## Course Submission Form

**Instructions: All courses submitted for the Common Core must be liberal arts courses. Courses submitted to the Course Review Committee may be submitted for only one area of the Common Core and must be 3credits/3contact hours. Colleges may submit courses to the Course Review Committee before or after they receive college approval. STEM waiver courses do not need to be approved by the Course Review Committee. This form should not be used for STEM waiver courses.**

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**Current Status** Approved **Course Selected:** **Subject** MATH (MATH - Mathematics) **Catalog Nbr** 120

### Course Revision & College

**Form Submission** Revised Submission **College** Guttman CC

**Please describe revisions that have been made to this course** In response to the response to the reviewers' comments: "There is no trigonometry in the sample course schedule, despite the course title and LOs. (Lack of trig emphasized by several reviewers.)" Response: Addressed by adding both right triangle trig and unit circle trig to the syllbus. Deleted in class work on project to make time for this.

"This course appears to be an algebra survey course." Response: Yes, it is. The name of the course is "College Algebra & Trigonometry."

"The sample course schedule should include more details about homework problems from the textbook, as well as about the semester- long project and applications mentioned." Response: Added required problems to the Sample course schedule and included a sample project after the sample course schedule. The applications are included in the problems that are included as samples in the submission form.

"In the responses to the LOs, it would be helpful to reference specific examples from the assignments." Response: There was previously one sample problem in each response but it wasn't specifically labeled as to where it came from. I have added an additional problem to each response and have labeled each problem with the chapter and problem number. All problems that are included are found in the required problems that are now part of the sample schedule.

"Syllabus grading scale exceeds 100%." Response: Fixed. It now adds to 100%. I decreased the attendance and participation by 5%.

"Please explain more about participation in terms of course assessment." Response: I added the word in-class in front of the participation in the Assessment section so it now reads Attendance and in-class Participation and decreased the weighting of it to 5%. I also changed the Assignments section to Assignments and Participation and added the following paragraph: 'Participation: Active participation in listening, speaking, and completing group and individual work in each class session is expected. Active respectful class participation is as much about listening to and engaging the ideas of others as it is about speaking one's own mind. If you are not respecting other people in the classroom you may be asked to leave the room.'

### Course Data

**Course ID** 119568 **Subject** MATH (MATH - Mathematics) **Catalog Nbr** 120

**Catalog Status** Approved **Contact Hours** 4 **No. of Credits** 3

**CourseTitle** College Algebra & Trigonometry

**Course Description** This course serves to prepare students for the mathematics required in the majors and launch them on a trajectory to calculus. Algebraic concepts and skills are developed through the study of functions. Verbal, numerical, and graphical representations of functions are employed throughout, with strong emphasis placed on the relationship between a function's algebraic properties and its graph. Topics include linear and quadratic equations; systems of linear equations; linear inequalities; radical equations; rational functions; absolute value; factoring polynomials; an introduction to trigonometric, exponential, and logarithmic functions; rates of change; and modeling realistic situations with functions. Graphing calculators and software such as Microsoft Excel, GeoGebra, and Maple will be incorporated into all aspects of the course. Students will design and carry out a semester-long project involving algebraic analysis of a pressing issue currently facing New York City.

**Department** Stella and Charles Guttman Community College

**Pre-Requisites/Co-Requisites** Demonstration of Basic Algebra Proficiency & either MATH 103 or MATH 103A & MATH 103B and MATH 100A

**Course Syllabus [Attachment Filename(s)]**

Math_120_Syllabus_for_Pathways.docx

**Location(Required or Flexible) and Learning Outcomes**

| REQUIRED | | FLEXIBLE |
|---|---|---|
| | **English Composition** | **World Cultures & Global Issues** |
| ☑ | **Math & Quantitative Reasoning** | **US Experience in its Diversity** |
| | **Life and Physical Sciences** | **Creative Expression** |
| | | **Individual and Society** |
| | | **Scientific World** |

| Learning Outcomes: Questions | Learning Outcomes: Responses |
|---|---|
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| *** 1. Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables.** | Throughout the course, students are looking at multiple representations (equations, graphs and tables) of different types of functions and drawing inferences about the connections among the different representations and also about the real world situations that the functions can be used to model. Two sample problems are:<br><br>Section 3.2 Problem 14: Given a sketch of the graph of a quadratic function (without any values label on the axes) with equation of the form f(x) =a(x-r)(x-s) students are asked to determine whether the constants a, r, and s are positive, negative or zero.<br><br>Section 4.2 Problem 27: A city's electrical consumption, E, in gigawatt-hours per year is given by E=0.15/p^(3/2')<br>Where p is the price in dollars per kilowatt-hour charged.<br>a. Is E a power function of p? If so, identify the exponent and the coefficient.<br>b. Use the algebraic structure of the function to check if E is an increasing or decreasing function.<br>c. Explain what your answer to part b means in practical terms. |
| *** 2. Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems.** | A major focus of the course is developing students' ability to use algebraic and graphical techniques to solve linear, quadratic, exponential, and polynomial equations. Students are asked to do this both in and out of real-world contexts. Two sample problems are:<br><br>Section 2.6 Problem 59: A motel plans to build small rooms of size 250 sq. ft and large rooms of size 500 sq. ft, for a total area of 16,000 sq. ft. Also local fire codes limit the legal occupancy of the small rooms to 2 people and of the large rooms to 5 people, and the total occupancy of the entire motel is limited to 150 people.<br>a. Use linear equations to express the constraints imposed by the size of the motel and by the fire code.<br>b. Solve the resulting system of equations. What does your solution tell you about the motel?<br><br>Section 3.4, Problems 47 and 58: Solve the quadratic equations by any method, or state that there is no solution:<br>47. 2x(x + 1) = 5x(x ? 4)<br>58. (2x + 5)(x ? 3) = 7 |
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| *** 3. Represent quantitative problems expressed in natural language in a suitable mathematical format.** | Students do this as they use linear, quadratic, power, and exponential functions to model real world situations. Two sample problems are:<br><br>Section 2.5, Problem 26: In a dorm meal plan, you pay a membership fee; then all your meals are at a fixed price per meal. (a) if 100 meals cost $1125 and 160 meals cost $1440, write a linear function that describes the cost of a meal plan in terms of the number of meals. (b) What is the cost per meal and what is the membership fee? (c) Find the cost for 140 meals. (d) What is the maximum number of meals you can buy on a budget of $1545?<br><br>Section 6.2, Problem 32: Write an expression for a population at time t years if it is initially 2 million and is growing at a rate of 3% per year. |
| *** 4. Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form.** | Students are expected to share their problem solving processes orally with classmates during class and in written form on exams throughout the semester. They also complete a project in which they create a written report that uses mathematical models to help analyze a real world situation. See the syllabus for general criteria that the project must meet and for an example of a specific project that students would be asked to complete. |
| *** 5. Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation.** | Through the use of algebraic, graphical, and numerical methods of analyzing problems, students are expected to check the reasonableness of their solutions. As a matter of practice they are expected to check the reasonableness of all solutions that they find. Two sample problems that specifically ask students to check their work or estimations are:<br><br>Section 3.3, Problem 13: Write the expression (x + 3)^2 ? 1 in standard form and in vertex form. Then evaluate the expression at x = 0 and x = 3 using each of the three forms and compare the results.<br><br>Section 6.4, Problem 53: A lab receives 1000 grams of an unknown radioactive substance that decays at a rate of 7% per day. (a) Write an expression for Q, the quantity of substance remaining after t days. (b) Make a table showing the quantity of the substance remaining at the end of 8, 9, 10 , 11 and 12 days. (c) a lab worker says that the half-life of the substance is between 11 and 12 days. Is this consistent with your table? If not, how would you correct the estimate? |
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| *** 6. Apply mathematical methods to problems in other fields of study.** | Throughout the course students use mathematical models to analyze problems from a variety of fields of study. They are often asked to create models and then use them to make both conclusions and predictions. In addition to the examples provided above and the work on the project, here are two samples of the types of problems students complete:<br><br>Section 2.2, Problem 21: A company's profit after t months of operation is given by P(t) = 1000 + 500(t ? 4).<br>a. What is the practical meaning of the constants 4 and 1000?<br>b. Rewrite the function in the slope-intercept form and give the practical interpretation of the constants.<br><br>Section 3.4, Problem 71: A diver jumps off a diving board that is 6 ft above the water at a velocity of 20 ft/sec. For t > 0, in seconds, his height, s, in feet above the water can be modeled by s(t) = -16t^2 + 20t + 6.<br>a. How long is the diver in the air before he hits the water?<br>b. What is the maximum height achieved and when does it occur? |
| **A. If there is a change to the course title, what is the new course title?** | N/A |
| **B. If there is a change to the course description, what is the new course description?** | N/A |
| **C. If there is a change to the pre-requisites and/or co-requisites, what are the new pre-requisites and/or co-requisites?** | N/A |

| **Chair (Approver) Comments** |
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| **Comments** Approved. |

**Guttman Community College**
**MATH 120: College Algebra and Trigonometry**

Instructor:
Email:
Phone:
Course eportfolio:

Office:
Office Hours:

**Bulletin Description:**

This course serves to prepare students for the mathematics required in the majors and launch them on a trajectory to calculus. Algebraic concepts and skills are developed through the study of functions. Verbal, numerical, and graphical representations of functions are employed throughout, with strong emphasis placed on the relationship between a function's algebraic properties and its graph. Topics include linear and quadratic equations; systems of linear equations; linear inequalities; radical equations; rational functions; absolute value; factoring polynomials; an introduction to trigonometric, exponential, and logarithmic functions; rates of change; and modeling realistic situations with functions. Graphing calculators and software such as Microsoft Excel, GeoGebra, and Desmos will be incorporated into all aspects of the course. Students will design and carry out a semester- long project involving algebraic analysis of a pressing issue currently facing New York City.

**Prerequisites:** Demonstration of Basic Algebra Proficiency and either Math 103: Statistics or Math 103A: Statistics A and Math 103B: Statistics B

**Co-Requisites:** None

**Credits/Hours: 3 Credits/4 Hours**

**Course Learning Outcomes:**

- Students will correctly and efficiently carry out complicated numerical calculations, both with and without electronic devices.
- Students will correctly and efficiently carry out operations on algebraic expressions, both with and without electronic devices.
- Students will correctly and efficiently solve algebraic equations and inequalities, both with and without electronic devices.
- Students will use function notation correctly.
- Students will accurately graph an assortment of functions and obtain information about a function's behavior from its graph.
- Students will translate realistic situations into representative functions and use their representations to solve problems.
- Students will demonstrate an understanding of the properties shared by a family of functions (e.g., quadratic, exponential) and apply their understandings to solve problems.
- Students will distinguish expressions from equations and equations from inequalities.
- Students will demonstrate an understanding of the meanings of trigonometric functions as these functions arise from both circles and triangles.
- Students will successfully apply trigonometry to problems involving right triangles.

**Guttman Learning Outcomes:**
Upon successful completion of this course, you will be able to do the following:

*Intellectual Skills for Life-Long Learning*

c. Present accurate mathematical calculations and operations, and explains how they are used to solve problems and to interpret data.

f. Demonstrate ability to use appropriate technologies, acquire new ones and to resolve technology problems to meet academic, professional and personal goals

**Required Texts/Readings:**

- McCallum, Connally, Hughes-Hallet et al. Algebra: Form and Function, 2nd edition. (Wiley Binder Version). ISBN-13: 978-1-118-64078-4
  You will purchase the text directly through WIleyPlus at https://www.wileyplus.com/. In the process of purchasing the online access to the text and homework platform you will be given an opportunity to buy a downloadable or physical copy of the text if you would like one. Homework and online access to textbook is $80. The downloadable textbook is an additional $18 and the physical copy of the textbook is an additional $40.

**Required Materials:**

- Internet access

**Assignments and Participation**

**WileyPlus Problem Sets:** There will be weekly problem sets that you will complete on WileyPlus.

**Short Quizzes:** There will be a short quiz every other week. Quiz dates will be announced in class.

**Tests or Midterms:** There will be four tests during the semester. The tests will be given during class and will be completed individually. No make-up tests will be given unless prior arrangements are made and the reason for the absence was unavoidable.

**Final Exam:** The final exam will be cumulative over the whole semester and will be given during the final exam period.

**Project:** The project(s) will require students to model and analyze a real-world situation using at least two different types of functions.

Specifically, the Project will

- Require students to construct a model (function formula) using data and/or reasonable assumptions about the context.
- Require students to use function notation.
- Require students to graph functions and solve related equations/inequalities.
- Involve some type of writing that interprets and explains the mathematical work in context.
- Require students to use graphing or mathematical technology such as Desmos, GeoGebra, Excel, etc.

**Participation:** Active participation in listening, speaking, and completing group and individual work in each class session is expected. Active respectful class participation is as much about listening to and engaging the ideas of others as it is about speaking one's own mind. If you are not respecting other people in the classroom you may be asked to leave the room.

**Assessment**.
Your final grade will be based on attendance, participation in class, homework, quizzes, three midterm exams, a final exam and a semester-long project, which are worth the following percentages of your grade.

- Attendance + in-class Participation 5%
- Homework Assignments 20%
- Quizzes 10%

- Midterm Exams 30%
- Final Exam 20%
- Semester-long Project 15%

Overall grades will be based on the following scale:

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|---|---|---|---|---|---|
| A | 93% and up | A- | Between 90% and 93% | B+ | Between 87% and 90% |
| B | Between 83% and 87% | B- | Between 80% and 83% | C+ | Between 77% and 80% |
| C | Between 73% and 77% | C- | Between 70% and 73% | D+ | Between 67% and 70% |
| D | Between 60% and 67% | F | Below 60% | | |

*Incomplete Grades*: See policies in the student handbook regarding grades and incompletes. Incomplete grades will only be considered if the student was unable to complete the work for reasons beyond his or her control. The student must also have completed the majority of the work for the course and be passing the course when the work completed up to that point is taken into consideration.

**Sample Course Schedule with Selected Homework Problems (Your instructor will ask you to complete the problems below and will also assign additional problems.)**
**AQ= Additional Questions, GT = Go Turorial Question, R = Review Question, CT = ConcepTest Question**

| Class # | Topic | Textbook section(s) | Selected Homework Problems |
|---|---|---|---|
| 1 | Course introduction | | |
| 2 | What is a function? | 1.1 | 10, 11, 12, 28, 30, AQ 2 |
| 3 | Simplifying algebraic expressions | A.1, A.2 | A.1: 18, 24, 28, 32, AQ 3<br>A.2: 7, 14, 21, 52, 59, AQ 3 |
| 4 | Simplifying algebraic expressions<br>Quiz 1 | A.1, A.2 | |
| 5 | Solving equations and inequalities | B.1, C.1 | B1: 20, 26, 27, 48, CT 2<br>C1: 5, 10, 18, 22, 31, 37 |
| 6 | Solving equations and inequalities | B.1, C.1 | |
| 7 | Algebraic fractions | E.1 | 1, 2, 13, 16, 30, 33, 38, 45, 47, 51, AQ 2 |
| 8 | Functions and expressions | 1.2 | 18, 24, 41, 51, 70, AQ7 |
| 9 | Functions and equations | 1.3 | 16, 21, 22, 23, 35, 42, AQ 4 |
| 10 | Functions, modeling, and proportionality<br>Quiz 2 | 1.5 | 8, 23, 36, 43AQ 2, AQ 4 |
| 11 | Review | | |
| 12 | Test 1 | | |
| 13 | Introduction to linear functions | 2.1 | 15, 18, 27, 32, 42, 43 |
| 14 | Linear expressions | 2.2 | 5, 12, 14, 21, 51, 52, 54 |
| 15 | Linear equations<br>Quiz 3 | 2.3 | 3, 30, 42, 44, 49, 74 |

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|---|---|---|---|
| 16 | Modeling with linear functions | 2.4, 2.5 | 2.4: 3, 5, 15, 20, 40<br>2.5: 15, 20, 23, 26 |
| 17 | Project work | | |
| 18 | Systems of linear equations | 2.6 | 21, 27, 34, 51, 56, 59 |
| 19 | Review | | |
| 20 | Test 2 | | |
| 21 | Quadratic functions and expressions | 3.1, 3.2 | 3.1: 2, 8, 9, 10, 11, 13, 23, R 10<br>3.2: 6, 14, 20, 39, 41, 45, R 8 |
| 22 | Quadratic equations | 3.3, 3.4 | 3.3: 13, 17, 21, 33, 43, 45<br>3.4: 13, 23, 24, 47, 58, 60, 71 |
| 23 | Power functions<br>Quiz 4 | 4.1, 4.2 | 4.1: 6, 12, 13, 15<br>4.2: 13, 14, 16, 26, 27 |
| 24 | Modeling with power functions | 4.4, 4.5 | 4.4: 20, 22, 24, 26, 32, 49<br>4.5: 13, 16, 22 |
| 25 | Review | | |
| 26 | Test 3 | | |
| 27 | Exponential functions | 6.1, 6.2 | 6.1: 1, 12, 28, 29, 44, 47<br>6.2: 25, 27, 28, 31, 32, 50 |
| 28 | Exponents with integer powers | G.1 | 3, 17, 30, 32, 34, 39, 42, 68, 80 |
| 29 | Exponents with fractional powers<br>Quiz 5 | G.2 | 1, 3, 11, 14 |
| 30 | Modeling with exponential functions | 6.4, 6.5 | 6.4: 17, 47, 52, 53, 72, 74<br>6.5: 16, 20, 25, 26, R 56 |
| 31 | Project work | | |
| 32 | Right Triangle Trigonometry | Supplement | In Packet |
| 33 | Trigonometric Functions | Supplement | In Packet |
| 34 | Trigonometric Functions | Supplement | In Packet |
| 35 | Review | | |
| 36 | Test 4 | | |

**Project Details**

One of the challenges facing many people who live in New York City is finding an affordable place to live. In this project you will explore the average rental prices for one neighborhood in New York City. You will use both a linear and an exponential model to make predictions about what the median rent will be in the future. You will also explore what it means to be rent burdened and consider what your annual salary would need to be in order for you not to be rent burdened.

1. Using the website http://furmancenter.org/research/sonychan choose two neighborhoods that you might want to live in when you live on your own. Then use the data on the website to complete the following table.
   The neighborhoods that will be the focus of my project are
   _____ and _____

| Median Rent | 2006 | 2016 |
|---|---|---|
| Neighborhood 1 | | |
| Neighborhood 2 | | |

2. Assuming that median rents will grow linearly, use the data in the table to write a linear function for each neighborhood of the form $L(t) = mt + b$ that will allow you to predict the median rent for all renters in that neighborhood at any time $t$ years after 2006. Then create a graph that shows the functions. Interpret the slope and y-intercept of each function. Include the interpretations in a paragraph that discusses what these functions tell you about how rents will change in your selected neighborhoods.
3. Assuming that median rents will grow exponentially, use the data in the table to write two exponential functions in the form $E(t) = ab^t$ that will allow you to predict the median rent for all renters in each neighborhood at any time $t$ years after 2006. Then create a graph that shows both of these functions. Interpret the values of $a$ and $b$ for each function. Include the interpretations in a paragraph that discusses what these functions tell you about how rents will change in your selected neighborhood.
4. Complete research to determine why the median asking rent for is greater than the median rent for all renters. What is it about NYC housing policy that might make this be the case in every community district in NYC?
5. Research what it means to be rent burdened and write an inequality that gives the maximum rent that someone can pay and not be rent burdened, as a function of their earnings. You will need to decide what type of function is best for this relationship. Write a paragraph that describes what it means to be rent burdened, provides your function rule and discusses the meaning of the coefficients that are in your equation.
6. Now think about when you might be first renting an apartment of your own and use your linear and exponential rent of each neighborhood to determine the predicted median rent for that year. How much money will you need to earn in order to pay the median rent and not be rent burdened? Which function do you think better predicts the rent for the year you will be moving?
7. Include all of the above in a well-organized paper that illustrates your understanding of both linear and exponential functions and how they can be used in situations such as this.