

MATH 105 - Spring 2024

Mathematics Applications, Appreciation & Skills

| | |
|----------------------|--|
| Instructor: | Alvin Schuller |
| Office: | CCC 302A MathPad |
| Office Phone: | NA 715-572-3995 (personal) |
| Email: | aschulle@uwsp.edu |
| Office Hours: | M 3:00 – 3:50 pm W 3:00 – 3:50 pm *Or by appointment (at your and my convenience*) |

Section 3 ~ MTT 4:00 – 4:50 pm CCC 212

Prerequisite: Math 90 or a suitable placement score.

Text: The Heart of Mathematics: An Invitation to Effective Thinking, 3rd-ed. by Edward Burger & Michael Starbird.

Course Outline:

In this course, we will explore some of the great ideas within the realm of mathematics - comparable to the works of Shakespeare and Plato. Mathematics is an artistic endeavor, which is shaped by each person's imagination and creativity.

There are three basic goals for this course:

1. To help you attain a better understanding of some significant mathematical ideas.
2. To sharpen your analytical skills for life issues that are beyond the realm of mathematics.
3. To develop a fresh perspective and outlook on your view of the world.

In addition, we will also explore ways

4. To help you better and more concisely communicate mathematical ideas to others and
5. To help you learn how to work more effectively in groups

This course satisfies the Quantitative Literacy Requirement. In particular, it addresses the following:

Quantitative Literacy Learning Outcomes

- Select, analyze, and interpret appropriate numerical data used in everyday life in numerical and graphical format.
- Identify and apply appropriate strategies of quantitative problem solving in theoretical and practical applications.
- Construct a conclusion using quantitative justification.

For more information see <http://www.uwsp.edu/acadaff/Pages/generalEducation.aspx>

Calculators: This course will be more concerned with mathematical ideas than formulas or computations, and so for the most part, calculators will not be necessary, but they will be handy. Your smart phone probably has a good enough calculator for most of the work we will do. However, **you will need an actual, approved calculator for the exams.**

We will cover only part of the text, as there is more than a semester's worth of material presented in the text. This will include about six different chapter topics. The "bottom line," so to speak, is to gain an appreciation for mathematics and to discover the power of mathematical thinking in your everyday life.

"...It is essential in this course that you have an open mind, a piqued curiosity, and a willingness to explore and discover..."

Minimal mathematical background will be assumed.

* See details below for a list of sections to be covered.

SECTIONS TO BE COVERED:

Here are the sections that I intend to cover. There may be some adjustment(s) based on time available.

CH 1: Fun and Games

- 1.4

CH 2: Number Contemplation

2.1 - 2.3, 2.6, 2.7

CH 3: Infinity

3.1-3.3

CH 4: Geometric Gems

4.1, 4.3 - 4.5

CH 5: Contortions of Space

5.2

CH 6: Fractals and chaos

6.1, 6.2, other sections possibly, based on time

CH 7: Taming uncertainty

7.1, 7.2

Attendance Policy:

You are required to **attend each class period and participate** as these elements form a part of your course grade. You actually will have to pay attention, ask questions, and try stuff. You are expected to **attend all sessions, as required**, as well.

It is your responsibility to obtain notes and information for the class times that you miss. When circumstances arise to prevent you from coming to class, you should let me know prior to the absence, usually BEFORE the day in question (detailed texts and emails are ways to do so).

Permission to miss assignments, tests, exams and/or presentation days will only be allowed for extreme circumstances, and you will be required to provide sufficient reason and appropriate documentation for the intended absence. In the case of an intended absence, all arrangements for make-up assignments, quizzes and exams must be made before the scheduled exam time. Absences for serious illness, family emergencies, military duty or University sponsored activities may be excused provided you inform me, timeously. Homework assignment due dates may be adjusted for excused absences. *More than 4 unexcused absences will affect and lower your grade.*

Academic Misconduct Policy:

You are expected to complete the coursework assignments for this course. Failure to complete any assignment will result in zero points being awarded for that assignment. Late assignments will lose points as per my discretion. Also read the following link:
<http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf>

Evaluation: There will be a weighted total of 600 points for the semester.

Homework Assignments (50%): (120 out of 600 pts.)

Homework assignments will be assigned for each section covered in class and will be due as posted or stated. Your success in learning the material presented requires that you complete each assignment and do not fall behind. We will use class time to go over some of your questions regarding the assignments. We will not, however, have enough class time to answer all questions that arise. The Wednesday tutoring session will be a good time to get homework questions answered. Your textbook and classmates are also valuable resources. Homework grades will reflect daily participation, accuracy, and effort.

Exams (30%): There will be 3 exams, each worth 120 points (360 out of the 600 points). Actual dates will be announced as they are confirmed.

Tentative dates (these dates may change):

Thursday, March

Thursday, April

Thursday, May

Again, make-up exams and accommodations will be available only in very special cases and will be handled on an individual basis. Notification and arrangements in such cases must be made prior to the examination.

NOTE: Once an exam has been passed out, you may not leave the classroom until you've turned in your exam.

Research Project / Poster Session Presentations (20%): (120 out of 600 pts.)

This project is an opportunity to explore and discover a mathematical topic on one's own or the one assigned.

You may select a mathematical topic outside of those covered in our class, learn any necessary background information and then investigate the topic.

This may be a topic that is related to your discipline, for instance, or you may choose to depict a mathematical idea in a creative way (via a song or poem, for example).

You may work individually or in a group of two (collaboration is encouraged - it's more fun!).

Each student will submit an abstract of the intention for their project, write a final paper on their findings, and present a poster display by the end of the semester (usually during the last few class periods and the **final exam period** - Wednesday, May 15th, 5pm - 7pm.)

Some interim reports on the progress of the project will be collected during the semester.

Discussion and further details will be provided during class.

If no individual ideas are forthcoming, then I'll assign group projects.

Grading and Grading Scale:

| | |
|-------------------|-----------------|
| Homework: | 120 pts. = 50% |
| Exams: | 360 pts. = 30% |
| Research Project: | 120 pts. = 20% |
| Total: | 600 pts. = 100% |

Course letter grades will be based on the scale below,
with + and - marks within each range:

- A: 90 - 100
- B: 80 - 89
- C: 70 - 79
- D: 65 - 69
- F: below 65

I may use my discretion to raise a student's grade if her/his final grade does not reflect the quality of her/his work in the course (for example, from a low exam score early in the course). I will not, however, use such discretion to lower a student's final grade.

Community Bill of Rights and Responsibilities:

In accordance with UW system policies, Math 105 is dedicated to a safe, supportive, and non-discriminatory environment for all persons regardless of age, race, religion, gender, sexual orientation, or disability.

You have certain rights and responsibilities as a UWSP student, and you are expected to be fully aware of them.

These are detailed in the UWSP Community Bill of Rights and Responsibilities:
<http://www.uwsp.edu/dos/Documents/Community%20Rights%20and%20Responsibilities.pdf>

In particular, this includes the UWSP Student Academic Disciplinary Procedures:
<http://www.uwsp.edu/stuaffairs/Documents/RightsRespons/SRR-2010/rightsChap17.pdf>

Information concerning accommodations made as per Section 504 of the Rehabilitation Act or the Americans with Disabilities Act can be found at:

<http://www4.uwsp.edu/special/disability/>

In particular, to request any accommodations of this type, relevant to this class, discuss the matter with the Disability Services Office. Information and contact information may be found at:

<http://www4.uwsp.edu/special/disability/ToQualifyforDisabilityServicesProcedure/> .

Canvas Storage and homework boards (*POSSIBILITY?? MAYBE NOT...*)

Canvas may or will serve as a storage space for homework assignments and some daily worksheets. That way you can easily get access to them if you miss them. There may also be discussion boards available for you to post comments or questions.

And if there are, the boards will be monitored after the fact. That is, you will post directly to the board, and I will monitor (semi-weekly). Postings are never anonymous and must not contain inappropriate (foul, rude, hostile, offensive) language. Violations of this rule may constitute academic misconduct (see above/below)

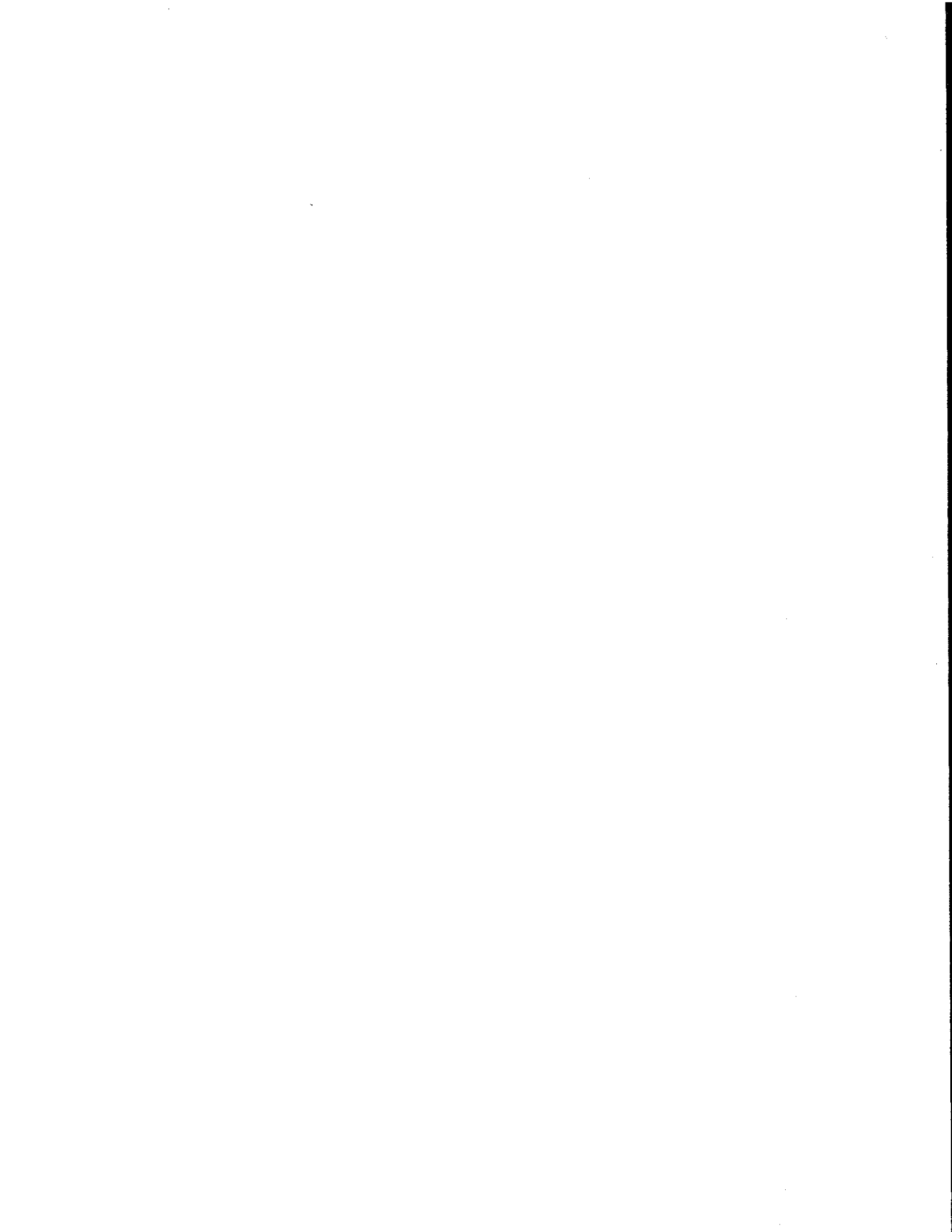
There may be a discussion board each week for homework questions. You would get extra credit if you post a question from the homework or an answer to another person's question (it does not matter if the question is required or suggested).

To earn the extra credit, your post must meet the following criteria:

1. You ask a question about how to do part of the homework/quiz assignment for the week, or you answer such a question or correct someone else's wrong answer, and
2. The posting contains new content (so a posting which says: "I agree" is not worth extra credit!)
3. You cannot earn credit for asking or answering a question that was previously asked by someone else on the board.

You can earn up to one extra credit point per week by posting in this way.

I intend to check all boards at least once every 24 hours (except on weekends)



| |
|---|
| MATH 105 - 3credits |
| Mathematics Applications, Appreciation & Skills- presenter: Alvin Schuller |
| Syllabus Content Outline |

*Course content may be modified and streamlined as per the stipulations of the department

Text: The Heart of Mathematics: An Invitation to Effective Thinking, 3rd-ed. by Edward Burger & Michael Starbird.

SECTIONS TO BE COVERED:

Here are the sections that I intend to cover. There may be some adjustment based on time available. The order of the sections listed below is not necessarily the order in which they will be covered.

CH 1: Fun and Games with riddles, brainteasers and conundrums

- 1.4

CH 2: Number Contemplation

2.1 - 2.3, 2.6, 2.7

Counting and the Number System

The Pigeonhole Principle

The Fibonacci Sequence and Fibonacci Nim

The Golden Ratio

Prime Numbers

Uniqueness of prime factorizations

Infinitude of prime numbers

Modular Arithmetic

Applications of Modular Arithmetic

Barcodes

Detecting Barcode Errors

Other Error Checking Methods

RSA Public Key Cryptography

Generating the Public and Private Keys

The Information You Put on Your Website

The Information You Keep Secret

Coding a Message Only You Can Decode

How You Decode the Coded Message

Simple Coding and Decoding

There are Lots of Rational Numbers

Irrational Numbers

Rational and Irrational Numbers

The Ancient Greeks

Examples of Irrational Numbers

The Irrationality of $\sqrt{2}$
The Irrationality of $\sqrt{3}$
More Irrational Numbers

The Real Number System
Finite Decimal Expansions

CH 3: Infinity

3.1-3.3

Comparing Sets
Countably Infinite Sets
Different Sizes of Infinity
An Infinite Hierarchy of Infinities

CH 4: Geometric Gems (Project based)

4.1, 4.3 - 4.5

Euclidean Geometry
Pythagoras's Theorem
Art Gallery Theorem
Golden Rectangle and Golden Ratios explored

CH 5: Contortions of Space

5.2

Polygons
Platonic Solids and Euler's Formula
Visualizing the Fourth Dimension

Planar, Spherical, and Hyperbolic space
Great Circle Distances

Topology, Isotopy and Homeomorphisms
One Sided Surfaces and Non-Orientable Surfaces

CH 6: Fractals and chaos

6.1, 6.2

A Gallery of Fractals
Iterative Dynamical Systems
Fractals by Repeated Replacement
Julia Sets and Mandelbrot Sets
Dimensions Which Are Not Integers
Iterated Function Systems
Simple Processes Can Lead to Chaos

CH 7: Taming uncertainty

7.1, 7.2

Gaming Probability and Odds