

**Credit Hours:** 3

**Contact Hours:** This is a 3-credit course, offered in accelerated format. This means that 16 weeks of material is covered in 8 weeks. The exact number of hours per week that you can expect to spend on each course will vary based upon the weekly coursework, as well as your study style and preferences. You should plan to spend 14-20 hours per week in each course reading material, interacting on the discussion boards, writing papers, completing projects, and doing research.

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## **COURSE DESCRIPTION AND OUTCOMES**

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**Course Description:**

This course emphasizes quantitative reasoning and problem solving presented through various mathematical concepts. Topics include set and graph theory, probability, voting techniques, consumer mathematics, and statistics. This course fulfills the Mathematics general education requirement. MTH109 is an approved Colorado Pathways course. Recommended Prior Course: None

**Course Overview:**

This course will provide students with an introduction to a variety of topics in mathematics that emphasize the development of logic, critical thinking, and problem-solving skills.

The course includes set and number theory, including the use of Venn diagrams in solving set union and intersection operations; an examination of graph theory; consumer mathematics, including interest calculations and their application to loans and investments, amortization, and annuities; a critique of voting methods; counting methods and probability, including combinations, permutations, and odds; and an introduction to methods of calculating statistical measures of central tendency and variation.

**Course Learning Outcomes:**

1. Explain sets and set operations; use the language and logic of sets to categorize elements, relate categories, make comparisons, and solve problems.
2. Describe the elements of graph theory; apply graph skills to applied and hypothetical optimization problems by rendering quantities graphically and applying theorems.
3. Explain Consumer Mathematics (pertaining to prices, taxes, interest, etc.) as it related to applied mathematical problems encountered in purchase and finance decisions.
4. Apply mathematical concepts to analyze, evaluate, and explain the methods, results, and strategies associated with voting and elections.
5. Use various systems and methods of counting elements in a set; apply the principles, theories, and methods of counting to solve counting problems.
6. Describe basic probability theory and apply probability theory and methods to calculate, express, and interpret probabilities and expected values.
7. Use graphic representations and descriptive statistical theory and methods to display and compare data and to compute and interpret measures of central tendency and dispersion.

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## COLORADO GTPATHWAYS COURSE

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Colorado Guaranteed Transfer (GT) Pathways Course: The Colorado Commission on Higher Education has approved MTH109: Mathematical Explorations for inclusion in the Guaranteed Transfer (GT) Pathways program in the GT-MA1 category. For transferring students, successful completion with a minimum C– grade guarantees transfer and application of credit in this GT Pathways category. For more information on the GT Pathways program, go to <http://highered.colorado.gov/academics/transfers/gtpathways/curriculum.html>

The table in Appendix A details the specific alignment of Course Learning Outcomes and Assessments to gtPathways Content and Criteria requirements.

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## PARTICIPATION & ATTENDANCE

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Prompt and consistent attendance in your online courses is essential for your success at CSU-Global Campus. Failure to verify your attendance within the first 7 days of this course may result in your withdrawal. If for some reason you would like to drop a course, please contact your advisor.

Online classes have deadlines, assignments, and participation requirements just like on-campus classes. Budget your time carefully and keep an open line of communication with your instructor. If you are having technical problems, problems with your assignments, or other problems that are impeding your progress, let your instructor know as soon as possible.

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## COURSE MATERIALS

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**Textbook Information is located in the CSU-Global Booklist on the Student Portal.**

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## COURSE SCHEDULE

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### Due Dates

The Academic Week at CSU-Global begins on Monday and ends the following Sunday.

- **Discussion Boards:** The original post must be completed by Thursday at 11:59 p.m. MT and Peer Responses posted by Sunday 11:59 p.m. MT. Late posts may not be awarded points.
- **Opening Exercises:** Take the opening exercise before reading each week’s content to see which areas you will need to focus on. You may take these exercises as many times as you need. The opening exercises will not affect your final grade.
- **Mastery Exercises:** Students may access and retake mastery exercises through the last day of class until they achieve the scores they desire.
- **Critical Thinking:** Assignments are due Sunday at 11:59 p.m. MT.
- **Live Classroom:** Although participation is not required, Live Classroom sessions are held during Weeks 2, 3, 5, and 7. There are four total sessions.

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## WEEKLY READING AND ASSIGNMENT DETAILS

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### Module 1

#### Readings

- Chapter 2 in *Thinking Mathematically*

- Gefter, A. (2012). Is everything made of numbers? *New Scientist*, 215(2884), 38.

**Opening Exercise (0 points)**

**Discussion (25 points)**

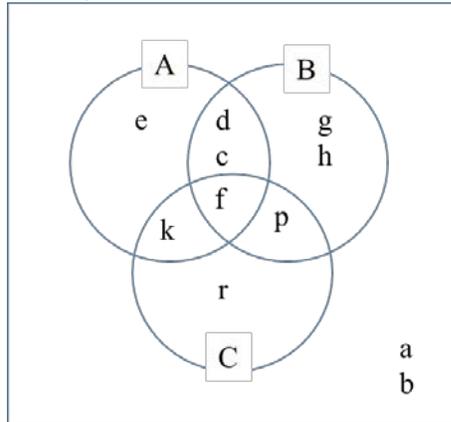
**Mastery Exercise (10 points)**

**Critical Thinking (90 points)**

Choose one of the following two assignments to complete this week. Do not do both assignments. Identify your assignment choice in the title of your submission.

**Option #1: Set Theory Option 1**

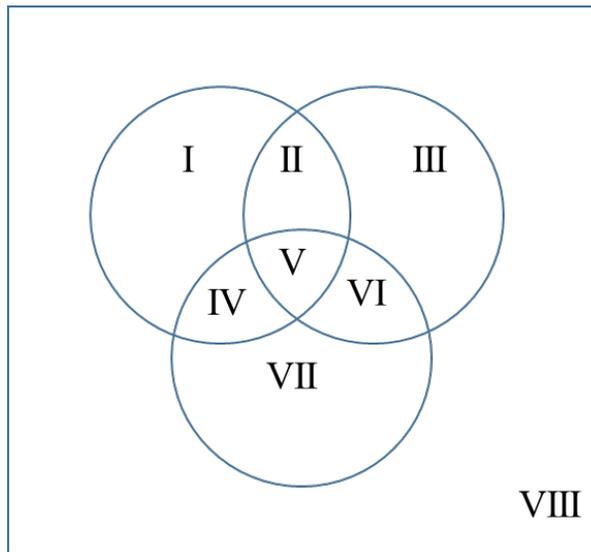
- Determine the number of subsets and proper subsets for each of the following
  - $\{\frac{1}{2}, \frac{1}{8}, \frac{1}{10}, \frac{1}{20}\}$
  - $\{x \mid x \text{ is a US coin worth less than a dollar}\}$
- A survey of 1000 American adults was taken to analyze their investments. Of those surveyed 650 had invested in stocks, 550 in bonds, and 400 in both stocks and bonds. Use a Venn diagram to answer the following questions.
  - How many invested in only stocks?
  - How many invested in stocks or bonds?
  - How many did not invest in either stocks or bonds?
- Use the Venn diagram to represent each set in roster form



- $(A \cap B) \cup C$
- $A \cap C'$
- $(A \cap C)'$

**Option #2: Set Theory Option 2**

- List the elements of each set
  - The set of all positive, even numbers less than or equal to 10.
  - The set of all letters in the word "AUSTRALIA."
  - The set of all whole numbers greater than 3 and smaller than 16, and divisible by 3.
- Use the Venn diagram below to answer the following questions.



- a) Which regions represent  $A \cap (B \cup C)$ ?
- b) Which regions represent  $C \cup (B \cap A)$ ?

3. Find the cardinal number for each of the following sets:
  - a)  $C = \{x \mid x \text{ is a month of the year that begins with the letter W}\}$
  - b)  $B = \{x \mid x \in \mathbf{N} \text{ and } 3 \leq x < 10\}$

## Module 2

### Readings

- Chapter 14 in *Thinking Mathematically*
- Gosling, E. (2012, 11 October). Artistic robots solve the travelling salesman's problem. *Design Week (Online)*.
- Zhao, H., & Kang, Q. (2015). Large sets of almost Hamilton cycle and path decompositions of complete bipartite graphs. *Graphs & Combinatorics*, 31(6), 2481-2491. doi:10.1007/s00373-014-1513-2.

**Opening Exercise (0 points)**

**Mastery Exercise (10 points)**

**Discussion (25 points)**

**Live Classroom (0 points)**

## Module 3

### Readings

- Chapter 8 in *Thinking Mathematically*

**Opening Exercise (0 points)**

**Discussion (25 points)**

**Mastery Exercise (10 points)**

**Live Classroom (0 points)**

**Critical Thinking: (90 points)**

Choose one of the following two assignments to complete this week. Do not do both assignments. Identify your assignment choice in the title of your submission.

**Option #1: Consumer Mathematics Option 1**

**Question #1 – Income Tax**

Compute the FICA taxes for a self-employed individual who make an annual net profit of \$153,000. If the same person's net income was reduced to \$103,000, what would be the FICA taxes for those earnings?

**Question #2 – Annuity Payment**

Jake is saving money for a down payment on a car. He needs \$1,800 in 10 months to make his down payment and is saving money in an annuity yielding an annual interest rate of 7% compounded monthly. If the annuity requires that Jake make monthly investments, what annuity payment must Jake make to save enough for his down payment?

**Question #3 – Mortgage Financing**

Paul wants a home that costs \$195,000. He wants to finance the home for 15 years with a 5% annual rate mortgage. He plans to pay \$60,000 as a down payment. Calculate his projected monthly mortgage payment.

**Option #2: Consumer Mathematics Option 2****Question #1 – Income Tax**

You would like to have extra spending money for the holidays, so you get a part-time job at your local discount store. The job pays \$15 per hour and you work 17 hours per week. Your employer with holds 11% of your gross pay for federal taxes, 5.65% for FICA, and 4% for state taxes. Given this information, answer the following questions. (Assume this is your only job.)

- What is your weekly gross pay?
- How much is withheld per week for federal taxes?
- How much is your net pay?
- What percentage of your gross pay is withheld for taxes?

**Question #2 – Annuity Earnings**

Ricky is saving money in an annuity earning 9% annual interest compounded monthly. If he deposits \$400 in the account every month for 10 years, what will the future value of his account equal? How much interest will he have earned?

**Question #3 – Mortgage Finances**

Richard and Mia purchased a home in Orlando Florida. A bank financed the purchase with a mortgage that included a 6% annual rate and 30-year term, costing the couple \$850/month. Calculate the amount of money the couple borrowed and the amount of interest will they pay over the life of the loan.

**Module 4****Readings**

- Chapter 13 in *Thinking Mathematically*, Sections 13.1-13.3
- Evrenk, H., & Sher, C. (2015). Social interactions in voting behavior: distinguishing between strategic voting and the bandwagon effect. *Public Choice*, 162(3/4), 405-423. doi:10.1007/s11127-015-0241-3

**Opening Exercise (0 points)****Discussion (25 points)****Mastery Exercise (10 points)**

### **Mid-Term Exam (150 points)**

This exam in MyMathLab will open at the start of Week 4 and close at the end of Week 4. You may access the pre-test prior to these dates. You are only given one attempt at the Mid-term Exam, ensure that you are prepared.

### **Module 5**

#### **Readings**

- Chapter 11 in *Thinking Mathematically*, Sections 11.1 – 11.3

#### **Opening Exercise (0 points)**

#### **Discussion (25 points)**

#### **Live Classroom (0 points)**

#### **Mastery Exercise (10 points)**

#### **Critical Thinking: (90 points)**

Choose one of the following two assignments to complete this week. Do not do both assignments. Identify your assignment choice in the title of your submission.

#### **Option #1: Counting Principles Option 1**

##### **Question #1**

Five Card Draw is a poker game in which each player is dealt an initial hand of five cards from a 52-card deck. How many unique five-card hands are possible?

##### **Question #2**

A basketball team has 16 women on the roster. In how many ways can the coach choose a roster consisting of five different positions?

##### **Question #3**

How many four-letter words (nonsense words included) can be created from the letters in *thunderclap* if repetition of letters is not allowed?

#### **Option #2: Counting Principles Option 2**

##### **Question #1**

A door lock code consists of four letters followed by four digits. Only upper case letters A to E and numbers 1 to 6 can be used. If letters and numbers cannot be repeated, how many different door codes are possible?

##### **Question #2**

A teacher wants to give an eight-question quiz with questions she can pull from a pool of 30 questions. How many quizzes, with different questions, can she make from the pool of 30 questions?

##### **Question #3**

In a 5K race to support cancer research, prizes are given to first- through fourth-place finishers. If 75 people run the race, how many possible ways can first through fourth place be rewarded?

### **Module 6**

#### **Readings**

- Chapter 11 in *Thinking Mathematically*, Sections 11.4, 11.6 – 11.8
- Hand, D. J. (2014). Never say never. *Scientific American*, 310(2), 72.

**Opening Exercise (0 points)**

**Discussion (25 points)**

**Mastery Exercise (10 points)**

**Critical Thinking: (100 points)**

Choose one of the following two assignments to complete this week. Do not do both assignments. Identify your assignment choice in the title of your submission.

**Option #1: Probability Option 1**

**Question #1**

Four cards are chosen from a 52-card deck. What is the probability that four cards are either face cards or aces? There are 12 face cards and four aces in a deck of cards.

**Question #2**

You have purchased a used car. Historically, the chance of spending \$2,000 in repairs for the car is 72% and the chance of spending \$3,000 is 28%. What is the expected value of the amount you will spend in repairs for the car?

**Question #3**

Foreign soccer leagues often test their athletes for using illegal performance-enhancing drugs. The probability that an athlete has used these drugs is 0.27. The probability that the athlete has used drugs and has been playing for more than five years is 0.19. Find the probability that an athlete uses drugs given that the athlete has been playing for more than five years.

**Option #2: Probability Option 2**

**Question #1**

For a local retail store, the number of customers entering per hour and their corresponding probabilities are shown in the table below.

Probability	0.5	0.3	0.2
Customers	20	30	40

Given the table shown, what is the expected value of the number of customers entering the store per hour?

**Question #2**

The probability of being dealt two pairs in a five-card poker hand is 0.0475. What are the odds of being dealt two pairs?

**Question #3**

The odds of winning a game of Goldfish is 3 to 5 against your opponent. What is the probability that you win the game?

**Module 7**

**Readings**

- Chapter 12 in *Thinking Mathematically*, Sections 12.1 – 12.3

- Watson, J. (2014). What is 'typical' for different kinds of data? *Australian Mathematics Teacher*, 70(2), 33-40.

**Opening Exercise (0 points)**

**Discussion (25 points)**

**Live Classroom (0 points)**

**Mastery Exercise (10 points)**

## **Module 8**

### **Readings**

- Chapter 12 in *Thinking Mathematically*, Sections 12.4 – 12.6
- Above the curve: Six Sigma learning beings at home. (2005). *Industrial Engineer*, 37(11), 36.
- Kohen, D. E. (2010). Asthma and school functioning. *Health Reports*, 21(4), 35-45.

**Opening Exercise (0 points)**

**Discussion (25 points)**

**Mastery Exercise (10 points)**

**Final Exam (200 points)**

This course requires that you complete a Final Exam that covers the material represented in the entire course. To best prepare for the Final, review the Check Your Understanding (CYU) exercises and Opening Exercises. You have only one shot at the Final Exam. This exam in MyMathLab will open at the start of Week 8 and close at the end of Week 8. You may access the pre-test prior to these dates. You are only given one attempt at the Final Exam, ensure that you are prepared.

## **COURSE POLICIES**

<b>Grading Scale</b>	
A	95.0 – 100
A-	90.0 – 94.9
B+	86.7 – 89.9
B	83.3 – 86.6
B-	80.0 – 83.2
C+	75.0 – 79.9
C	70.0 – 74.9
D	60.0 – 69.9
F	59.9 or below

### **Course Grading**

20% Discussion Participation  
 0% Opening Exercises  
 0% Live Classroom  
 8% Mastery Exercises  
 37% Critical Thinking Assignments  
 35% Midterm and final Exams

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## IN-CLASSROOM POLICIES

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For information on late work and incomplete grade policies, please refer to our [In-Classroom Student Policies and Guidelines](#) or the Academic Catalog for comprehensive documentation of CSU-Global institutional policies.

### **Academic Integrity**

Students must assume responsibility for maintaining honesty in all work submitted for credit and in any other work designated by the instructor of the course. Academic dishonesty includes cheating, fabrication, facilitating academic dishonesty, plagiarism, reusing /re-purposing your own work (see *CSU-Global Guide to Writing and APA Requirements* for percentage of repurposed work that can be used in an assignment), unauthorized possession of academic materials, and unauthorized collaboration. The CSU-Global Library provides information on how students can avoid plagiarism by understanding what it is and how to use the Library and Internet resources.

### **Citing Sources with APA Style**

All students are expected to follow the *CSU-Global Guide to Writing and APA Requirements* when citing in APA (based on the APA Style Manual, 6th edition) for all assignments. For details on CSU-Global APA style, please review the APA resources within the CSU-Global Library under the “APA Guide & Resources” link. A link to this document should also be provided within most assignment descriptions in your course.

### **Disability Services Statement**

CSU-Global is committed to providing reasonable accommodations for all persons with disabilities. Any student with a documented disability requesting academic accommodations should contact the Disability Resource Coordinator at 720-279-0650 and/or email [ada@CSUGlobal.edu](mailto:ada@CSUGlobal.edu) for additional information to coordinate reasonable accommodations for students with documented disabilities.

### **Netiquette**

Respect the diversity of opinions among the instructor and classmates and engage with them in a courteous, respectful, and professional manner. All posts and classroom communication must be conducted in accordance with the student code of conduct. Think before you push the Send button. Did you say just what you meant? How will the person on the other end read the words?

Maintain an environment free of harassment, stalking, threats, abuse, insults or humiliation toward the instructor and classmates. This includes, but is not limited to, demeaning written or oral comments of an ethnic, religious, age, disability, sexist (or sexual orientation), or racist nature; and the unwanted sexual advances or intimidations by email, or on discussion boards and other postings within or connected to the online classroom. If you have concerns about something that has been said, please let your instructor know.