

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: EC Course #: 1050

Semester when assessment will occur: Spring Summer **Fall** Year: **2019** ~~or 2020~~

Course Title: Elementary Mathematical Economic and Business Models

Section Types and number of sections offered in 2019-20. Complete all that apply.

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: Dr. Zdravka Todorova zdravka.todorova@wright.edu
Name email

List at least two assessors; this may include course instructor only if there are multiple sections and multiple instructors of the course. Note - The instructor may not assess his/her students' papers.

- Carol Herrick
- Kerry Martin
- _____
- _____

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.

Course Outcomes. 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:

Word Problem question(s). Provide the question(s) and outcome(s) below.

1. Outcome #: 2 Word Problem:

You run a bike shop and sell your bikes for \$165 each. You have the following daily cost function:

$$C(q) = \frac{400q + 400}{q + 4} \quad \text{where costs are in dollars and } q \text{ represents units}$$

What is your daily **profit function**? What is your **breakeven quantity**?

2. Outcome #: 3 Word Problem:

The cost to produce q electric cat brushes is described by the function:

$$C(q) = -10q^2 + 250q \quad \text{for volumes less than 2000.}$$

The demand function for electric cat brushes is described by:

$$p(q) = -q^2 - 3q + 299 \quad \text{where } p = \text{dollars}$$

What is the company's function for its **average cost per unit**? What is the company's **minimum average cost** and **how many units** will it produce to achieve that?

What are the company's **marginal cost and marginal revenue functions**?

Calculate the number of units that produces the **maximum profit**. What **price** should the company charge and what is the maximum profit it will earn?

Find the company's function for its **average cost per unit** and determine the average cost per unit at the profit maximizing level of production.

3. Outcome #: 4 Word Problem:

Midtown Manufacturing Company makes plastic plates and cups, both of which require time on two machines. Producing a unit of plates requires 1 hour on machine A and 2 hours on machine B, while producing a unit of cups requires 3 hours on machine A and 1 hour on machine B. Each machine is operating for at most 15 hours per day. Each unit of plates brings in \$10 in profit for the company and each unit of cups brings in \$12 in profit.

- Write a system of inequalities expressing these conditions and graph the feasible region.
- Find the profit maximizing combination of plates and cups this company can and should produce.

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

- 4. Outcome #: _____ Essay Question: _____
- 5. Outcome #: _____ Essay Question: _____
- 6. Outcome #: _____ Essay Question: _____

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: __ Assignments will be part of final exam. Student submissions will be written and collated for evaluation after the exams have been graded.

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		Benchmark 1
		3	2	
Interpretation <i>Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i>	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. <i>For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.</i>	Provides accurate explanations of information presented in mathematical forms. <i>For instance, accurately explains the trend data shown in a graph.</i>	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. <i>For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.</i>	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. <i>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.</i>
Representation <i>Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i>	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.
Application / Analysis <i>Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis</i>	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.

	Capstone 4	Milestones		Benchmark 1
		3	2	
Assumptions <i>Ability to make and evaluate important assumptions in estimation, modeling, and data analysis</i>	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 <i>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)</i>	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.

Note: Report Template will be added to each of the individualized assessment plans to facilitate having one final document (assessment and report) for each course.

SECTION 4: ASSESSMENT REPORT DUE May 7, 2021

A separate report needs to be submitted for each assessment plan approved by the Undergraduate Core Oversight Committee (UCOC).

Please upload this entire document to the Pilot course called Element 5 Core Course Assessment 2020-21 (continuous year) by Friday, May 7, 2021. The Final Report Dropbox link can be accessed via Content > Dropbox (Plans, Reports) > Final Report Dropbox.

Date Report Submitted: 5 May 2021

Element: Core Element 2 – Mathematics

Academic Year: Element 2 – 2019

Course and Sections Assessed:

Fall 2019: EC1050 – 01. 02, 02: Elementary Mathematical Economic and Business Models and Methods (only taught on Dayton Campus)

Describe the final assessment plan that was implemented and explain any changes made to the approved plan.

Plan: Written assignments/ word problems that address outcomes 2, 3 and 4 included in course final of each section. Slight wording changes occurred in two of the three sections for one of the problems.

I. Core Learning Outcomes Assessed (list):

- 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;**

II. Procedures Used for Assessment

For **each** learning outcome addressed by this report, state where and when data were collected (in a course, exam, or performance) and how they were evaluated (e.g. rubric, rating scale, key questions from exams, etc.). Specify the course or courses where students demonstrated the outcomes (if applicable) and the assignment(s) that you used for assessment purposes (e.g., capstone project, final examination, research paper, student presentation, performance, portfolio, etc.).

All outcome (2, 3, and 4) problems were part of the final exam given by each section of the course at the end of Fall 2019 term. Student submissions were hand written. Submissions were collected and copied for evaluation before the exams were graded.

After grades were submitted, student submissions were shared with the non-section Instructor for evaluation using the agreed upon rubric for each outcome.

Each outcome question was scored individually on the same three rubrics: Representation, Calculation and Application/Analysis. Scores for each question were individually tallied. Median scores for each section were recorded.

III. Summary of Assessment Results:

What did you find from your assessments? (Present and analyze the results from the Aqua system analysis by Vice Provost Tammy Kahrig and/or your departmental review of marker questions.) What did your data reveal about how well students are achieving the Core Learning Outcomes that you listed above? After analyzing your data, present a summary of the data, clearly indicating what any numbers represent (e.g. percentages? means? medians?). Please number each corresponding assessment, summary, and analysis.

Evaluation of the assessment scores indicate that students are demonstrating the expected level of achievement for the Core Learning Outcomes identified as significant for this course, although there is some variation across sections as expected. The variation most likely results from the difference emphasis placed on: complete description of the data included in the problem; including all steps in the calculation process; and translating the mathematical answer into business answers.

Analysis of the assessment scores disclosed the need for additional class examples of the calculation and the use of average cost per unit as well as the importance of finding the intersection point of a system of equations to calculate the most profitable production levels.

Summary of data:

Learning Outcome “ 2:

Rubric \ Section	- 01	- 02	- 03
Representation	3	2	4
Calculation	3	3	3
Presentation	3	2	4

Benchmark Met Yes or No

Learning Outcome “ 3:

Rubric \ Section	- 01	- 02	- 03
Representation	3	3	3
Calculation	3	2	3
Presentation	2	2	3

Benchmark Met Yes or No

Learning Outcome “ 4:

Rubric \ Section	- 01	- 02	- 03
Representation	3	3	3
Calculation	3	3	3
Presentation	2	3	3

Benchmark Met Yes or No

If not met, please identify conditions (if any) that may have impacted these findings.

IV. ACTIONS TAKEN/PLANNED TO IMPROVE STUDENT LEARNING

Describe how you shared the results with instructors of the courses, the department curriculum committee and chair, Lake campus, and other stakeholders. Explain briefly how department faculty will make improvements based upon the assessment findings (e.g. plans to gather more information; recommending changes to the learning outcomes or assessment procedures; changes in course content, instructional approaches, technology, order of course offerings, materials, resources, assignments, policies, funding, advising, planning, training for adjuncts, etc.).

Course Instructors did the evaluation of the submissions and collaborated on the Assessment findings, including the identification of instructional improvements. As benchmarks were met, additional assessments are not planned at this time although the assessment problems will continue to be included in the course final exam.

V. Assessment Administration Feedback

The assessment of the courses was part of the Core assessment cycle. The assessment plan was reviewed and approved by the UCOC. The UCOC provided a presentation on tools available to assist with the assessment, including Watermark Aqua.

Please describe any changes you recommend about the oversight of the assessment process by the UCOC and the Academic Affairs office.

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 2/11/2022