Illinois State University
Department of Mathematics
B.A./B.S. Assessment Plan

Common Undergraduate Program Goals (Shared by all undergraduate sequences: Actuarial Science, Mathematics, Mathematics Education, and Statistics.)

Program Goal 1: Acquire knowledge of mathematics commensurate with career/sequence goals.

- Outcome Measure: Demonstrate an understanding of the key concepts in:
    - Mathematics (MAT)
    - Actuarial Science (AS)
    - Statistics (MST)
    - Secondary Mathematics Education (MTE)
  - Data Needed: Measures of mathematical knowledge.
  - Assessment:
    - Overall major GPA (Every semester)
      - Standardized Exams: MAT/MST – GRE; AS – Actuarial Exams; MTE – State Content & APT Exams. (When taken or at graduation)
    - Benchmark Course Grades (Every Year):
      - MAT – MAT 175, 236, 247, 336, 337, 347
      - AS – MAT 280, 380, 384
      - MST – MAT 350, 351, Upper division course pair
      - MTE – MAT 211, 236, 350, 323, Student Teaching Evaluation
- Outcome Measure: Currency of program.
  - Data Needed: Program Review
  - Assessment:
    - Periodic review of programs using national recommendations, accrediting agencies, etc. (Every 5 years or less)
    - Faculty review of courses/content. (Every 3-5 years)
- Outcome Measure: Satisfaction of current students, alumni, employers.
  - Data Needed: Survey results
  - Assessment:
    - End of Semester evaluations. (Every semester)
    - Alumni surveys. (1 and 5 years after graduation)
    - MTE – EBI feedback, Graduate Survey Data. (Yearly)

Program Goal 2: Construct and critically analyze mathematical arguments.

- Outcome Measure: Demonstrate the ability to construct and analyze mathematical arguments (for example, proofs).
    - Data Needed: Samples of graded proofs, in-depth problems, and student work.
    - Assessment:
        - Benchmark Course Grades (Every Year):
            - MAT – MAT 175, 236, 247, 336, 337, 347
            - AS – MAT 280, 380, 384
            - MST – MAT 350, 351, Upper division course pair
            - MTE – MAT 211, 236, 350, 323, Student Teaching Evaluation
        - Instructor evaluation of student ability to construct and analyze mathematical arguments using department rubric given in Appendix II in MAT 175, 236, 350 (every semester).
        - Department Curriculum Committee evaluation of student ability to construct and analyze mathematical arguments on MAT 175 final exams using department rubric given in Appendix II. (Every semester)
        - Department Curriculum Committee evaluation of student ability to construct and analyze mathematical arguments on Senior Portfolios using department rubric. (Yearly) Senior Portfolio Instructions are given in Appendix III and the department portfolio rubric is given in Appendix IV.

Program Goal 3: Develop problem-solving skills, logical reasoning, and creative thinking.

- Outcome Measure: Demonstrate the ability to solve problems, and apply mathematical knowledge to new problem situations.
    - Data Needed: Samples of graded projects and student work.
    - Assessment:
        - Department Curriculum Committee evaluation of sample projects requiring synthesis of mathematics and applications to problems (not exercises) using Department rubric given in Appendix II. (Yearly)
        - Instructor evaluation of student skills using department rubric given in Appendix II in MAT 175, 236, 350. (Every semester)
        - Department Curriculum Committee evaluation of student skills on MAT 175 final exams using department rubric given in Appendix II. (Every semester)
        - Department Curriculum Committee evaluation of student skills on Senior Portfolios using department rubric. (Yearly) Senior Portfolio Instructions are given in Appendix III and the department portfolio rubric is given in Appendix IV.

Program Goal 4: Develop a positive attitude toward mathematics and its uses.

- Outcome Measure: Demonstrate an appreciation of mathematics as a vital, growing field.
    - Data Needed: Attitude information
    - Assessment:
        - Online Beliefs/Attitude Survey (Graduation), see Appendix I.

Program Goal 5: Use the language of mathematics to communicate ideas.

- Outcome Measure: Be able to use mathematical terms appropriately and correctly.
    - Data Needed: Assignments that demonstrate correct oral and/or written use of mathematical language.
    - Assessment:
        - Department Curriculum Committee evaluation of student use of mathematical terms in sample projects requiring synthesis of mathematics and applications to problems (not exercises) using department rubric given in Appendix II. (Yearly)
        - Instructor evaluation of student use of mathematical terms with department rubric given in Appendix II in MAT 175, 236, 350. (Every semester)
        - Department Curriculum Committee evaluation of student use of mathematical terms on MAT 175 final exams using department rubric given in Appendix II. (Every semester)
        - Department Curriculum Committee evaluation of student use of mathematical terms on Senior Portfolios using department rubric. (Yearly) Senior Portfolio Instructions are given in Appendix III and the department portfolio rubric is given in Appendix IV.
- Outcome Measure: Demonstrate the ability to communicate mathematics
    - Data Needed: Examples of written work
    - Assessment:
        - Department Curriculum Committee evaluation student ability to communicate mathematics in sample projects requiring synthesis of mathematics and applications to problems (not exercises) using department rubric given in Appendix II. (Yearly)
        - Instructor evaluation of student ability to communicate mathematics using department rubric given in Appendix II in MAT 175, 236, 350. (Every semester)
        - Department Curriculum Committee evaluation of student ability to communicate mathematics on MAT 175 final exams using department rubric given in Appendix II. (Every semester)
        - Department Curriculum Committee evaluation of student ability to communicate mathematics on Senior Portfolios using department rubric. (Yearly) Senior Portfolio Instructions are given in Appendix III and the department portfolio rubric is given in Appendix IV.

Implementing and Using Assessment Data

All assessment data are collected by the Undergraduate program director and analyzed to identify program strengths and areas for improvement. Data/findings are presented for review and discussion to the members of the Department Curriculum Committee, a committee made of up members from Actuarial Science, Mathematics, Mathematics Education, and Statistics. Issues related to the B.A./B.S. program or points of discussion arising in the Curriculum meetings are brought to the entire faculty at Department meetings.

Appendix I. Bachelor's Beliefs Survey

The Mathematics Department is collecting the results of this survey to help assess our undergraduate mathematics programs. This survey is a REQUIRED part of the graduation portfolio for those completing an undergraduate major in the Mathematics Department. Individual respondents of this survey will not be assessed, but rather the aggregate responses will be used. For the following items, express to the extent of your agreement with each of the following statements by marking the appropriate response.

1. Solving mathematics problems does not require much originality and creativity.

   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

2. New theorems in mathematics are constantly being found.

   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

3. Taking courses in mathematics helps one to think according to rules.

   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

4. Justifying the mathematical statements a person makes is an extremely important part of mathematics.

   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

5. Although there are some connections between different areas, mathematics is mostly made up of unrelated topics.

   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

6. Mathematics is mostly a set of rules of how to do problems.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

7. Although there may be many different ways to solve a mathematics problem, there is usually a best way to solve it.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

8. In mathematics, problems can be solved without using rules.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

9. Every college student should study some mathematics.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

10. There have not been many new concepts and ideas in mathematics in a long time.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

14. I look forward to trying difficult mathematics problems.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

11. The main objective in taking mathematics courses is to learn how to think logically.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

12. I am successful in doing most mathematics problems.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

13. I enjoy doing problems in mathematics.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

15. I feel good when I solve a mathematics problem myself.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

16. Knowing how to solve a problem is as important as getting the solution.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

17. It is important to know mathematics in order to get a good job.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

18. Learning mathematics involves mostly memorizing.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

19. I am looking forward to taking more mathematics.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

20. Mathematics has played an important part in the development of the civilized world.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

21. Using computers and calculators has helped me understand mathematics better.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

22. Using computers and calculators can make mathematics more interesting.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

23. I like to help others with mathematics problems.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

24. Memorizing rules and formulas is an important part of learning mathematics.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

25. Learning to do problem solving is an important goal in mathematics instruction.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

26. Computers and calculators are useful for learning mathematics.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

27. Listening carefully to the teacher explain a mathematics lesson is the most effective way to learn mathematics.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

28. Doing investigations in mathematics is an important way to learn mathematics.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

29. I continue trying new strategies when I encounter a problem that I cannot solve the first or second try.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

30. Mathematics plays an important role in today's society.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

Appendix II: Department of Mathematics B.A./B.S. Instructor/Final Exam/Project Assessment Rubric

Primary Traits	**Not Present**	**Emerging**	**Developed**	**Established**	**Goal**
Demonstrates an understanding of the key concepts in the course.		Describes/defines the key concepts in the course.	Explains the key concepts as described or defined in the course.	Applies the key concepts in the course as described or defined correctly.	1
Demonstrates the ability to construct and analyze mathematical arguments (for example, a proof).		Shows evidence of a critical analysis relevant towards the mathematical argument.	Shows evidence of a more developed critical analysis relevant towards the mathematical argument.	Provides a clear, concise mathematically correct argument.	2
Demonstrates the ability to solve mathematical problems.		Shows evidence of solving the problem, provides a partially correct solution.	Shows evidence of a more developed mathematical solution than just partially solving the problem.	Provides a clear, concise mathematically correct solution utilizing logical reasoning and creative thinking.	3
Applies mathematical knowledge to new problem situations.		Identifies mathematical knowledge relevant towards solving new problem situations.	Explains how the identified mathematical knowledge supports solving the new problem correctly.	Provides a clear, concise mathematically correct argument to solve the new problem.	3
Uses mathematical terms (notation, symbolism) appropriately and correctly.		Identifies the appropriate mathematical terms.	Explains mathematical terms appropriately and correctly.	Applies mathematical terms appropriately and correctly.	5
Demonstrates the ability to communicate mathematics.		Describes relevant mathematical ideas.	Explains relevant mathematical ideas.	Applies relevant mathematical ideas.	5

Appendix III: Senior Portfolio Instructions

A. Actuarial Science, Mathematics, and Statistics Senior Portfolio Instructions

Prior to graduation, all mathematics students must complete a senior portfolio, including the following cover sheet. This portfolio consists of three parts and must be signed by the student's academic advisor.

Part I: A collection of four to six mathematics artifacts.

Actuarial Science Sequence: At least four items from the following list:

1. Graded statistical project from an actuarial or statistics course, such as MAT 353, MAT 380, MAT 383, or MAT 384.
2. Internship report submitted for MAT 298.
3. Substantial proof or mathematical argument in a class taken in the major, most likely MAT 175.
4. Graded test from an advanced actuarial class, e.g., MAT 380, MAT 383, or MAT 384.
5. Proof of having passed two or more professional actuarial examinations.
6. File from a presentation made by a student in Actuarial Research Seminar.

Mathematics and Statistics Sequences: A collection of four to six mathematics artifacts. These problems with solutions can not all come from one course and are to demonstrate your ability to use the language of mathematics to communicate ideas, show how you are able construct and critically analyze mathematical arguments, and demonstrate your ability to develop your problem solving skills, logical reasoning, and creative thinking over a sequence of courses.

Suggested problems to include would be any project or extended problem given in courses numbered 175 or higher. You are encouraged to select problems from a series of related courses. For example, you might choose to include sample problems/solutions from a sequence of courses taken over the same mathematics subtopic, as given below.

Algebra: MAT 175, MAT 236, MAT 330, MAT 336, MAT 337

Analysis: MAT 247, MAT 340, MAT 341, MAT 345, MAT 347

Discrete Mathematics: MAT 260, MAT 361, MAT 362, MAT 363

Statistics: MAT 350, MAT 351, MAT 356, MAT 378

Research: MAT 175, MAT 260, MAT 268

Note that it is not necessary to include problems from every course listed in a subtopic above, only a subset of courses from a subtopic or subtopics. You are encouraged to submit several problems with solutions from two or more subtopics.

For each artifact, include a brief description of why this particular artifact was chosen and how it meets the criteria stated above. For example, how does this artifact demonstrate using the language of mathematics to communicate ideas? How does this artifact demonstrate your ability to critically analyze

mathematical arguments? How does this artifact show how you have developed your problem solving skills and/or creative thinking? It is not necessary that every artifact meet all the criteria suggested above, but each artifact should demonstrate at least one of these features. In addition, each of the criteria mentioned above should be addressed by at least one artifact.

Part II: Complete the Attitude Assessment Survey during your last semester. You will be sent a link to survey during your last semester.

Part III: Submit your scores on external professional examinations, if applicable to your sequence (see the following cover sheet).

SENIOR PORTFOLIO COVER SHEET

Name _____ Advisor_____

UID _____ Graduation Term_____ Catalog _____

Major (s) _____ Graduation GPAs: Major _____

Minor (s) _____ Overall _____

Math Courses Completed: 200-level _____

(circle transfer courses) 300-level_____

Part I: Problems, with solutions, from the following courses:

Artifact #	Title	Course	Grade	Brief description of artifact.
1.				
2.				
3.				
4.				
5.				
6.				

Part II: Attitude Assessment Survey

Date Survey Completed Online: _____

Part III: Professional Examinations Scores (enter NA if not applicable)

Illinois Certification Testing Exam in Math: Score _____

Actuarial Course Exams:

SOA P/ CAS 1 Score _____

SOA FM/CAS 2 Score _____

SOA MFE Score _____

SOA MLC Score _____

GRE:

Verbal Reasoning Score _____

Quantitative Reasoning Score _____

Analytical Writing Score _____

GRE Mathematics Subject Test: Score _____

Comparable Professional Exam: _____ Score _____

Portfolio Evaluation Date _____

Advisor Signature _____

B. Mathematics Education Senior Portfolio Guidelines

Prior to graduation, all mathematics education teacher candidates must complete a portfolio in LiveText. This constitutes the content portion of that portfolio and is collection of artifacts which must include examples of graded work from at least **four different mathematics content courses** as specified below.

1. **Problem Solving:** Two or more graded work samples to illustrate that the teacher candidate can:
   - 1.1 Apply and adapt a variety of appropriate strategies to solve problems.
   - 1.2 Solve problems that arise in mathematics and those involving mathematics in other contexts.
   - 1.3 Build new mathematical knowledge through problem solving.
   - 1.4 Monitor and reflect on the process of mathematical problem solving.

2. **Reasoning and Proof:** Two or more graded work samples to illustrate that the teacher candidate can:
   - 2.1 Recognize reasoning and proof as fundamental aspects of mathematics.
   - 2.2 Make and investigate mathematical conjectures.
   - 2.3 Develop and evaluate mathematical arguments and proofs.
   - 2.4 Select and use various types of reasoning and methods of proof.

3. **Mathematical Communication:** One or more graded work samples to illustrate that the teacher candidate can:
   - 3.1 Communicate their mathematical thinking coherently and clearly to peers, faculty, and others.
   - 3.2 Use the language of mathematics to express ideas precisely.
   - 3.3 Organize mathematical thinking through communication.
   - 3.4 Analyze and evaluate the mathematical thinking and strategies of others.

4. **Mathematical Connections:** One or more graded work samples to illustrate that the teacher candidate can:
   - 4.1 Recognize and use connections among mathematical ideas.
   - 4.2 Recognize and apply mathematics in contexts outside of mathematics.
   - 4.3 Demonstrate how mathematical ideas interconnect and build on one another to produce a coherent whole.

5. **Mathematical Representations:** One or more graded work samples to illustrate that the teacher candidate can:
   - 5.1 Use representations to model and interpret physical, social, and mathematical phenomena.
   - 5.2 Create and use representations to organize, record, and communicate mathematical ideas.
   - 5.3 Select, apply, and translate among mathematical representations to solve problems.

Process Standard Expectations and Performance Levels

	Exceeds Expectations (2 pts)	Meets Expectations (1 pt)	Needs Improvement
Knowledge of Problem Solving	Content artifacts illustrate that teacher candidate can apply and adapt a variety of appropriate strategies to solve problems. Artifacts indicate that teacher candidate can build mathematical knowledge through problem solving. Artifacts indicate that teacher candidates can reflect on the process of mathematical problem solving. (NCTM indicators 1.1, 1.3, 1.4)	Content artifacts illustrate that teacher candidate can apply and adapt a variety of appropriate strategies to solve problems. Artifacts indicate that teacher candidates can reflect on the process of mathematical problem solving. (NCTM indicators 1.1, 1.4)	Content artifacts illustrate that teacher candidate can apply appropriate strategies to solve routine problems. Artifacts indicate that teacher candidates can discuss the process of mathematical problem solving. (NCTM indicators 1.1, 1.4)
Knowledge of Reasoning and Proof	Content artifacts illustrate that teacher candidate recognizes reasoning and proof as fundamental aspects of mathematics. Artifacts indicate that teacher candidate can make and investigate mathematical conjectures. Artifacts indicate that teacher candidate can develop and evaluate mathematical arguments and proofs. Artifacts indicate that teacher candidate can select and use various types of reasoning and methods of proof (NCTM indicators 2.1, 2.2, 2.3, 2.4)	Content artifacts illustrate that teacher candidate recognizes reasoning and proof as fundamental aspects of mathematics. Artifacts indicate that teacher candidate can develop and evaluate mathematical arguments and proofs. Artifacts indicate that teacher candidate can select and use various types of reasoning and methods of proof (NCTM indicators 2.1, 2.3, 2.4)	Content artifacts indicate that can develop mathematical arguments and proofs. Artifacts indicate that teacher candidate can use various types of reasoning and methods of proof (NCTM indicators 2.3, 2.4)
Knowledge of Mathematical Communication	Content artifacts illustrate that teacher candidate communicates his or her mathematical thinking clearly to others. Artifacts indicate that teacher candidate can use the language of mathematics to express ideas precisely. Artifacts indicate that teacher candidate can organize mathematical thinking through communication. (NCTM indicators 3.1, 3.2, 3.3)	Content artifacts illustrate that teacher candidate communicates his or her mathematical thinking clearly to others. Artifacts indicate that teacher candidate can use the language of mathematics to express ideas precisely. (NCTM indicators 3.1, 3.2)	Content artifacts illustrate that teacher candidate can use the language of mathematics in some appropriate ways. (NCTM indicators 3.2)
Knowledge of Mathematical Connections	Content artifacts illustrate that teacher candidate can recognize and use connections among mathematical ideas. Artifacts indicate that teacher candidate can recognize and solve problems that arise in mathematics and in other contexts. Artifacts indicate that teacher candidate can demonstrate how mathematical ideas interconnect and build on one another to produce a coherent whole. (NCTM indicator 1.2, 4.1, 4.2, 4.3)	Content artifacts indicate that teacher candidate can recognize and solve problems that arise in mathematics and in other contexts. (NCTM indicator 1.2, 4.2)	Content artifacts indicate that teacher candidate can recognize and solve problems that arise in mathematics. (NCTM indicator 1.2)
Knowledge of Mathematical Representations	Content artifacts illustrate that teacher candidate can use representations to model and interpret physical, social, and mathematical phenomenon. Artifacts indicate that teacher candidate can use representations to organize, record, and communicate mathematical ideas. Artifacts indicate that teacher candidate can select, apply, and translate among mathematical ideas to solve problems. (NCTM indicator 5.1, 5.2, 5.3)	Content artifacts illustrate that teacher candidate can use representations to model physical, social, or mathematical phenomenon. Artifacts indicate that teacher candidate can use representations to organize, record, and communicate mathematical ideas. (NCTM indicator 5.1, 5.2)	Content artifacts indicate that teacher candidate can use representations to organize, record, and communicate mathematical ideas. (NCTM indicator 5.2)

Problem Solving

Two or more graded work samples to illustrate that the teacher candidate can:

1.1 Apply and adapt a variety of appropriate strategies to solve problems.
1.2 Solve problems that arise in mathematics and those involving mathematics in other contexts.
1.3 Build new mathematical knowledge through problem solving.
1.4 Monitor and reflect on the process of mathematical problem solving.

Each artifact must be preceded by a brief paragraph in which you describe the nature of the artifact and justify its inclusion. Specifically, the paragraph should include:

- Course from which artifact was selected;
- Type of artifact (e.g., quiz item, test item, project, paper, homework assignment);
- Mathematical content knowledge demonstrated (e.g., understanding of integration, understanding of linear independence, understanding of the pigeon hole principle); and
- Mathematical process knowledge explanation (i.e., how the artifact illustrates your ability to successfully engage in the mathematical process you are identifying). Please refer to the rubric for information on aspects of each process that you may want to make note of.

This collection of artifacts and the justifications should be assembled throughout the program and finalized for instructor review during fall semester in MAT 323.

Suggested courses: Introduction to Secondary Mathematics Education (MAT 223), Discrete Mathematics (MAT 260), Technology Tools (MAT 326), Capstone Course (MAT 389.65/328), or electives including Undergraduate Research (MAT 268) or Number Theory (MAT 330)

Reasoning and Proof

Two or more graded work samples to illustrate that the teacher candidate can:

2.1 Recognize reasoning and proof as fundamental aspects of mathematics.
2.2 Make and investigate mathematical conjectures.
2.3 Develop and evaluate mathematical arguments and proofs.
2.4 Select and use various types of reasoning and methods of proof.

Each artifact must be preceded by a brief paragraph in which you describe the nature of the artifact and justify its inclusion. Specifically, the paragraph should include:

- Course from which artifact was selected;
- Type of artifact (e.g., quiz item, test item, project, paper, homework assignment);
- Mathematical content knowledge demonstrated (e.g., understanding of integration, understanding of linear independence, understanding of the pigeon hole principle); and
- Mathematical process knowledge explanation (i.e., how the artifact illustrates your ability to successfully engage in the mathematical process you are identifying). Please refer to the rubric for information on aspects of each process that you may want to make note of.

This collection of artifacts and the justifications should be assembled throughout the program and finalized for instructor review during fall semester in MAT 323.

Suggested courses: Introduction to Secondary Mathematics Education (MAT 223), Elementary Linear Algebra (MAT 175), Euclidean and Non-Euclidean Geometry (MAT 211), Elementary Abstract Algebra (MAT 236), or electives including Number Theory (MAT 330)

Mathematical Communication

One or more graded work samples to illustrate that the teacher candidate can:

3.1 Communicate their mathematical thinking coherently and clearly to peers, faculty, and others.
3.2 Use the language of mathematics to express ideas precisely.
3.3 Organize mathematical thinking through communication.
3.4 Analyze and evaluate the mathematical thinking and strategies of others.

Each artifact must be preceded by a brief paragraph in which you describe the nature of the artifact and justify its inclusion. Specifically, the paragraph should include:

- Course from which artifact was selected;
- Type of artifact (e.g., quiz item, test item, project, paper, homework assignment);
- Mathematical content knowledge demonstrated (e.g., understanding of integration, understanding of linear independence, understanding of the pigeon hole principle); and
- Mathematical process knowledge explanation (i.e., how the artifact illustrates your ability to successfully engage in the mathematical process you are identifying). Please refer to the rubric for information on aspects of each process that you may want to make note of.

This collection of artifacts and the justifications should be assembled throughout the program and finalized for instructor review during fall semester in MAT 323.

Suggested courses: Probability and Statistics (MAT 250/350/351), Technology Tools (MAT 326), Capstone Course (MAT 389.65/328), or electives including Undergraduate Research (MAT 268)

Mathematical Connections

One or more graded work samples to illustrate that the teacher candidate can:

4.1 Recognize and use connections among mathematical ideas.
4.2 Recognize and apply mathematics in contexts outside of mathematics.
4.3 Demonstrate how mathematical ideas interconnect and build on one another to produce a coherent whole.

Each artifact must be preceded by a brief paragraph in which you describe the nature of the artifact and justify its inclusion. Specifically, the paragraph should include:

- Course from which artifact was selected;
- Type of artifact (e.g., quiz item, test item, project, paper, homework assignment);
- Mathematical content knowledge demonstrated (e.g., understanding of integration, understanding of linear independence, understanding of the pigeon hole principle); and
- Mathematical process knowledge explanation (i.e., how the artifact illustrates your ability to successfully engage in the mathematical process you are identifying). Please refer to the rubric for information on aspects of each process that you may want to make note of.

This collection of artifacts and the justifications should be assembled throughout the program and finalized for instructor review during fall semester in MAT 323.

Suggested courses: Elementary Abstract Algebra (MAT 236), Probability and Statistics (MAT 250/350/351), Capstone Course (MAT 389.65/328), or electives including Undergraduate Research (MAT 268)

Mathematical Representations

One or more graded work samples to illustrate that the teacher candidate can:

5.1 Use representations to model and interpret physical, social, and mathematical phenomena.

5.2 Create and use representations to organize, record, and communicate mathematical ideas.

5.3 Select, apply, and translate among mathematical representations to solve problems.

Each artifact must be preceded by a brief paragraph in which you describe the nature of the artifact and justify its inclusion. Specifically, the paragraph should include:

- Course from which artifact was selected;
- Type of artifact (e.g., quiz item, test item, project, paper, homework assignment);
- Mathematical content knowledge demonstrated (e.g., understanding of integration, understanding of linear independence, understanding of the pigeon hole principle); and
- Mathematical process knowledge explanation (i.e., how the artifact illustrates your ability to successfully engage in the mathematical process you are identifying). Please refer to the rubric for information on aspects of each process that you may want to make note of.

This collection of artifacts and the justifications should be assembled throughout the program and finalized for instructor review during fall semester in MAT 323.

Suggested courses: Calculus I, Calculus II, or Calculus III (MAT 145, 146, or 147), Discrete Mathematics (MAT 260), or Technology Tools (MAT 326), or electives

Appendix IV: Department of Mathematics B.A./B.S. Portfolio Assessment Rubric

Primary Traits	Not Present	Developing	Established	Advanced	Goal
Demonstrates the ability to construct and analyze mathematical arguments (for example, a proof).		Shows evidence of developing mathematical arguments and proofs; gives evidence of using various methods of reasoning and proof.	Shows evidence of fully developed mathematical arguments and proofs; shows evidence of recognizing reasoning and proof as fundamental aspects of mathematics; shows evidence of selecting and using various methods of reasoning and proof.	Shows evidence of fully developed mathematical arguments and proofs that are elegant and creative; shows evidence of recognizing reasoning and proof as fundamental aspects of mathematics; shows evidence of selecting and using various methods of reasoning and proof in creative ways; shows evidence of making and investigating mathematical conjectures.	2
Demonstrates the ability to solve mathematical problems.		Shows evidence of solving routine problems; provides evidence of knowing the process of mathematical problem solving.	Shows evidence of applying a variety of strategies to solve mathematical problems; shows evidence of more developed mathematical problem solving skills.	Shows evidence of applying and adapting a variety of strategies to solve mathematical problems utilizing logical reasoning and creative thinking; artifacts indicate that the student can build mathematical knowledge through problem solving skills.	3
Applies mathematical knowledge to new problem situations.		Shows evidence of recognizing and solving new problem situations.	Shows evidence of recognizing and solving new problems in a variety of contexts.	Shows evidence of recognizing and solving new problems in a variety of contexts; shows evidence of selecting, applying, and translating mathematical ideas to solve new problems.	3
Uses mathematical terms (notation, symbolism) appropriately and correctly.		Shows evidence of using mathematical terms to organize, record, and communicate mathematical ideas.	Shows evidence of using mathematical terms to organize, record, and communicate mathematical ideas; shows evidence of using mathematical terms to model physical, social, or mathematical phenomenon.	Shows evidence of using mathematical terms to organize, record, and communicate mathematical ideas; shows evidence of using mathematical terms to model and interpret physical, social, or mathematical phenomenon;	5
Demonstrates the ability to communicate mathematics.		Shows evidence of using the language of mathematics in some appropriate ways.	Shows evidence of communicating his or her mathematical thinking clearly to others; shows evidence of using the language of mathematics to express ideas precisely.	Shows evidence of communicating his or her mathematical thinking clearly to others; shows evidence of using the language of mathematics to express ideas precisely; shows evidence of organizing mathematical thinking through communication.	5