for parts of number sentences.*

1. Complete constructivist definitions; find Fact Families; use, understand term “number sentence.”
2. Know when division involving 0 is possible/not; use PRECISE definitions to explain.
3. Create number sentences having given numbers/behavior in specified roles; recognize when you cannot.
4. Identify by name (memorize them!) the scenario and/or operation represented in a given word problem.
5. Write the complete number sentence represented in a given word problem. Name its operation.
6. Make up an original word problem requiring a given computation and scenario.

W Arithmetic Algorithms: *Prepare for ordinary base ten! Algorithms must have perfect scratchwork.*

1. Work in familiar or *unfamiliar* other bases (when I give you necessary extra digits or a rule).
2. Tell what the terms algorithm and manipulative mean in the elementary mathematics classroom.
3. Add and subtract using the Standard Algorithms; also know and use Scratch Addition.
4. In subtraction regrouping, use correct notation at the top of a column. Stay in the given base!
5. Add/subtract mixed measurements such as inches-feet-yards, time, etc., as in text HW.
6. Multiply in other bases using Lattice Multiplication or the Partial Products Algorithm.

Number Theory: *Understand, convert between: factor, divisor, multiple, divisible, divides, | notation.*

1. Use definition of “divides” in explanations, including for true/false statements about synonyms/notation.
2. Create sentences using the synonyms or the | or / symbols. Especially apply them to zero and one.
3. List all whole or natural numbers that are factors or multiples of a given number.
4. List factors or multiples meeting extra conditions: even, odd, prime, composite, certain size, etc.
5. Know, use, classify: prime, composite, or unit; memorize primes up to 50.
6. State precisely: definition of prime, defn of composite, Fundamental Theorem of Arithmetic.
7. Prime factor a given number by Tree and Tower. Recognize wrong prime factorizations.
8. Predict how many factors a given number has; show work by listing “# of ways...” as in class.
9. Apply the Prime Number Test to a given number, showing all steps. Use in tough factor trees.
10. Understand the Sieve of Eratosthenes (no spelling). State what circled vs crossed-out numbers represent.
11. Find, explain when a given Sieve will be complete - Answer: After (*blank*) has caused its crossing out...
12. Identify other items in a Sieve: last number crossed out, largest number crossed/not crossed, etc.
13. Demonstrate divisibility tests for 2 through 12. Use to find missing digits or make up entire numbers.
14. Explain what GCDs, LCMs are without using any words these letters represent. Know “relatively prime.”
15. Demonstrate all methods to find GCDs, LCMs: listing, prime factors, Euclidean Algorithm.

Bring an approved calculator: not cell phone, no text-based memory.

If you forget, you may borrow mine - for a THREE point deduction.

(*) Grades will be posted as available, but I am writing and giving Final Exams through FRIDAY, Dec. 14.

(*) I can't begin grading the MATH 210 Finals until AFTER the second one is finished late Thursday afternoon.

(*) Monday, Dec. 16, is the EARLIEST I anticipate being done grading the finals and computing course grades.

(*) Scores will be posted on D2L, but they are UNOFFICIAL. I double-check all scores that are “close” to a cut-off.

(*) Please don't phone or email unless it's urgent; such interruptions only slow me (and other professors) down.