

SINCLAIR COMMUNITY COLLEGE
DAYTON, OHIO

DEPARTMENT SYLLABUS FOR COURSE IN

MAT 1445 - QUANTITATIVE REASONING
(3 Credit Hours)

- I. COURSE DESCRIPTION: The course will explore various applications of mathematics in the social, finance, health and environmental fields with emphasis on developing informational, technological, logical, and visual reasoning skills. Topics from numeracy, probability and statistics, finance, mathematical modeling with linear, statistical, and exponential functions, and other areas of mathematics will be covered. Note: Students who have not completed the required pre-requisite courses listed, but have successfully completed DEV 0028 with a grade of C or better, can register for MAT 1445 together with the co-requisite course MAT 0445, Quantitative Reasoning Booster.
- II. COURSE OBJECTIVE:
- Reason using the language and structure of statistics to investigate, represent, and solve applied problems requiring data analysis.
 - Integrate, analyze and synthesize ideas from multiple disciplines to find rational solutions to problems; manipulate symbols from a variety of systems such as visual, verbal, mathematical and logical.
 - Reason using the language and structure of algebraic modeling, linear, exponential and multivariate, to investigate, represent, and solve applied problems.
 - Apply the concepts of numeracy to investigate and describe quantitative relationships and solve problems in a variety of contexts.
 - Appended at the bottom of the document are more specific mathematical outcomes
- III. PREREQUISITE: A grade of “C” or better in MAT 1340, or MAT 1270 or a satisfactory score on the mathematics placement test
- IV. COURSE OUTLINE:
- Investigation of numeracy with applications in personal and community decision making
 - Investigation of amortization and interest with applications in personal finance
 - Investigation of descriptive and inferential statistics
 - Investigation of probability and conditional probability with applications in scientific studies and medical risk
 - Investigation of statistical center, spread and shape, and hypotheses, sampling, and graphs with applications in scientific studies including spreadsheets
 - Investigation of linear modeling including piecewise and multi-equation models
 - Investigation of exponential modeling including piecewise models with applications in personal finance

- Investigation of multivariate modeling including financial spreadsheets

III. TEXT: **Quantitative Reasoning Course Packet**
Sinclair Community College Bookstore
Note on text: Text consists of daily lessons developed by The Carnegie Foundation for the Advancement of Teaching, Stanford CA and online access code.

IV. CALCULATOR A scientific calculator is required.

V. PREPARED BY: Jim Willis
Date: September, 2016
Effective: Spring 2017

SINCLAIR COMMUNITY COLLEGE
 DAYTON, OHIO
 CLASS SCHEDULE FOR COURSE IN
 MAT 1445 - QANTITATIVE LITERACY
 (4 Credit Hours)

CLASSES MEETING TWO TIMES A WEEK

Period	Section	Topics (Main Math Topic)
1	---	Introduction to the Class
	5.1	Numbers, Numbers, Everywhere; Topic: Quantitative Literacy as a skill
2	5.2	Millions, Billions, or Trillions? Topic: Estimating with large numbers
	5.3	The Great Pacific Garbage; Topic: Scaling factors and area unit conversion
3	5.3	The Great Pacific Garbage; Topic: Scaling factors and area unit conversion
	5.4	A Trillion Dollars of Student Loans; Topic: Interest rates and estimation
4	5.5	Computing and Interpreting Percentages; Topic: Calculating with percentages
	5.6	Measuring Risk and Changes in Risk; Topic: Absolute and relative change, percentages
5	5.6	Measuring Risk and Changes in Risk; Topic: Absolute and relative change, percentages
	5.7	Reading a Scientific Study; Topic: Understanding designs of statistical studies
6	5.8	Investigating Causes of Homelessness; Topic: Critical analysis of statistical studies
7	5.9	Measuring Success; Topic: Reading and interpreting visual displays of data
8	5.10	Media Piracy; Review and synthesis of Module 5
9		<i>Review Module 1 for Exam ONE</i>
10		Module 5 Assessment
11	6.1	Screening Tools - How Effective Are They? Topic: Sensitivity of screening tools
	6.2	Rising Gasoline Prices; Topic: Spreadsheet, data; CPI compare cost over time
12	6.2	Rising Gasoline Prices; Topic: Spreadsheet, data; CPI compare cost over time
	6.3	At Risk for Homelessness; Topic: Reading, interpreting, and creating bar and pie charts
13	6.4	A Closer Look at Screening Tools; Topic: Two-way tables, sensitivity and specificity
	6.5	Tax Targets; Topic: Reading, creating statistical graphs of quantitative data, histograms
14	6.5	Tax Targets; Topic: Reading, creating statistical graphs of quantitative data, histograms
	6.6	Average Expectations; Topic: Measures of central tendency, data distribution
15	6.7	Weighted Averages; Topic: Weighted averages
	6.8	Rising Temperatures Across the United States; Topic: Standard deviation
16	6.8	Rising Temperatures Across the United States; Topic: Standard deviation
	6.9	Gender Differences in Mathematics; Review and synthesis of Module 6

MAT 1445 - QANTITATIVE LITERACY
TWO DAYS A WEEK SECTIONS CLASS SCHEDULE (continued)

Period	Section	Topics (Main Math Topic)
17		Review for EXAM TWO
		Module 6 Assessment
18	7.1	Measuring The Best; Topic: Introduction to Mathematical Models, Equations, Variables
19	7.2	Overview of Linear Models; Topic: Linear models: words, tables, graphs, and equations
20	7.3	Four Equation, Two Models; Topic: Linear and piecewise models, points of intersection
21	7.4	Linear Trends; Topic: Approximating data with linear models
22	7.5	Remembering Exponential Models; Topic: Exponential models
23	7.6	Social Security for Me; Topic: Modeling situations with exponential equations
24	7.7	There's No Place Like Home; Review and Synthesis of Chapter 7
		Review for EXAM THREE
25		Module 7 Assessment
26	8.1	Body Mass Index and other Health Numbers Topic: Understanding and using multi-variable mathematical models
27	8.2	The Trillion Dollar Debt Topic: Using spreadsheets to calculate time value of money especially with large numbers over a long time period.
28	8.3	Comparing Car Loans Main Math Topic: Using common financial equations to investigate options and the impact of various variables.
29	8.4	Predicting the Weather Main Math Topic: Investigating mathematical models that are neither linear or exponential including graphs, tables, and verbal descriptions of the model when an equation is not readily available.
30	8.5	Review and Synthesis of Module 8
		Review for EXAM FOUR
31		Module 8 Assessment
32		Final Exam or Review

Specific Mathematical Outcomes MAT 1445 Quantitative Literacy

Module 5

Students are able to:

- find their own examples of how numbers are reported in the media and consider the mathematical skills necessary to make sense of those numbers.
- estimate the approximate size of the product of several large quantities.
- use the Consumer Price Index and proportional reasoning to adjust dollar amounts for inflation.
- compare the US national debt at various times in history by both 1) adjusting for inflation and 2) expressing the debt as a percentage of the Gross Domestic Product.
- compute a scaling factor between two quantities having the same dimension.
- use a scaling factor to convert units in a variety of contexts.
- compute estimations related to personal budget/finance issues.
- estimate the total interest charged on a loan.
- estimate monthly payments for a variety of loans.
- determine if an estimate is an under-estimate or over-estimate.
- compute the absolute and relative change between two quantities (including rates).
- correctly compare quantities using both absolute and relative change (including rates).
- represent chances or probabilities by both percentages and ratios.
- interpret statements in medical studies about death rates and survival rates.
- compute death rates and survival rates given appropriate information.
- compare death rates and survival rates using absolute changes, relative changes, and ratios
- identify the hypothesis being tested by a scientific study.
- identify the sample and population of a study.
- identify control and experimental groups in a study.
- read an article that uses quantitative information to make arguments.
- ask questions in order to better understand the numbers being used.
- determine the sample size of a statistical study and determine the population that was studied (assuming this information is given in the article).
- come up with possible biases and confounding variables in statistical studies.
- apply a short checklist of issues to consider when critically evaluating a graph
- use statistics from a media report and/or graph to create new statistics
- discuss how changing the reference value changes the percentage and why paying attention to reference values is important.

Module 6

Students are able to:

- interpret the meaning of a screening tool's sensitivity and specificity
- use the Consumer Price Index to convert nominal dollars to constant dollars.
- construct spreadsheets using basic formulas (such as ABS, AVERAGE, COUNTIF).

- read bar charts and pie charts
- interpret the story behind bar charts and pie charts.
- create their own bar and pie charts by hand and using Excel (or another spreadsheet software package).
- correctly interpret phrases or statements referring to conditional probabilities.
- calculate different types of conditional probabilities with information in a two-way table (contingency table). These conditional probabilities include: specificity, sensitivity, false positive rate, false negative rate.
- create a two-way table to model the effectiveness of a screening tool.
- recreate bar graphs or histograms by changing the “bin” size of the bars.
- create a tax plan to raise the required amount of revenue.
- consider if a mean or median would more accurately represent a set of data.
- thoughtfully interpret uses of the terms “average,” “mean,” or “median” in authentic contexts.
- compare the mean and median for a set of data. Then, make conclusions about the spread of the data
- calculate the weighted average of a set of numbers.
- construct an expression for a weighted average problem.
- find the missing piece of information if the weighted average is known.
- use a spreadsheet to compute the mean and standard deviation of a data set.
- use the standard deviation to describe the spread of a data set.
- use the mean and standard deviation to describe how extraordinary a single datum (data point) is.
- use the means and standard deviations of multiple datasets to compare data values between these two datasets.
- synthesize or combine the tools taught in Module 6 by applying it to one problem.
- understand that a theoretical model may not be supported by data.

Module 7

Students are able to:

- define what is meant by the term “variable”.
- describe what a mathematical model is.
- identify the possible variables which may be used to model a given scenario.
- use a given mathematical model to make comparisons.
- create a table, graph and/or equation from a verbal description of a linear model.
- move freely between the four different modes of looking at linear models (words, tables, graphs and equations).
- find and interpret the slope of a linear model from the four different representations.
- find and interpret the horizontal and vertical intercepts of a linear model from the four different representations.
- create and use piecewise linear models.
- set two linear expressions equal to each other and solve the resulting linear equation.
- interpret the slope and y-intercept in context from an equation or a graph.
- understand when a linear model is appropriate as a model for data.
- Use a spreadsheet to create a scatterplot and linear regression model from data.

- be able to set up and refine algebraic equations for exponential models for various growth and decay situations.
- discuss similarities and differences between linear and exponential models.
- use at least one strategy to “solve” an exponential equation.
- create exponential models with given half-lives.
- investigate *when* an exponential model will reach a give value.
- quantify error in predictive values based on changes in initial assumptions.
- distinguish between appreciation and depreciation of home values.
- construct exponential growth and decay models of home values over time.
- graphically represent and interpret exponential piecewise models

Module 8

Students are able to:

- Use a multivariate mathematical model to estimate a value.
- understand precision, including how small changes in initial assumptions can effect large changes later on.
- understand and re-interpret Excel notations, such as scientific notation, symbols for exponentiation, etc.
- use spreadsheet software to calculate monthly loan payments for a given loan principal.
- calculate the total amount of interest being charged on an installment loan.
- articulate the advantages and disadvantages associated with shorter and longer loan periods.
- identify characteristics and differences in visual models.
- identify when a model is neither linear nor exponential.
- create visual models based on data and information.
- describe or draw conclusions about a given model.
- compare multiple modeled data sets.
- read a hypnogram.