



GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 105 QUANTITATIVE REASONING - FALL 2011

Learning Objectives

Students will correctly and confidently interpret, transform, and create quantitative information in a variety of personal, professional, and societal contexts to solve problems, understand phenomena, draw conclusions, and make decisions.

Quantitative information is conveyed by numbers, measurements, estimates, computations, data, statistics, probabilities, proportions, rates, graphs, tables, maps, diagrams, equations, functions, statistical inferences, assumptions, inductive arguments, and logical arguments.

Students will improve problem solving, communication, collaboration, and professionalism skills.

Instructor

David Housman, SC 117, dhousman@goshen.edu, 535-7405, 875-0339 (home)
Office hours posted on office door and at <http://people.goshen.edu/~dhousman/Schedule11Fall.htm>

Class Time

MWF 2:00-2:50 a.m. in SC 107.

Textbooks

Using and Understanding Mathematics: A Quantitative Reasoning Approach, 5/E, by Jeffrey O. Bennett & William L. Briggs, Pearson, 2011, ISBN-13: 9780321652799 (required).

Student Study Guide and Solutions Manual for Using and Understanding Mathematics, 5/E, by Jeffrey O. Bennett & William L. Briggs, Pearson, 2011, ISBN-13: 9780321652973 (recommended).

On-line

<https://moodle.goshen.edu>.

Technology

A scientific calculator (with keys for trigonometric, exponential, and logarithmic functions), which can be purchased for less than \$20 or may come free on a cell phone. Some software, such as Excel or WolframAlpha, may be used but are available on all campus computers.

Notebook

A three-ring binder with loose-leaf lined and graph paper is recommended so that you can keep a written record of problem solving attempts, questions, math discoveries, and skill assessments.

Activities

The study of mathematics is not a spectator sport! Reading, listening, solving problems, writing explanations, reflecting upon ideas, and receiving feedback are essential to learning mathematics. An average student can obtain an average grade with an average of nine hours each week devoted to this course—adjust if you are not average or desire a grade that is not average.

Before class: read the text in an anticipatory fashion, attempt the suggested exercises, and write down questions you have.

During class: share understandings with peers, actively listen, engage in activities, and ask your unanswered questions.

After class: complete the assigned exercises. If needed, seek assistance from peers, tutors, or the instructor. Check the posted solutions when a perfect score is not achieved.

Grading

Course grades will be based on performance in the following activities.

Activity	Weight
A1. Logic and Problem Solving Assignments	10%
E1. Logic and Problem Solving Exam	10%
A2. Quantitative Information in Everyday Life Assignments	10%
E2. Quantitative Information in Everyday Life Exam	10%
A3. Probability and Statistics Assignments	10%
E3. Probability and Statistics Exam	10%
A4. Modeling Assignments	10%
FE. Final Exam	15%
MP. Miniprojects	15%

If helpful, E1, E2, E3, and/or FE grades will replace A1, A2, A3, and/or the minimum of the E1, E2, and E3 grades. Final numerical averages will be translated into letter grades in the following manner.

Minimum Percentage	93	90	87	83	80	77	73	70	67	60	0
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F

Assignments Achieve and exhibit understanding by completing exercises after almost every class. Solve each exercise on paper before submitting your answer on line. Determine the error in your thinking if marked incorrect and then resubmit a revised answer without penalty. It can be beneficial to collaborate but make sure you could solve similar problems on your own.

Exams Exhibit your ability to use quantitative techniques in well-defined contexts and without assistance or collaboration. There will be an in-class portion and may be a take-home portion.

Miniprojects Find examples from the news or from daily life of the ideas presented in a chapter. This requires application of the knowledge obtained from the text, class, and exercises.

Extra Credit Find errors in the text or posted course materials, attend a quantitative presentation (e.g., Science Speakers), or participate in a quantitatively based activity (e.g., Math Problem of the Week) to receive extra credit toward your miniprojects grade.

Topic	Chapters	Exam Date
Logic and Problem Solving	1 – 2	Monday, September 19
Quantitative Information in Everyday Life	3 – 4	Wednesday, October 12
Probability and Statistics	5 – 7	Monday, November 14
Modeling	8 – 10	Monday, December 5
Everything	1-10	Thursday, December 8, 8-10am

Academic Resource & Writing Center and Disabilities Goshen College wants to help all students be as academically successful as possible. If you have a disability and require accommodations, please contact Lois Martin, the Director of the Academic Resource & Writing Center early in the semester. In order to receive accommodations, documentation concerning your disability must be on file with the Academic Resource & Writing Center, Good Library 113, x7576, lmartin@goshen.edu. All information will be held in the strictest confidence. The Academic Resource & Writing Center offers tutoring and writing assistance for all students. For further information please see <http://www.goshen.edu/studentlife/asc.php>.

Collaboration and Academic Integrity You are encouraged to use all available resources in order to learn the concepts and techniques discussed in this course. In particular, conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.

For assignments and miniprojects, you may look at and discuss another student's work, but any written work developed during collaboration with another student should be destroyed before writing your own solutions. You should give written acknowledgement to people with whom you have had discussions and to any written materials (other than the text) that were helpful.

For exams, you may *not* use any resources unless a specific exception is stated by the instructor.

Failure to observe the above rules will result in a zero on the assignment, miniproject, or exam. Any violation of academic integrity will be reported to the Academic Dean.

Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.

Placement Advice All students need to establish mathematics competency. This can be done with a SAT math score of 550 or higher, an ACT score of 23 or higher, college credit in a 100 or higher level mathematics course, a passing score (60% or higher) on the Goshen College math competency exam, or passing Math 105. If you are unlikely to take more math courses, Math 105 is a good course to take.

If you plan to take more mathematics courses (say, you want to major in business or science), then you should think about Math 141 Finite Mathematics (a good course for business majors) or Math 170 Precalculus (a good course for science majors).

All students must meet a mathematics and science general education requirement. Math 105 does not meet this requirement. However, Math 141 or Math 170 would count. It is also possible to meet this requirement by taking no additional math course (e.g., by taking Biol 100 and Phys 100).

**Exam 1
Learning
Objectives**

1. Identify an argument's premises and conclusions.
2. Recognize fallacious arguments and describe their logical flaws.
3. Recognize whether an argument is inductive or deductive.
4. Evaluate inductive arguments in terms of strength.
5. Evaluate deductive arguments in terms of validity and soundness.
6. Identify units and use appropriate units for length, area, volume, weight, mass, energy, power, density, and concentration.
7. Work with units to check answers and help solve problems.
8. Estimate lengths, volumes, and weights in metric units.
9. Convert between United States customary system and metric system units.

**Exam 2
Learning
Objectives**

1. Calculate and use absolute/relative change/difference to solve problems.
2. Obtain reasonable estimates of quantities using simple calculations involving other quantities obtained from basic knowledge of the world.
3. Identify random and systematic errors in measurement.
4. Report and interpret absolute/relative error in a quantity.
5. Write and interpret numbers in scientific notation.
6. Apply rounding rules for combining approximate numbers.
7. Calculate simple conditional probabilities, and recognize the difference between drug test accuracy and the probability of disease given a positive test result.
8. Use index numbers, such as the Consumer Price Index, to make comparisons.
9. Understand how to make a budget.
10. Prorate income and expenses over one time interval to another time interval.
11. Understand different investment types: stock, bond, cash.
12. Calculate compound interest on a single transfer and regular transfers.
13. Calculate total and annual return.
14. Calculate the payment for a standard loan.
15. Understand the uses and dangers of credit cards, strategies for early payment of loans, and considerations in choosing a mortgage.

**Exam 3
Learning
Objectives**

1. Understand the process of a statistical study.
2. Determine whether a sample is likely to be representative or not of a population.
3. Find margins of error and confidence intervals for proportions and means.
4. Interpret and create frequency tables, bar graphs, pie charts, and histograms.
5. Interpret multiple bar graphs, stack plots, contour maps, box plots, and other media graphs.
6. Create and interpret scatter diagrams and best fit lines.
7. Understand possible explanations for correlation and additional evidence required to prove causality.
8. Calculate and interpret mean, median, quartiles, and standard deviation.
9. Estimate the mean, percentiles, and standard deviation from a histogram, and sketch a histogram from a mean and standard deviation.
10. Conduct a hypothesis test involving a population proportion or mean.
11. Distinguish among theoretical, empirical, and subjective probabilities.
12. Determine theoretical probabilities via systematic enumeration.
13. Understand risk in terms of accident or death rates.

**Final Exam
Learning
Objectives**

1. Exam 1, 2, and 3 learning objectives.
2. Interpret, solve problems with, and translate among line graphs, constant absolute rate of change verbal descriptions, and symbolic linear functions.
3. Use and manipulate linear equations to solve problems.
4. Interpret, solve problems with, and translate between constant relative rate of change verbal descriptions and symbolic exponential functions.
5. Know and use area and perimeter formulas for two-dimensional figures.
6. Know and use area and perimeter formulas for three-dimensional figures.
7. Understand the implications of the surface-area-to-volume ratio.

- M1 Arguments** Find a passage (roughly 1-4 paragraphs) in an article or opinion piece in a recent (2011) newspaper or magazine in which an argument is made.
- In the passage, identify the premises and conclusion of the argument and analyze the strength, validity, and soundness of the argument. The analysis should include whether the argument illustrates a fallacy, contains hidden assumptions, and is deductive or inductive.
- M2 Units** Find one or two passages from a recent (2011) newspaper or magazine that contain two measurements of different attributes (e.g., length, volume, mass, time, temperature, money, or energy).
- Include four questions of the form (change the phrases in angle brackets appropriately): (1) For <first measurement number>, what is being measured, what units are used, and how was the measurement obtained? (2) <a reasonable question that uses the first measurement in a calculation>. (3) For <second measurement number>, what is being measured, what units are used, and how was the measurement obtained? (4) <a reasonable question that uses the second measurement in a calculation>.
- Answer your four questions.
- M3 Numbers** Find one to three short passages from a recent (2011) newspaper or magazine that contain a (1) percentage, (2) absolute or relative change, and (3) a large or small number.
- Include (1) an explanation of the meaning of the percentage and how it was calculated; (2) an explanation of the meaning of the absolute or relative change, how it was calculated, and a calculation of the other type of change; and (3) a comparison that helps place the large or small number in perspective.
- M4 Credit** Find a credit card solicitation on the internet.
- Include (1) url for the web page, (2) name of the bank and credit card, (3) the APR for purchases after any introductory period, (4) whether the APR is fixed or could vary, (5) how the minimum payment is calculated, and (6) a schedule of payments and the total amount paid to pay off a \$200 purchase if you only pay the minimum amount each month.
- M5 Statistical Study** Find a passage (roughly 2-4 paragraphs) in a recent (2011) newspaper or magazine that describes a statistical study.
- Include an evaluation of the description and study based on all eight guidelines for evaluating a statistical study (Unit 5B).
- M6 Experiment** (1) Choose an experiment. Carry out the experiment a few times for practice and to set up a consistent procedure. Describe your experiment in your report. (2) Carry out your assigned experiment at least 30 times, recording the data. (3) Rewrite your data in ascending order. (4) Draw a histogram of your data on graph paper. Remember to label your axes and include a title. Choose your scale so that the histogram fills about half of the piece of paper. (5) Determine the five-number summary (minimum, first quartile, median, third quartile, and maximum). (6) Draw a box plot underneath your histogram using the same horizontal scale. (7) Calculate the mean (m) and standard deviation (s). (8) Draw vertical marks below your histogram at m , $m - s$, $m + s$, $m - 2s$, and $m + 2s$. (9) Determine the percentage of your data that is between $m - s$ and $m + s$. Determine the percentage of your data that is between $m - 2s$ and $m + 2s$. Compare with the 68-95-99.7 rule for normal distributions. (10) Find the z-scores of your first and last (not necessarily smallest and largest) measurements. (11) Describe the population and the variable. (12) Calculate the margin of error for the population mean and explain its meaning.
- M7 Models** Find four recent (2011) news stories that describe quantities having a (1) linear relationship, (2) exponential relationship, (3) periodic relationship, and (4) any relationship of your choice. For each news story, provide (1) an appropriate citation, (2) a short quote describing the quantities, and (3) a description of the type of relationship.
- M8 Geometry** For each of the following measurements and calculations, state your answers with appropriate units and precision. (1) Our classroom is roughly a box. Find the length, width, and height of our classroom. Find the perimeter and area of the floor. Find the surface area and volume of our classroom. (2) A can is roughly a right circular cylinder. Describe the can measured. Find the diameter, radius, and height of the can. Find the area of the top of the can. Find the surface area and volume of the can. (3) A ball is roughly a sphere. Describe the ball measured. Find the circumference, diameter, and radius of the ball. Find the surface area and volume of the ball.