

LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action Date:
		09-24e	AP-10/20/09	App-12/1/09

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person John D. Baker	Email Address jdbaker@iup.edu
Proposing Department/Unit Mathematics	Phone 724-357-3795

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply) ☐ New Course ☐ Course Prefix Change ☐ Course Deletion ☒ Course Revision ☒ Course Number and/or Title Change ☒ Catalog Description Change	
MATH 420 Patterns and Functions for Elementary and Middle School Teachers	MATH 420 Patterns and Functions for Elementary/Middle Level Teachers
<u>Current</u> Course prefix, number and full title	<u>Proposed</u> course prefix, number and full title, if changing
2. Additional Course Designations: check if appropriate ☐ This course is also proposed as a Liberal Studies Course. ☐ Other: (e.g., Women's Studies, Pan-African) ☐ This course is also proposed as an Honors College Course.	
3. Program Proposals ☐ New Degree Program ☐ Program Title Change ☐ Program Revision ☐ New Minor Program ☐ New Track ☐ Other	
<u>Current</u> program name	<u>Proposed</u> program name, if changing
4. Approvals	
Department Curriculum Committee Chair(s)	Date 3-9-09
Department Chair(s)	3-9-09
College Curriculum Committee Chair	03/16/09
College Dean	3-16-09
Director of Liberal Studies *	
Director of Honors College *	
Provost *	
Additional signatures as appropriate: (include title)	07-26-09
UWUCC Co-Chairs	7-23-09
	10-23-09

* where applicable

Received

Received

SEP 01 2009

1. New Syllabus of Record, etc.

I. Catalog Description

MATH 420 Patterns and Functions for Elementary/Middle Level Teachers (3c-0l-3cr)

Prerequisite: MATH 152

Examines and develops expertise with sequences, patterns, and functions, including linear, quadratic, logarithmic, exponential, and trigonometric functions. Appropriate technology is incorporated throughout the course. Explores curricular materials, resources, and activities relevant to teaching diverse groups at the Elementary/Middle Level.

II. COURSE OUTCOMES

Students will:

1. conduct an exploration of a variety of patterns, and describe, analyze, and define those patterns. *PDE Guidelines II.B.2.f, II.B.6.c*
2. analyze a variety of sequences, including arithmetic, geometric, and recursive sequences, and develop expertise in defining sequences explicitly and recursively. *PDE Guidelines II.B.5.c, II.B.6.c*
3. demonstrate a deep understanding of concepts related to function including composition of functions, inverse functions, and transformations on functions. *PDE Guidelines II.B.2.g, II.B.5.a*
4. demonstrate a deep understanding how quadratic, polynomial, exponential, logarithmic, trigonometric and other functions can be represented and modeled by equations, graphs, tables and matrices. *PDE Guidelines II.B.2.i, II.B.5a, II.B.5.b, II.B.6.e*
5. make connections between real world situations and how those situations can be modeled and explained through the use of patterns and functions. *PDE Guidelines II.B.2.h, II.B.6.a, II.B.6.b, II.B.6.d, II.B.6.e*
6. explore and demonstrate an understanding of the conic sections and how they can be represented. *PDE Guidelines II.B.6.e*
7. examine mathematical proof as it pertains to patterns and functions. *PDE Guidelines II.B.6.c*
8. demonstrate appropriate uses of technology, including graphing calculators, when working with patterns and functions. *PDE Guidelines II.B.6.f*

Course Outcomes	College Conceptual Framework / Danielson	INTASC Standard/ Principle	NCATE / NCTM Middle Level Mathematics Standards	Course Assessment Measuring Outcome
1	1a	1	1, 2, 3, 4, 5, 10	In-Class Activities/Homework, Projects, Quizzes, and Midterm & Final Exam
2	1a	1	1, 2, 3, 4, 5, 10, 12	In-Class Activities/Homework, Projects, Quizzes, and Midterm & Final Exam
3	1a	1	1, 2, 3, 4, 5, 10	Key Assessment: Final Exam
4	1a	1	1, 2, 3, 4, 5, 10	In-Class Activities/Homework, Projects, Quizzes, and Midterm & Final Exam
5	1a	1	1, 2, 3, 4, 5, 10	In-Class Activities/Homework, Projects, Quizzes, and Midterm & Final Exam
6	1a	1	1, 2, 3, 4, 5, 10	In-Class Activities/Homework, Projects, Quizzes, and Midterm & Final Exam
7	1a	1	1, 2, 3, 4, 5, 10	In-Class Activities/Homework, Projects, Quizzes, and Midterm & Final Exam
8	1a, 1d	1	6	In-Class Activities/Homework, Projects, Quizzes, and Midterm & Final Exam

III. Detailed Course Outline

- A. Exploring and analyzing patterns (*Outcomes 1, 5, and 7*) 6 academic hours
 - 1. numerical patterns
 - 2. geometric patterns
 - 3. generalizing to the n th pattern
 - 4. applications of patterns to the real world
- B. Exploring and analyzing sequences (*Outcomes 2, 5, and 7*) 6 academic hours
 - 1. arithmetic sequences
 - 2. geometric sequences
 - 3. recursively defined sequences
 - 4. generalizing to the n th term in a sequence
 - 5. infinite sequences and their sums
 - 6. deductive proof and proof by induction
 - 7. applications of sequences to the real world

- C. Concepts related to functions (*Outcomes 3 and 8*) 8 academic hours
1. understanding the definition of function
 2. domain and range
 3. one-to-one and inverse functions
 4. composition of functions
 5. transformations to a function
 6. use of technology to analyze function concepts
 7. applications of matrices
- D. Exploring and analyzing properties of classes of functions (*Outcomes 4, 5, and 8*) 10 academic hours
1. quadratic and other polynomial functions
 - a. different forms of quadratic equations
 - b. solving quadratic equations and inequalities
 - c. determining maximum and minimum values for polynomial functions
 2. exponential and logarithm functions
 3. trigonometric functions
 4. absolute value, greatest integer, and step functions
 5. piecewise functions
 6. applications of functions to the real world
 7. use of technology to analyze properties of functions
- E. The Conic Sections (*Outcomes 5, and 6*) 9 academic hours
1. defining the conic sections using models
 2. defining the conic sections algebraically
 3. defining the conic sections using analytic geometry

This syllabus covers 39 academic hours, leaving 3 academic hours for testing and/or review. The final is an additional 2 academic hours.

IV. Evaluation Methods

- 20% In-Class Activities/Homework.
- 20% Projects/Presentations.
- 20% Quizzes.
- 40% Midterm and Final Exam. Exams provide a summative assessment of content topics covered. The final is the key assessment, comprising 20% of the course grade, and shall be required of all instructors of MATH 420. The midterm comprises 20% of the grade.

V. Grading Scale

- A: 90% - 100%
- B: 80% - 89%
- C: 70% - 79%
- D: 60% - 69%

F: 0% - 59%

VI. Undergraduate Course Attendance Policy

The course attendance policy is consistent with the University policy.

VII. Required Textbook

None.

VIII. Special Resource Requirements

An up to date graphing calculator.

IX. Bibliography

Bellman, A. (2009). *Exploring Mathematics with the Transformation Graphing Application*. Texas Instruments.

Bittinger, M., Beecher, J., Ellenbogen, J., and Penna, J. (2009) *Algebra and Trigonometry: Graphs & Models and Graphing Calculator Manual Package*. Upper Saddle River, NJ: Pearson Education.

Brueningsen, C., Bower, B., Antinone, L., and Kerner, E. (2009). *Real World Math Made Easy*. Texas Instruments.

Dossey, J., McCrone, S., Giordano, F., and Weir, M. (2002). *Mathematical Methods and Modeling for Today's Mathematics Classroom*. Pacific Grove, CA: Wadsworth Group.

Foerster, P. (2009). *Precalculus with Trigonometry: Concepts and Applications*. Emeryville, CA: Key Curriculum Press.

Murdock, J., Kamischke, E., and Kamischki, E. (2009). *Discovering Advanced Algebra: An Investigative Approach, 2nd edition*. Emeryville, CA: Key Curriculum Press.

National Council of Teachers of Mathematics (2009). *Navigating through Reasoning and Proof in Grades 9 - 12*. Reston, VA: NCTM.

National Council of Teachers of Mathematics (1992). *Patterns: Curriculum and Evaluation Standards for School Mathematics Addenda Series, Grades K-6*. Reston, VA: NCTM.

- National Council of Teachers of Mathematics (1991). *Patterns and Functions: Curriculum and Evaluation Standards for School Mathematics Addenda Series, Grades 5-8*. Reston, VA: NCTM.
- National Council of Teachers of Mathematics (2001). *Navigating through Algebra in Grades 6-8*. Reston, VA: NCTM.
- National Council of Teachers of Mathematics (2001). *Navigating through Algebra in Grades 9-12*. Reston, VA: NCTM.
- National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.
- Nelsen, R. B. (2000). *Proofs Without Words II*. Washington, DC: Mathematical Association of America.
- Nelsen, R. B. (1993). *Proofs Without Words*. Washington, DC: Mathematical Association of America.
- Neuwirth, E. and Arganbright, D. (2004). *The Active Modeler: Mathematical Modeling with Microsoft Excel*. Pacific Grove, CA: The Wadsworth Group.
- Papick, I. (2007). *Algebra Connections*. Upper Saddle River, NJ: Pearson Education.
- Sandefur, J. (2004). *Elementary Mathematical Modeling*. Pacific Grove, CA: The Wadsworth Group.

2. Summary of the Revision

We propose to change the name and prerequisite for the course, and establish a current syllabus of record. The last syllabus we have on file is from 1992.

Current – MATH 420 Patterns and Functions for Elementary and Middle School Teachers
3c-0l-3cr

Prerequisites: MATH 152, Elementary Education concentrate.

Students examine the function concept as applied to elementary real number functions and graphing techniques for these functions. A subset of these functions is included: absolute value, step, linear, quadratic, polynomial, trigonometric, exponential and logarithmic, sequence, and inverse. Students are exposed to these varied functions by means of families of functions and transformations. Students examine curricular materials that develop function concepts in Grades pre-K-8.

Proposed – MATH 420 Patterns and Functions for Elementary/Middle Level Teachers
3c-0l-3cr

Prerequisites: MATH 152

Students examine and develop expertise with sequences, patterns, and functions, including linear, quadratic, logarithmic, exponential, and trigonometric functions. Appropriate technology is incorporated throughout the course. Students explore and discuss curricular materials, resources, and activities relevant to teaching diverse groups of elementary and middle school students.

3. Rationale for the Revision

Overview

The state of Pennsylvania has mandated changes to teacher training programs to support its new teacher licensing scheme. The current program for elementary grades K-6 is being replaced by new requirements for two training programs in: (1) Grades pre-K to 4 and (2) Grades 4-8.

These mandates from the state require revisions to existing courses and the addition of new courses. For Grades pre-K to 4, the new IUP teacher training program includes two courses in methods of teaching. The two new methods courses are revisions of existing methods courses for early childhood and elementary education.

For Grades 4 to 8, the new IUP teacher training program must provide coursework for prospective teachers to teach all subjects, but with a specialty in one subject area. The

new program has four subject area tracks with mathematics being one track. The Mathematics Department, which supports the current K-6 program through a math concentrate for elementary education majors, will have a greater role in the math-track program.

The new math-track program will consist of nine mathematics content and one methods of teaching courses. The existing math concentrate courses (of which MATH 420 is one) need approval for revisions to fit the requirements of the new math-track program. Three new courses also need approval. The three other tracks will include three math content courses and one methods of teaching course drawn from the Mathematics Department's math-track courses.

1. Catalog Name Change

Rationale: This change makes the name of the course consistent with the course name designations in new state guidelines.

2. Prerequisite Change

Rationale: The reference to a concentrate was eliminated. Under the new state mandates for teacher preparation programs, the concentrate for elementary education majors will no longer exist.

3. Catalog Description Change

Rationale: The change makes the catalog description consistent with current course content and consistent with the content prescribed in new state guidelines.

4. Course Revision - Syllabus of Record

Rationale: The last syllabus in our files is from 1992 and this revision is consistent with the content prescribed in the new state guidelines.

4. Old Syllabus of Record

Next page

Mathematics Department
Indiana University of Pennsylvania
Indiana, PA 15705

Course Number: MA 420 or EM 520

Course Title: Pre-Calculus Mathematics I

Credits: 3 semester hours

Prerequisites: MA 152; Elementary Mathematics concentration

Textbook:

Revised: 9/92

Catalog Description:

Examines the function concept as applied to elementary real number functions and graphing techniques for these functions. Topics include real number functions such as absolute value, step, linear, quadratic, and other polynomial functions, trigonometric and other periodic functions, exponential logarithmic functions, and all other inverse functions. Students will examine curricular materials that develop function concepts in Grades K-8.

Course Objectives, General:

- A. To use arithmetic, algebra, geometry, trigonometry, probability and statistics in studying patterns and functions.
- B. To trace and explore the development of patterns and functions in K-8 mathematics curricula material.
- C. To develop a portfolio of interesting pattern and function problems.

Course objectives, Specific:

- A. To recognize and extend patterns.
- B. To analyze and describe patterns.
- C. To create patterns.
- D. To describe and represent relationships with tables, graphs, and rules.
- E. To explore the use of variables and open sentences to express relationships and functions.
- F. To analyze functional relationships and to explain how a change in one quantity results in a change in another.
- G. To connect conceptual and procedural knowledge.
- H. To utilize concrete, pictorial, and symbolic representations of patterns and functions.
- I. To engage in cooperative learning.
- J. To make appropriate use of calculators.
- K. To examine various methods of evaluation.
- L. To use good questioning techniques.
- M. To use patterns and functions to represent and solve problems.