Senior Portfolio Graduation Requirement

In addition to completing all course and university requirements, candidates for a B.A. or B.S. in Mathematics, Applied Mathematics, and Mathematics with Teacher Licensure must successfully pass at least one of the following two assessments as part of the graduation requirement for candidacy: (1) The **Senior Portfolio** and if necessary (2) the **Exit Interview**. This document gives guidelines and policies related to both items.

As of Fall 2025, the senior portfolio guidelines have changed. Do not refer to past portfolios when writing your portfolio.

Portfolio Due Dates: The deadline for submitting the portfolio depends on the semester in which you intend to graduate:

- The due date is **February 15** for those graduating at the end of the **Spring** semester**.**
- The due date is **October 1** for those graduating at the end of the **Fall or Winter** semesters.
- The due date is **May 1** for those graduating at the end of **either Summer** session**.**

Cover Letter or Graduate School Personal Statement and Resume Due Dates: Every student submitting a portfolio must have their resume and a cover letter or graduate school personal statement evaluated by the SPDC. For more information see Section 4. The deadlines for making an appointment with the SPDC are listed below.

- **January 15** for those graduating at the end of the **Spring** semester**.**
- **September 15** for those graduating at the end of the **Fall or Winter** semesters.
- **April 15** for those graduating at the end of **either Summer** session**.**

How to Submit your Portfolio: You must submit a single PDF file via a link that will be posted on the *Senior Portfolio Graduation Requirement* Canvas site. If you have issues, please contact the Portfolio Coordinator.

Senior Portfolio Guidelines

Purpose:
The senior portfolio is a **combination of narrative and evidence** produced by the candidate that together **argues the candidate's mastery** of the theory and applications of mathematics. The most essential components of the portfolio consist of the candidate presenting arguments to demonstrate their mastery. To support these arguments, the candidate includes suitable **products** from coursework and from a mathematics capstone experience.

Contents

The portfolio will include the sections below. You will find detailed explanations of each section after the outline.

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Sources of Help:

After you have read and absorbed the contents of this Portfolio Guidelines document, you may have further questions. In such cases, you are encouraged to consult one or more resources below:

- **Be on the lookout** for emails in the fall, winter and early spring that provide information on how to get help while working on your portfolio.
- **The Portfolio Coordinator**. This person can answer specific questions related to portfolio policies. If a candidate asks a question already answered in the Portfolio Guidelines, the Coordinator will refer the student to these documents.

Section 1: Cover Page

The cover page must be the first page of the portfolio and include the following information.

- Candidate's name
- Major(s) - specify B.S. or A.B.
- Minors

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Section 2: Signed Honor Code Statement

1. The second page of the portfolio must include the following Honor Code Statement:

Portfolio Honor Code Statement

"On my honor, I certify that this portfolio upholds the four values of Elon University -- honesty, integrity, responsibility, respect -- as cited in Elon's Honor Code

https://www.elon.edu/u/student-conduct/honor-code/

In assembling this portfolio, I have refrained from lying, cheating, plagiarizing, and facilitating others in these actions.

I understand that any violation of the Honor Code may result in receiving a failing grade on my portfolio. Further, I understand that egregious violations of the Honor Code may result in disciplinary suspension or permanent separation from Elon University."

2. The Honor Code Statement **must be signed and dated** by the candidate.

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Section 3: Table of Contents

You must include a table of contents.

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Section 4: Cover Letter, Resume, and List of Courses

*You must have the **Cover Letter or Graduate School Personal Statement** and **Resume** evaluated by a member of the Student Professional Development Office - See below for **Due** **Dates**. **PLAN AHEAD!!!** A confirmation of the **Meeting with SPDC** MUST be included in the Portfolio.*

1. **Cover Letter or Graduate School Personal Statement.** This letter, addressed to a prospective employer or graduate school, must follow professional conventions in both form and content. **This should not be a letter written for an internship.**
2. **Resume.** The resume should be professionally composed, providing the prospective employer/program with all details necessary to be considered a competitive applicant.
3. **Proof of Meeting with SPDC**. You must include verification that you have met with a member of the SPDC. This includes, but is not limited to, an email from the person you met stating you have completed the evaluation of the Cover Letter and Resume.
4. **List of courses.** List all courses that you have taken that count towards your math/applied math major.

The deadlines for making an appointment with the SPDC are listed below.

- **January 15** for those graduating at the end of the **Spring** semester**.**
- **September 15** for those graduating at the end of the **Fall or Winter** semesters.
- **April 15** for those graduating at the end of **either Summer** session**.**

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Stipulations for Choosing a Product in Sections 5 & 6

Use the guidelines below to pick one product that demonstrates your use of Mathematical Argumentation (Section 5) and one product that demonstrates your use of Problem Solving by Transformation (Section 6).

- Each product must be a single mathematical problem, proof, or model that the candidate has created, solved, written, or analyzed on a test, homework assignment, project, or other graded work from the appropriate course. (Each product should be an individual problem and should not be an entire homework set, entire test, etc.)
- Clearly state which course the product comes from.
- Each product must include a statement of the mathematical problem and a correct solution to the problem *worked out by the student.*
- If possible, the candidate should include the original product complete with the instructor's grade and comments. However, if the candidate does not have the original product, then they may replicate the product.
- Your products must come from courses in the list below with at least one product coming from a starred (*) course.
- Your two products must come from different courses.

Course List

- MTH 2310 Linear Algebra
- MTH 2410 Discrete Structures
- MTH 2520 Multivariable Calculus and Analytic Geometry
- MTH 3300 Mathematical Reasoning
- MTH 3350 Modern Geometry
- MTH 3410 Probability Theory and Statistics
- *MTH 3430 Mathematical Modeling
- *MTH 3510 Differential Equations
- MTH 3710 Special Topics
- *MTH 4300 Abstract Algebra
- *MTH 4450 Numerical Analysis
- *MTH 4510 Fourier Analysis and its Applications
- *MTH 4550 Analysis

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Section 5: Mathematical Argument

In this section, you will reflect on a specific instance in which you used **Mathematical Argument.**

Mathematical Argument: We use mathematical argument when we apply logical thinking and precise mathematical language and syntax to develop a mathematical proof or solve a mathematical problem. Thus, a mathematical argument consists of a claim or solution and a sequence of statements that supports the claim or solution.

For the Mathematical Argument Product

1. You must adhere to the stipulations outlined on page 5 when choosing a product.
2. Clearly state what course your product is from.
3. Include the statement of the problem and your solution to the problem. (These items are separate from the explanation below.)
4. Provide a detailed reflection and explanation of your use of **Mathematical Argument** within the product.
    a. Identify examples of where you used logical thinking in your sequence of statements.
    b. Identify examples of where you used precise mathematical language, syntax, or both.
        i. Mathematical language: subject-specific words defined for use in the discipline of mathematics (e.g., differentiate, determinant, equivalence relation).
        ii. Syntax: the set of conventions for organizing symbols, words, and phrases together into structures (e.g., sentences, graphs, tables). That is, the symbols and way you write down your logic on paper in mathematics.

            For example, $A \cup B = \{x | x \in A \text{ or } x \in B\}$ contains examples of syntax.

    c. Discuss ways in which you could improve the mathematical argument in your chosen product.
5. Do NOT explain how to redo the product. Instead, focus on the above prompts.
6. The explanation should be no more than 200 words long.

See the Appendix for examples of Mathematical Argument products and reflections.

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Section 6: Problem Solving by Transformation

In this section, you will reflect on a specific instance in which you used **Problem Solving by Transformation**.

Problem Solving by Transformation: We use this technique when we begin with a difficult problem that we cannot approach in its current form. However, we recognize that we can transform or change the problem into an equivalent problem that is easier to solve. So, we perform this transformation and solve the easier problem instead of the more difficult one we started with.

For the Problem Solving by Transformation Product

1. You must adhere to the Stipulations on page 5 when choosing a product.
2. Clearly state what course your product is from.
3. Include the statement of the problem and your solution to the problem. (These items are separate from the explanation below.)
4. Provide a detailed reflection and explanation of your use of **Problem Solving by Transformation** in the product in which you identify
    a. where you used Problem Solving by Transformation in the product you selected
    b. why you needed to use Problem Solving by Transformation
    c. how you used Problem Solving by Transformation
5. Do NOT explain how to redo the product. Instead, focus on the above prompts.
6. The explanation should be no more than 200 words long.

See the Appendix for examples of Problem Solving by Transformation products and reflections.

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Section 7: Logic

This section of the portfolio will be completed **in person** and is designed to assess your understanding of the logic of if/then statements.

During the assessment, you will be given an if/then statement that you have likely not seen before. You will then answer a series of questions about the logical structure and meaning of that statement. The purpose of the assessment is to evaluate your understanding of the logic of if/then statements, rather than your familiarity with a particular mathematical result.

The assessment will take approximately 10–15 minutes and must be completed without the use of technology or outside resources. Your responses will be included as part of the evaluation of your portfolio.

You will receive an email with instructions for scheduling your assessment. The assessment must be completed during the two weeks prior to your portfolio due date.

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Section 8: Capstone Reflection

In this section, you will reflect on your capstone experience.

Presentation Requirement for BS Majors:
*** Students using 2 or more research semester hours for their capstone credit for a BS degree must give an oral presentation related to their capstone project at a venue approved by their MTH 4999 mentor. Some examples of presentation venues include SURF or a regional conference.**

Please indicate your plans for completing the presentation requirement. Presentations must be completed by the last day of class of your final semester.

In the unlikely event you are not able to present at your chosen venue, you must contact the portfolio coordinator no later than 3 days after the planned event to make other arrangements to satisfy this requirement.

Product:

- Include the capstone product that you created in your capstone experience for your math, math with teacher licensure, or applied math major.
- Acceptable capstone products are
    - Final Research Paper from your MTH 4999 or MTH 4970 experience
    - Final Internship Paper from you MTH 4985 experience
    - Teaching licensure candidates are **required** to use their Unit Plan from EDU 4220: Methods

Note: If you are currently working on your capstone paper, please contact the Portfolio Coordinator with a request to change the inclusion date of the Capstone Section.

Rationale:

Provide a **detailed description** of the capstone experience and a **strong argument** of how the experience has helped you achieve mastery in the following three areas: (1) **application of knowledge**, (2) **communication of knowledge**, and (3) **independent thinking**. You must use your chosen capstone product to support your argument. Specifically, you must clearly identify *where* and *how* your capstone product demonstrates mastery of items (1), (2), and (3) above. The rationale must be at least **one page** in length.

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Evaluation of the Portfolio

Portfolios will be assessed independently by two faculty reviewers from Elon. Each reviewer reads the candidate's portfolio very carefully and issues either a pass or fail on each section. The reviewers give their evaluations to the Portfolio Coordinator who will then notify candidates of the results of their portfolio evaluation no later than one month after the due date. The possible outcomes of the portfolio evaluation are as follows:

- **The candidate passes the portfolio**. This means both reviewers issued a pass on each portion of the candidate's portfolio. The candidate does not have to participate in the exit interview process.
- **The candidate needs to submit revisions**. This means at least one reviewer has failed you on at least one portfolio section. If a reviewer issues a fail on a portion of the portfolio, the candidate will be required to revise and resubmit that portion of the portfolio.
    - Each fail will be accompanied by comments from the reviewer(s). The candidate **must address all comments** in their revision.
    - The Portfolio Coordinator will contact the candidate by email listing all required revisions and their corresponding reviewer comments. This communication will also contain the due date for submitting revisions.
    - To submit revisions, the candidate will submit one zip file via a link on Canvas. This file should contain a separate PDF file for each item that requires revisions and a single PDF file of the entire revised portfolio.
    - If revisions are not received by the due date, the candidate will receive a fail on the entire portfolio and will not be able to graduate with a mathematics/applied mathematics major during the current semester.

  Once revisions are received, the reviewers will assess all revised documents one final time. The reviewers give their evaluations to the Portfolio Coordinator, who will then notify the candidate of the outcome of their revisions. The possible outcomes are:

    - **The candidate passes the revisions.** The candidate has successfully completed the portfolio requirement for graduation. The candidate does not have to participate in the exit interview process.

- **The candidate fails the revisions**. The candidate has not successfully completed the portfolio requirement for graduation. The candidate must continue to the Exit Interview Process. (See Exit Interview Guidelines)

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Exit Interview Guidelines

If the candidate has not passed the portfolio process by the end of the revision process, they will be contacted by the Portfolio Coordinator to set up their Exit Interview. The purpose of the Exit Interview is to judge the candidate's ability to discuss and interpret factual material concerning mathematics and its applications. The Interview will be administered by at least two faculty from Elon's Department of Mathematics and Statistics and will be graded on a Pass/Fail scale. Each candidate will be informed of their interviewers' names and must contact them immediately to set up their Interview. All Exit Interviews must be scheduled within two weeks of being notified of their interviewers' names.

Interview Format

- Exit interviews will be approximately 30 minutes in length.
- Candidates will be asked to discuss the mathematics reported in **any** of the products included in their portfolio.
- Candidates will be asked to orally explain mathematical ideas, methods, or results using mathematical language correctly.
- Candidates will NOT be informed of the product choices before the interview so they should familiarize themselves with all their submitted products.
- The possible outcomes are:
    - **The candidate passes the Exit Interview.** The candidate has successfully completed the portfolio requirement for graduation. The Portfolio Coordinator will email the candidate a link to the Senior Survey, in which they rate their confidence in the skills related to the program learning objectives and offer feedback on the math major, teaching effectiveness, advising, and course offerings.
    - **The candidate does not pass the Exit Interview.** The Portfolio Coordinator will confer with the interviewers to determine where the deficiencies are located and relay this to the Candidate. The Portfolio Coordinator will set up a last-chance interview with the Candidate, a faculty member, and the Portfolio Coordinator.
        - If the candidate passes this last-chance interview, then the candidate has successfully completed the portfolio requirement for graduation.
        - If the candidate does not pass the last-chance interview, the candidate will not meet the portfolio requirement for graduation. Within a week, the candidate will have to meet with the Portfolio Coordinator and Department Chair to discuss a plan for additional work to be completed after the

current semester ends.

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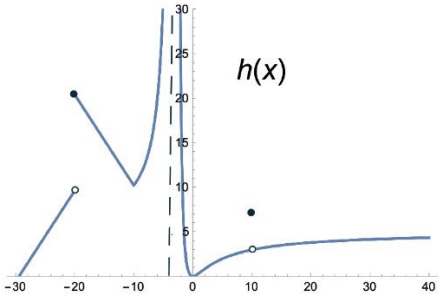
Appendix: Example Products and Reflections for Section 5 & Section 6

Note: All examples are taken from Calculus 1 and 2. However, recall from the Stipulations for Sections 5 & 6 that you may **not** choose products from these courses.

Mathematical Argument Example 1

My Product and Solution: The Calculus 1 Test question with my solution shown below.

1. Use the graph of $h(x)$ shown below to answer the following questions.



(a) [6 pts] Find all x-values at which $h(x)$ is discontinuous. Provide a detailed and precise explanation for each x-value. Your explanation must focus on the Calculus 1 definition of continuous.

$x=-20$ b/c of the break in the graph

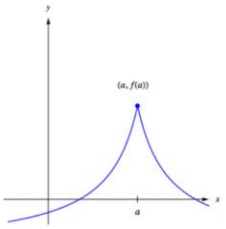
$x=-4$ b/c of the vertical asymptote

$x=10$ b/c $\lim_{x\to 10} h(x) \neq h(10)$

My Reflection: I applied logical thinking when I figured out what part of the formal definition of continuity I needed to use at each x-value. I used precise mathematical language in explaining that the function is not continuous at $x = -4$ because of the vertical asymptote. I also use precise mathematical language when explaining why the function is discontinuous at $x = 10$ because the limit does not equal the function value. I also use proper mathematical syntax in my explanation that the function is discontinuous at x=10 by writing that the limit does not equal the function value using proper limit and function notation. I could have improved my mathematical argument in my explanation of why the function is discontinuous at $x = -20$. Saying that there is a break in the graph is not mathematically precise. A better argument would have been to explain that $\lim_{x\to -20} h(x)$ does not exist because the lefthand limit does not equal the righthand limit, making the function discontinuous at $x = -20$. Using proper syntax, I would write $\lim_{x\to -20^-} h(x) \neq \lim_{x\to -20^+} h(x)$. (Word Count: 167)

Mathematical Argument Example 2

My Product and Solution: The following Calculus 1 test question with my solution



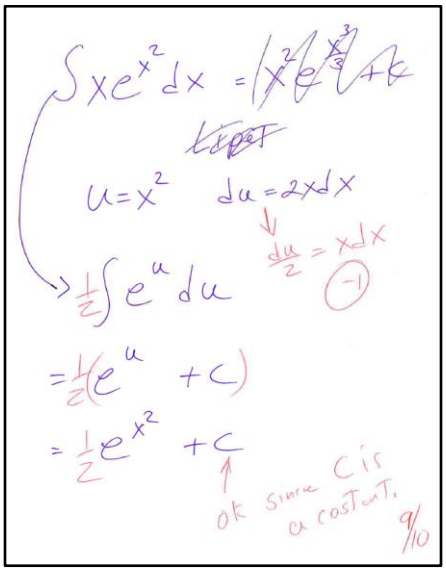
1) (4 points) Is the function f(x) **differentiable** at x =a? Explain.

Not differentiable because there is a cusp which means I can draw in different tangent lines at x=a so there is no way to define a single tangent slope. So, $\lim_{h \to 0} \frac{f(a+h)-f(a)}{h}$ does not exist.

My Reflection: I used logical thinking in this problem when I connected the fact that there is a cusp at $\boldsymbol{x = a}$ to the fact that many different tangent lines could be drawn at $\boldsymbol{x = a}$. I continued to use logical thinking when I discussed that there is no single tangent slope and the implication that has on the existence of the derivative at $\boldsymbol{x = a}$. I used proper mathematical language when I talked about the cusp at $\boldsymbol{x = a}$ and when I talked about the tangent slope. I use proper syntax when stating the limit definition of derivative as $\boldsymbol{\lim_{h \to 0} \frac{f(a+h)-f(a)}{h}}$. I could have improved my solution by explaining why $\boldsymbol{\lim_{h \to 0} \frac{f(a+h)-f(a)}{h}}$ does not exist. In particular, I could have explained that when there is a cusp at $\boldsymbol{x = a}$ it means that the lefthand limit $\boldsymbol{\lim_{h \to 0^-} \frac{f(a+h)-f(a)}{h}}$ does not equal the righthand limit $\boldsymbol{\lim_{h \to 0^+} \frac{f(a+h)-f(a)}{h}}$. The lefthand limit $\boldsymbol{\lim_{h \to 0^-} \frac{f(a+h)-f(a)}{h}}$ must equal the righthand limit $\boldsymbol{\lim_{h \to 0^+} \frac{f(a+h)-f(a)}{h}}$ in order for the derivative to exist. (Word Count: 153).

Problem Solving by Transformation Example 1

My Chosen Product: Calculus 2 Exam Question: Evaluate $\int xe^{x^2}\,dx$.
My Solution:



My Reflection: On a Calculus 2 test I used Problem-Solving by Transformation to evaluate the above integral. I needed to transform this integral because I did not immediately know the antiderivative of $y = xe^{x^2}$. So, I used u-substitution to to transform the integral into something I could antidifferentiate. I let $u = x^2$ because I recognized that the derivative of x^2 is (more or less) in the integrand. Then $du = 2x\,dx$ and so (I missed this in my solution) $x\,dx = \frac{1}{2}du$. Now we can transform the original integral into something we can integrate: $\int x\,e^{x^2}dx = \int \frac{1}{2}e^u\,du$. (Word Count: 90)

Problem Solving by Transformation Example 2

My Product: Calculus 2 Homework Question: Determine if $\sum_{n=1}^{\infty} \frac{7}{(6n-4)^5}$ converges or diverges.

My Solution:

Exercise 5. For each of the series below...

- Determine which test will help you determine if the series converges or diverges. Explain why you chose that test.
- Use the test to determine if the series converges or diverges. Neatly and clearly show all work.

a. $\sum_{n=1}^{\infty} \frac{7}{(6n-4)^5}$ Integral test. $f(x) = \frac{7}{(6x-4)^5}$ is pos, contn, and decr.

$$\int_1^{\infty} \frac{7}{(6x-4)^5}\,dx = \lim_{t\to\infty} \int_1^t 7(6x-4)^{-5}\,dx$$

$$= \lim_{t\to\infty} \frac{-7}{4} \cdot \frac{1}{6}(6x-4)^{-4}\Big|_1^t$$

$$= \lim_{t\to\infty} \frac{-7}{24}\left(\frac{1}{(6t-4)^4} - \frac{1}{(6-4)^4}\right) = \frac{-7}{24} \cdot \frac{-1}{24} \Rightarrow \text{converges}$$

So the series converges

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My Reflection: The integral test allows us to analyze a series by transforming it into an integral and analyzing the integral instead. In this problem, I was not sure how to test the series itself for convergence, but I realized that I knew how to evaluate the improper integral $\int_1^{\infty} \frac{7}{(6x-4)^5}$, and the Integral Test states that if the improper integral converges then so does the series, and if the integral diverges, the series diverges. I checked that the assumptions of the integral test were satisfied (i.e., that the function is positive, continuous, and decreasing on $[1,\infty)$) to ensure that we were allowed to make the transformation. I then transformed the series into the improper integral. I used integration techniques and limits to determine that the integral converges. I was then able to conclude that the series converges as well. (Word Count: 137)