Core Course Assessment Plan, 2019-20
Element 2: Mathematics

Please complete all sections; do not delete section information. Submit to Pilot when complete.

SECTION 1: GENERAL INFORMATION

Course Dept. Prefix: __**MTH**___   Course #: __**2310**_____

Semester when assessment will occur: **Spring** Year: **2020**

Course Title: _____**Calculus II**_____

Section Types and number of sections offered in 2019-20. Complete all that apply.
__**X**__ Dayton face-to-face   _____ Lake face-to-face
_____ Dayton online   _____ Lake online
_____ Dayton Honors   _____ Lake Honors

Attributes: ____   Integrative Writing in Core
                    ____   Multicultural Competency in Core
                    ____   Service Learning in Core

Dept. Core Assessment Lead: **Joe Zhou**   ___**xiangqian.zhou@wright.edu**_____
                                Name   email

List at least two assessors; this may include course instructor only if there are multiple sections <u>and</u> multiple instructors of the course. Note - The instructor may not assess his/her students' papers.
- ____**Qun Li**_____
- ____**Phan Loi**_____
- ____**Erik Potts**_____
- ____**Tom Svobodny**_____

SECTION 2: ASSESSMENT PLAN

It is preferable to have the assessment plan for all sections of a course. If not feasible, please complete an assessment plan for separate sections.

<u>Course Outcomes.</u> _____ Check here if Outcomes have been modified.

The course must address all 5 outcomes but must assess a minimum of 1 outcome. Highlight in yellow the outcome(s) you will assess. If you have modified the outcomes, please insert here in place of standard outcomes.

1. Identify the various elements of a mathematical or statistical model;
2. Determine the values of specific components of a mathematical/statistical model or relationships among various components;
3. Apply a mathematical/statistical model to a real-world problem;
4. Interpret and draw conclusions from graphical, tabular, and other numerical or statistical representations of data; and
5. Summarize and justify analyses of mathematical/statistical models for problems, expressing solutions using an appropriate combination of words, symbols, tables or graphs.

Assignments. Select **one** of the options below for assessment of one or more outcomes

☐ Written assignment(s) that addresses/address outcome(s). Include outcome #, title and description for each assignment.

Outcome #: _____ Title:

Description of assignment:

☐ Essay question(s). Provide the question(s) and outcome(s) below.

1. Outcome #: __**3**__ Essay Question: _____**a volume problem using integration**_____
   Example: find the volums of the solid obtained by rotating the region enclosed y=x^2 and y=x around the line x=1
2. Outcome #: __**4**__ Essay Question: _____**a problem on Euler's Method for initial-value problem**_____
   Example: Use Euler's method with step size 0.1 to estimate y(0.5) where y(x) is the solution of the initial-value problem y'=y+xy, y(0)=1.

☐ Pilot asynchronous written discussion that addresses outcome(s). Provide the outcome # and question(s).

1. Outcome #: _____ Discussion Question: _____
2. Outcome #: _____ Discussion Question: _____
3. Outcome #: _____ Discussion Question: _____

☐ Multiple Choice or T/F Marker questions – 3 to 4 questions per outcome. List the outcome and question numbers. A rubric is not used for Marker questions. "All the above" should not be used as the correct answer more than once. **Courses that are IW or SRV/SRVI must use written assignments for those attributes**. Complete the benchmark: We expect _____% of students to answer ____% of the question(s) correctly.

1. Outcome #: _____
   a) Question: _____
   b) Question: _____
   c) Question: _____
   d) Question: _____
2. Outcome #: _____
   a) Question: _____
   b) Question: _____
   c) Question: _____
   d) Question: _____
3. Outcome #: _____
   a) Question: _____
   b) Question: _____
   c) Question: _____
   d) Question: _____

Collecting and submitting the student assignment(s)

_____ Will upload assignment(s) to Pilot   _____ Will give access to assignment(s) on Pilot

Other: _____**photocopies provided upon request**_____

Rubric Selection (A, B). Select the items you feel best match your assignment(s) in the rubric(s) on the next pages. Please highlight in yellow. **If this course has an IW attribute, please also see section B.**

A. Element 2 Rubric. Select the item(s) you will use in your rubric by highlighting in yellow the item(s). You may select one or more of them. As there is overlap, **choose the items that best fit the assignment you select for assessment.** The items below are taken from the Association of American Colleges and Universities (AACU) Value Rubrics for Math Literacy.

IF YOU ARE USING MARKER QUESTIONS FOR THE OUTCOME, DO NOT USE THIS RUBRIC.

	Capstone 4	Milestones 3	2	Benchmark 1
Interpretation *Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. *For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.*	Provides accurate explanations of information presented in mathematical forms. *For instance, accurately explains the trend data shown in a graph.*	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. *For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.*	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. *For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.*
Representation *Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.
Calculation	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.

	Capstone 4	Milestones 3	2	Benchmark 1
Application / Analysis *Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis*	Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work.	Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work.
Assumptions *Ability to make and evaluate important assumptions in estimation, modeling, and data analysis*	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.
Communication *Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)*	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)

B. If this is an IW course, you will use the items on this page. You may select one or more of them. Please highlight in yellow.

Item	Mastery 4	Partial Mastery 3	Progressing 2	Emerging 1
Includes considerations of audience, purpose, and the circumstances surrounding the writing task(s).	Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work.	Demonstrates adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context).	Demonstrates awareness of context, audience, purpose, and to the assigned tasks(s) (e.g., begins to show awareness of audience's perceptions and assumptions).	Demonstrates minimal attention to context, audience, purpose, and to the assigned tasks(s) (e.g., expectation of instructor or self as audience).
Content Development	Uses appropriate, relevant, and compelling content to illustrate mastery of the subject, conveying the writer's understanding, and shaping the whole work.	Uses appropriate, relevant, and compelling content to explore ideas within the context of the discipline and shape the whole work.	Uses appropriate and relevant content to develop and explore ideas through most of the work.	Uses appropriate and relevant content to develop simple ideas in some parts of the work.
Formal and informal rules inherent in the expectations for writing in particular forms and/or academic fields (please see glossary).	Demonstrates detailed attention to and successful execution of a wide range of conventions particular to a specific discipline and/or writing task (s) including organization, content, presentation, formatting, and stylistic choices	Demonstrates consistent use of important conventions particular to a specific discipline and/or writing task(s), including organization, content, presentation, and stylistic choices	Follows expectations appropriate to a specific discipline and/or writing task(s) for basic organization, content, and presentation	Attempts to use a consistent system for basic organization and presentation.
Sources and Evidence	Demonstrates skillful use of high-quality, credible, relevant sources to develop ideas that are appropriate for the discipline and genre of the writing	Demonstrates consistent use of credible, relevant sources to support ideas that are situated within the discipline and genre of the writing.	Demonstrates an attempt to use credible and/or relevant sources to support ideas that are appropriate for the discipline and genre of the writing.	Demonstrates an attempt to use sources to support ideas in the writing.
Control of Syntax and Mechanics	Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.	Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.	Uses language that sometimes impedes meaning because of errors in usage.

The next section is for the University Core Oversight Committee (UCOC) Review only.

UCOC Review

Item	Complete/NA	Revision Requested	Comments
Learning Outcomes for Global Traditions	**XX**		
Rubric for LOs	**XX**		
Rubric for MC Attribute	**N/A**		
Rubric for IW Attribute	**N/A**		
Rubric for SRV/SRVI Attribute	**N/A**		
Assigned Departmental Reviewers	**XX**		

Committee Review Completed XX

Committee Chair Signature _____*Ann M. Bowling*_____ Date __12/2019_____

Spring 2021 MTH 2310 - Core Assessment Element 2 Report

Date Report Submitted: June 23, 2021 (Delayed due to pandemic)

Element: Core Element 2 – Mathematics

Academic Year: 2020-2021

Course and Sections Assessed: Spring 2021 - MTH 2310 all Sections.

Assessment Plan:

Following the assessment plan, we have included two problems for assessment purposes in the dept common final. One problem is on finding the volume of a solid obtained by rotation and the other one is on finding the radius and interval of convergence of an infinite power series. Electronic copies of students' work were collected and a random sample containing 50% were selected and graded based on the two rubrics specified in the assessment plan, also attached below. (a score is 0 is given if a student left a problem completely blank.)

Rubrics used for Assessment

	Capstone	Milestones		Benchmark
	4	**3**	**2**	**1**
Interpretation *Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. *For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.*	Provides accurate explanations of information presented in mathematical forms. *For instance, accurately explains the trend data shown in a graph.*	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. *For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.*	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. *For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.*
Calculation	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.

Assessment Data Collection:

Problem #1: Calculate the volume of the solid obtained by rotating the region enclosed by $y = \sqrt{x}$ and y=x about the x-axis.

	Interpretation	Calculation
Score of 4	13	19
Score of 3	9	9
Score of 2	12	9
Score of 1	6	5
Score of 0	1	1
Average Score	2.6585	2.8537

Problem #2: Find the radius and interval of convergence of the power series $\sum_{n=0}^{\infty} \frac{n(x-1)^n}{2n+1}$.

	Interpretation	Calculation
Score of 4	5	5
Score of 3	11	7
Score of 2	12	17
Score of 1	13	12
Score of 0	0	0
Average Score	2.1951	2.1220

Assessment Results:

The two problems we used for assessment are very standard exercises as they represent some of the basic outcomes that are expected from students and the computations required were at an appropriate level of proficiency.

For the first problem, most students did very well with the correct interpretation of setting up the definite integral and calculating it by the FTC. About 50% of the students were able to set up the correct definite integral for the volume while 70% of them knew how to calculate a definite integral.

Students' performance on Problem #2 were Okay, just not as good as they did on Problem #1. One possible reason might be that infinite series is perhaps of the most challenging topic in Calculus II. We have 5 out of 40 students who completely grasped the concepts and calculations of different test methods. Many students got to an interval of convergence and radius of convergence; however, most of them did not check for convergence at the endpoints; and for those who did, some only made a claim about the convergence or divergence and did not explain why. About 30% of the students had trouble with the initial Ratio Test setup for various reasons.

Assessment Feedback:

We uploaded the report together with the raw data (in excel) to the Pilot Page named Calculus Sequence: faculty and committee; where every instructor can login to view the result, including the department chair.

Based on the assessment results, it appears that students are performing much better in Calculus II than they did in Calculus I. One reason could be the students are more mature and engaged. We are happy to see that most students had the right idea for both problems. They were able to carry out more complicated calculations such as integration by parts, partial fractions, ratio test, etc. In the future, our goal is to help them better understand the theory behind these calculations. We need to encourage them to think more either in class or while working on their own.

The results will be shared with the department curriculum committee through our department Pliot page, either before or shortly after it is submitted to the Undergraduate Core Oversight Committee (UCOC).

Assessment Administration Feedback

The whole process of core assessment was well structured and carefully planned. The only thing we would like to suggest is the following: since our department (math and stat) has a relatively large number of core courses, it would be very helpful if we can avoid doing the core assessment for all of them in one academic year, in other words, we can split these core classes into several groups and let each group have a different 5-year cycle for assessment purposes.

UCOC Report Review

Item	Complete/NA	Revision Requested	Comments
Identified Outcome Assessed	**XX**		
Identified Procedure for Assessment	**XX**		
Summary of Results	**XX**		
Results Shared with Instructor, Dept Curriculum Committee, etc.	**XX**		
Plan for Improvements	**XX**		

Committee Review Completed XXX

Committee Chair Signature ___ Dr. Anne M. Bowling _____ Date __10/7/2022_____