**College of Science and Health  
Department of Mathematics  
Course Outline**

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| 1. | **Title of Course, Course Number and Credits:** Problem Solving in Mathematics - MAEN 5030, 3 credits |
| 2. | **Description of Course:** This course covers the theory of problem solving as it applies to different areas in mathematics, such as: sets, numerations systems, number theory, counting techniques, probability, statistics, network theory, and algebra. In addition, each week, interactive activities using the Internet will be explored to understand how the Internet can be incorporated within the mathematics classroom.  . |
| 3. | **Course Prerequisites**: The prerequisites for this course are [MAEN 500](http://www.wpunj.edu/cos/math/outlines/maen500.htm)0 and [MAEN 501](http://www.wpunj.edu/cos/math/outlines/maen501.htm)0 or knowledge of algebra. |
| 4. | **Course Objectives:**   |  |  | | --- | --- | |  | to understand the theoretical framework of mathematical problem solving | |  | to develop a repertoire of problem solving methods | |  | to relate problem solving methods to the different areas of mathematics | |  | to incorporate the Internet into the Mathematics curriculum | |  | to be introduced to some recent developments in mathematics to be included in the K-8 curriculum | |
| 5. | **Student Learning Outcomes.**  Students will be able to:   |  |  | | --- | --- | |  | Apply a variety of problem solving methods appropriate to different curriculum areas | |  | Use more than one method to solve any given problem | |  | Understand limitations of methods in different contexts | |  | Apply appropriate mathematical ideas presented to real-world situations | |  | Use different Internet capabilities such as Applets, plug-ins with mathematical applications | |
| 6. | **Topical Outline of the Course Content:**   1. Problem Solving Theory 2. Sets and Venn Diagrams 3. Numerations Systems 4. Number Theory 5. Counting Principles. Permutations, and Combinations 6. Probability: Conditional Probability, Independent Events, and Mathematical Expectation 7. Statistics, Measures of Central Tendency and Dispersion and Statistical Graphs 8. Problem Solving in Geometry, Network and Graph Theory 9. Problem Solving in Algebra with Functions and Graphs |
| 7. | **Guidelines/Suggestions for Teaching Methods and Student Learning Activities:** Course is being offered on-line. Each week includes readings, exercises, discussion postings and some interactive internet project |
| 8. | **Guidelines/Suggestions for Methods of Student Assessment (Student Learning Outcomes)** Students will have   1. Weekly assignments to assess the learning of the mathematics 2. Weekly postings to discuss problem solving methods 3. A presentation of a more sophisticated problem with its solution and the methods use to solve it 4. Weekly Internet activities to explore and report back to the class |
| 9. | **Suggested Reading, Texts and Objects of Study:** Bello, I. and J. R. Britton, Topics in Contemporary Mathematics, 7th Edition. New York, NY: Houghton Mifflin Company, 2001. |
| 10. | **Bibliography of Supportive Texts and Other Materials: Websites**Each week has a webliography with resources on the particular topic of that week. The web sites listed below are more general web sites on areas in problem solving.   |  |  | | --- | --- | |  | 21st Century Problem Solving - one of the leading web sites on what is called problem solving literacy <http://www2.hawaii.edu/suremath/home.html> | |  | Dale Seymour Publications on Problem Solving - Book publishers have many resources for teachers. For example, the Pearson Learning now handles the Dale Seymour publications which is well-known for their variety of math activity books <http://www.pearsonlearning.com/plearn/html/cat_7.cfm?prog_id=437> | |  | Challenging Math Problems <http://donut.math.toronto.edu/~naoki/mathprob.html> | |  | EAI Material for Learning Math and Science - a commercial site of a company located in NJ with attribute materials, patterns and number sense, counting and sorting, probability, and problem solving activities and manipulatives. | |  | Jackie Cooke's Problem Solving Web sites - an excellent resource page with lots of good links to problem solving activities! Jackie has been teaching in elementary classrooms around the Portland, Oregon area since 1981 and serves as the N.C.T.M. Representative for the Oregon Council Teachers of Mathematics (O.C.T.M.). <http://westgresham.gresham.k12.or.us/jcooke/prob.html> | |  | Math Competitions on the Web <http://donut.math.toronto.edu/~naoki/comp.html> | |  | Math Forum's Problem Solving Resources <http://forum.swarthmore.edu/library/topics/problem_solving/> | |  | NCTM's Principles and Standards for School Mathematics - with examples, lesson plans and resources linked to the standards. <http://standards.nctm.org/> | |  | NCTM's Electronic Examples - Internet activities matched with the standards at all grade levels <http://standards.nctm.org/document/eexamples/index.htm> | |  | The Northwest Regional Educational Laboratory - their list of web resources to problem solving <http://www.nwrel.org/msec/mpm/resources.html> |   with also a listserv on problem solving in mathematics you can join <http://mail.nwrel.org/scripts/lyris.pl?enter=prob-solve-teaching&text_mode=0>   as well as a special project called the Problem-Solving Model which trains teachers in problem solving. However, their lesson plans are only available to teachers who have taken their workshop! <http://www.nwrel.org/msec/mpm/index.html>   |  |  | | --- | --- | |  | Problem Solving In Mathematics - a group of problems suitable for grades 6 - 12 using the methods: Guess and Check, Look for a Pattern, Make A Systematic List, Make A Drawing Or Model, and Simplify the Problem <http://jersey.uoregon.edu/~chuckp/> | |  | Project Interactivate - many interactive Mathematics lesson plans on the Internet <http://www.shodor.org/interactivate/> | |  | Resource Page on Mathematical puzzles - develop be Juha Puranen, Department of Statistics, University of Helsinki <http://noppa5.pc.helsinki.fi/p2.html> | |  | Role of calculators in the classroom - a collection of papers on use of calculators http://ued.uniandes.edu.co/servidor/em/recinf/tg18/Base/WWWfiles-1.html |   **Books**   |  |  | | --- | --- | |  | Alexander, V. T. and E. G. Phadia. Probability and Statistics: A No Nonsense Approach. Reading, CA: C. T. Publishing, 1995. | |  | Angel, A. & S. R. Porter. A Survey of Mathematics with Applications. New York: Addison Wesley, 1989. | |  | Applebaum, P. "Eight Critical Points for Mathematics" in Perspectives in Critical Thinking: Essays by Teachers in Theory and Practice, edited by Dan Weil, New York, NY: Peter Lang Publishing, Inc., 1999. | |  | Bamberger, H., and P. Hughes. Super Graphs, Venns, and Glyphs: Hundreds of Great Data Collecting Activities to Build Real-Life Math Skills. NY: Scholastic, Inc. 1996. | |  | Baron J. and R. Sternberg. Teaching Thinking Skills: Theory and Practice. New York: W. H. Freeman and Company, 1987. | |  | Bennett, J. O. and W. K. Briggs, Understanding and Using Mathematics: A Quantitative Reasoning Approach. Readinh, MA; Addison- Wesley, 1999. | |  | Bennett, A. B. and L. T. Nelson. Mathematics for Elementary Teachers: A Conceptual Approach. New York, McGraw-Hill, 1998. | |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, Mathematics for Elementary Teachers: An Activity Approach. New York, McGraw-Hill, 1998. | |  | Botermans, J. and P. van Delft. Creative Puzzles of the World. New York: Harry N. Abrams, Inc.1978. | |  | Bradley, G. Problem Solving with Creative Mathematics. New York: Brtooks/cole Publishing Company, 1995. | |  | Brown, S. and M. Walter. The Art of Problem Posing. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1983. | |  | Burril, G. and P. Hopfensperger. Exploring Statistics with the TI-81. Reading, MA: Addison-Wesley, 1993. | |  | Fisher, L. and W. Medigovich. Problem of the Week. Palo Alto: Dale Seymor Publications, PO Box 10888, Palo Alto, CA 94303, 1981. | |  | Greenes, C., J. Gregory, and D. Seymor. Successful Problem Solving Techniques. Palo Alto: Creative Publications, Inc. 1977. | |  | \_\_\_\_\_\_\_\_\_\_ and Others. The Mathworks: A Handbook of Activities for Helping Students Learn Mathematics. Palo Alto: Creative Publications, Inc. 1982. | |  | Halmos, P. Naive Set Theory, from the University Series in Undergraduate Mathematics, New York: D. Van Nostrand Company, Inc. 1960. | |  | Harvey, L. and A. Roper. The Pattern Factory-Elementary Problem Solving Through Patterning. Palo Alto: Creative Publications, Inc. 1978. | |  | Hayes J. The Complete Problem Solver. Hillsdale, NJ: Lawrence Erlbaum Associates Publishers, 1987. | |  | Hersh, R. What is Mathematics, Really? NY: Oxford University Press, 1997. | |  | Johnson, D. B. and T. A. Mowry. Mathematics: A Practical Odyssey. New York: PWS Publishing Company, 1995. | |  | Judd, W. Patterns to Play on a Hundred Charts. Palo Alto, CA: Creative Publications, 1975. | |  | Kordensky, B. The Moscow Puzzles. New York, Scribner, 1972. | |  | Krantz, S. G. Techniques of Problem Solving. Washington, D.C.: AMS, 1991. | |  | Krulik, S. and J. Rudnick. Problem Solving: A Handbook for Teachers. Palo Alto: Creative Publications, Inc. 1980. | |  | \_\_\_\_\_\_\_\_\_\_. A Sourcebook for Teaching Problem Solving. Newton, MA: Allyn and Bacon, 1984. | |  | \_\_\_\_\_\_\_\_\_\_. and R. E. Reys. Problem Solving in School Mathematics. National Council of Teachers of Mathematics, 1906 Association Drive, Reston, Virginia 22091. 1980 Yearbook. | |  | Krutetskii, V. A. The Psychology of Mathematical Abilities in Schoolchildren. Chicago: University of Chicago Press, 1976. | |  | Landwehr, J. M. and A. E. Watkins. Exploring Data. Palo Alto, CA: Dale Seymour Publications, 1987. | |  | Lochead, J. and J. Clement. Cognitive Process Instruction. Philadelphia: The Franklin Press, 1979. | |  | Newman, C. M., T. E. Obremski, and R. L. Schaeffer. Exploring Probability. Palo Alto, CA: Dale Seymour Publications, 1987. | |  | O'Daffer, P. G. and B. Thomquist. Critical Thinking, Mathematical Reasoning, and Proof. in Research Ideas for the Classroom: High School Mathematics, Patricia S. Wilson (ed.) NY: Macmillan/NCTM, 1993. | |  | Piaget, J. The Psychology of Intelligence. Totowa: Littlefield, Adams, 1981 | |  | Philips, E., G. Lappan, M. J. Winter, and W. Fitzgerald. Probability. from the Middle Grades Mathematics Project. Reading, MA: Addison-Wesley Company, 1986. | |  | Polya, G. How To Solve It, Princeton, NJ: Princeton University Press, 1945. | |  | Roberts, A. W. and D. E. Varberg. Faces of Mathematics. NY: Harper & Row, 1978. | |  | Sacco, W., W. Copes, C. Sloyer, and R. Stark Dynamic Programming: An Elegant Problem Solver. Providence, Janson Publications, 1987. | |  | \_\_\_\_\_\_. Graph Theory: Euler's Rich Legacy. Providence, Janson Publications, 1987. | |  | \_\_\_\_\_\_. Glyphs: Getting the Picture. Providence, Janson Publications, 1987. | |  | \_\_\_\_\_\_. Mathematics and Medicine: How Serious is the Injury? Providence, Janson Publications, 1987. | |  | \_\_\_\_\_\_. Queues: Will This Wait Never End? Providence, Janson Publications, 1987. | |  | Schoenfield, A. H. Mathematical Problem Solving. New York: Academic Press, 1985. | |  | \_\_\_\_\_\_. Problem Solving in the Mathematics Curriculum: A Report, Recommendations, and an Annotated Bibliography. MAA Notes, Number 1, 1983. | |  | Seymor, D. and M. Shedd. Finite Differences - A Problem Solving Technique. Palo Alto: Creative Publications, Inc. 1973. | |  | Smith, D. B. and W. Topp. An Activity Approach to Elementary Concepts of Mathematics. Reading, MA: Addison-Wesley Publishing Company, 1981. | |  | Tufte, E. Envisioning Information. Cheshire, CT; Graphics Press,1990. | |  | \_\_\_\_\_\_\_\_\_. The Visual Display of Quantitative Information. Chesshire, CT; Graphics Press,1983. | |  | \_\_\_\_\_\_\_\_\_. Visual Explanations. Cheshire, CT; Graphics Press,1997. | |  | Whimby, A. Analyzed Reading and Reasoning. Stamford, Connecticut: Innovative Sciences, 1983. | |  | \_\_\_\_\_\_ and J. Lockhead. Beyond Problem Solving and Comprehension. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers, 1984. | |  | \_\_\_\_\_\_ and L. Whimby. Intelligence Can Be Taught. New York: E. P. Hutton, 1975 | |  | Yackel, E. "Children's Talk in Inquiry Mathematics Classrooms." in The Emergence of Mathematical Meaning: Interaction in Classroom Cultures, P. Cobb & H. Bauresfeld (Eds.), pp. 131-162. Hillsdale, NJ: Lawrence Erlbaum,1995. |   **Journals**   |  |  | | --- | --- | |  | Journal of Computers in Mathematics and Science Teaching AACE PO Box 2966 Charlottesville, VA 22902 website: <http://www.aace.org/> | |  | NCTM Journals NCTM Headquarters 1906 Association Drive Reston, VA 20191-9988 website: <http://www.nctm.org/>  Journal for Research in Mathematics Education (JRME) <http://www.nctm.org/jrme/jrme.html> | |  | Mathematics Teaching in the Middle School (MTMS) <http://www.nctm.org/mtms/mtms.htm> | |  | Mathematics Teacher (MT) <http://www.nctm.org/mt/mt.htm> | |  | Teaching Children Mathematics (TCM) <http://www.nctm.org/tcm/tcm.htm> | |
| 11. | **Preparer’s Name and Date**: D. Kalish, Spring 1999 |
| 12. | **Original Department Approval Date:** |
| 13. | **Reviser’s Name and Date**: Dr. Beva Eastman, Spring 2001 |
| 14. | **Departmental Revision Approval Date**: Spring 2001 |
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