New Course Descriptions for Redesigned Math Curriculum

MTH 109: Math Literacy for College Students

The intent of this course is to replace the traditional developmental algebra sequence (MTH 101 and 102) for students on a non-STEM path. Many of the mathematical topics that are covered in 101 and 102 are found in this course. The major differences are the delivery of content, and an emphasis on applications and critical thinking rather than skills exercises. The course is designed for students to work together in groups, with the instructor acting as a facilitator and “as-needed group tutor” rather than a lecturer. Both writing and reading are significant components, helping remedial students in all remedial areas, not just math.

Most importantly, the intent is NOT to “water down” the curriculum and simply give non-STEM students an “easier” path. It’s about a more useful path, which in many cases also ends up being a more accessible path for those that struggle with traditional algebra. This course is intended to focus on active learning, requiring students to take control of their own learning. The end goal is an increase in study skills and intellectual maturity, as well as a focus on skills that will lead to success in STAT 261 and/or the new MTH 120 (Quantitative Literacy).

The course would need to be at least 4 hours; 5 would work as well, but my recommendation is 4. A sample TOC is attached, as well as a sample lesson, which gives an idea of what the course structure looks like. In the case of 4 hours, we probably would want to leave off some lessons in Unit 4. Note that a full complement of online tools will be available as well: online homework (where ALL skills problems will live), ebook, videos, and other resources.

While technology use is an important component of the course (spreadsheets and graphing calculator primarily), computer labs are NOT required. Students may find it useful to have at least one person in their group bring a laptop, but it’s not required at all. A computer projector, however, is needed as instructors will want to demonstrate technology from time to time.

As for placement, any student that places into MTH 101 or higher using our current standards should be able to succeed in MTH 109. As the nature of this course is to work through a workbook, the training needed for instructors is minimal, but is still an important consideration. I could arrange to have key instructors visit a school where the course is being taught currently; we could also arrange campus visits from experienced instructors, and online seminars for interested instructors. There are also videos for each lesson designed to help instructors teach most effectively, as well as other resources.
Unit 1: Numbers and Patterns

Broad Objectives: Focus on data. Set the stage for the course by addressing a range of study skills and student success issues. Work on number sense, encourage educated guesses, analyze data for patterns, and review some prerequisite material.

Lesson 1-1: Where Does the Time Go? (Percentages and Pie Charts)
Objective 1: Complete and analyze a weekly time chart.
Objective 2: Compute percentages.
Objective 3: Create and interpret pie charts using a spreadsheet and by hand.

Lesson 1-2: It's All About Style (Interpreting and Drawing Bar Graphs)
Objective 1: Identify and understand your learning style.
Objective 2: Create and interpret bar graphs using a spreadsheet and by hand.

Lesson 1-3: What's Your Type? (Organizing Information with Venn Diagrams)
Objective 1: Consider the role your personality type plays in how you interact with others and how you learn.
Objective 2: Create and interpret Venn diagrams.

Lesson 1-4: Take a Guess! (Estimation and Number Sense)
Objective 1: Make educated guesses.
Objective 2: Plot points on a number line.
Objective 3: Compare numbers using inequality symbols.
Objective 4: Approximate square roots.

Lesson 1-5: Do You Have Anything to Add? (Using Addition and Subtraction Skills)
Objective 1: Identify when it's appropriate to add quantities.
Objective 2: Practice addition and subtraction.
Objective 3: Interpret bank statements.
Objective 4: Use Excel to compute sums.
Objective 5: Calculate the perimeter of rectangles and triangles.

Lesson 1-6: It's About Accumulation (Using Multiplication and Division Skills)
Objective 1: Consider areas of your life where many small events add up to one large event.
Objective 2: Interpret multiplication as repeated addition.
Objective 3: Refresh multiplication and division skills.

Lesson 1-7: Avoiding Empty Pockets (Using Exponents and Order of Operations)
Objective 1: Distinguish between simple interest and compound interest.
Objective 2: Interpret exponents as repeated multiplication.
Objective 3: Practice working with exponents and the order of operations.

Lesson 1-8: Follow the Pattern (Comparing Linear and Exponential Growth)
Objective 1: Recognize patterns and use them to make predictions.
Objective 2: Distinguish between linear and exponential growth.

Lesson 1-9: Survival Skills (Understanding and Converting Units)
Objective 1: Identify important skills for college students to have.
Objective 2: Understand units for area and volume.
Objective 3: Convert units by multiplying and dividing.

Lesson 1-10: Did You Pass the Test? (Using Measures of Average)
Objective 1: Consider strategies for preparing for and taking math tests.
Objective 2: Understand the impact of a single question, or a single exam.
Objective 3: Calculate and interpret measures of average.
Unit 2: Relationships and Reasoning  85

Broad Objectives: Assemble the building blocks of functions and equations. Start to develop the idea of function, input/output, independent/dependent. Practice more number sense (including probability and percent chance). Carefully explore the meaning of a variable and develop the idea of a solution of an equation, solve some basic equations and inequalities, and develop a problem solving strategy.

Lesson 2-1: What Are the Chances? (Basic Probability)  87
Objective 1: Compute and interpret basic probabilities.
Objective 2: Express probability as a percent chance.
Objective 3: Understand the impact of events not being equally likely.

Lesson 2-2: Of Planes, Boats, Doll Houses, and Dr. Evil (Dimensional Analysis)  95
Objective 1: Understand the meaning of scale in models and maps.
Objective 2: Convert units using dimensional analysis.
Objective 3: View percentages in terms of scale.

Lesson 2-3: 88 Miles Per Hour! (Rates of Change)  105
Objective 1: Interpret and use rates of change.
Objective 2: Convert units involving rates.

Lesson 2-4: It's All Relative (Interpreting Relative Difference/Relative Error)  113
Objective 1: Compare difference to relative difference.
Objective 2: Apply relative error.
Objective 3: Find conversion factors for square and cubic units.

Lesson 2-5: Ins and Outs (Inputs, Outputs, and Writing Applied Expressions)  119
Objective 1: Distinguish between inputs (independent variables) and outputs (dependent variables).
Objective 2: Evaluate expressions and formulas.
Objective 3: Write and interpret expressions.

Lesson 2-6: Oh Yeah? Prove It! (Inductive and Deductive Reasoning)  127
Objective 1: Use inductive reasoning to make a conjecture.
Objective 2: Disprove a conjecture by finding a counterexample.
Objective 3: Use deductive reasoning.

Lesson 2-7: What's Your Problem? (Polya's Problem Solving Procedure)  137
Objective 1: Identify the four steps in Polya's problem solving procedure.
Objective 2: Solve problems using a diagram.
Objective 3: Solve problems using trial-and-error.
Objective 4: Solve problems requiring calculations.

Lesson 2-8: Indecision May or May Not Be My Problem (Algebraic Expressions in Decision Making)  147
Objective 1: Consider major life decisions that involve answering "Which is better?".
Objective 2: Decide if one option is better by looking at values in a table.

Lesson 2-9: All Things Being Equal (Solving Equations and Inequalities)  153
Objective 1: Understand and explain the meaning of solving equations and inequalities.
Objective 2: Develop and use procedures for solving basic equations and inequalities.
Unit 3: Thinking Linearly  165

Broad Objectives: Dig in on linear relationships. Cover the rectangular coordinate system. Explore slope-intercept form, direct variation, writing equations of lines, relating graphs and tables to equations, linear regression, problem solving, and systems.

Lesson 3-1: A Coordinated Effort (The Basics of Graphing)  167
Objective 1: Use a rectangular coordinate system.
Objective 2: Connect data to graphs.
Objective 3: Interpret graphs.

Lesson 3-2: Cabbing It (Slope and Rate of Change)  177
Objective 1: Define slope as a constant rate of change.
Objective 2: Define and interpret the intercepts of a line.
Objective 3: Tell a story based on the graph of a line.

Lesson 3-3: Planning a Pizza Bash (The Connection Between Graphs and Equations)  185
Objective 1: Connect tables and graphs to solving equations.
Objective 2: Write equations of lines by recognizing slope and y intercept.

Lesson 3-4: Big Mac Exchange Rates (Direct Variation)  191
Objective 1: Identify quantities that vary directly.
Objective 2: Write and use variation equations.

Lesson 3-5: The Effects of Alcohol (Writing Linear Equations Based on Data)  201
Objective 1: Write an equation of a line that models data from a description, table, or graph.
Objective 2: Graph lines from a given equation.

Lesson 3-6: The Great Tech Battle (Linear Relationships and Lines of Best Fit)  209
Objective 1: Decide if two data sets are linearly related.
Objective 2: Find the line of best fit for data using spreadsheets and calculators.

Lesson 3-7: If You Got a Problem, Yo I'll Solve It (Solving Problems with Linear Equations & Systems)  221
Objective 1: Use equations to solve applied problems.
Objective 2: Use systems of equations to solve applied problems.
Objective 3: Illustrate problems with tables and graphs.
Unit 4: Living in a Nonlinear World 231

Broad Objectives: Expand to nonlinear relationships. Study normally distributed data, the Pythagorean theorem and distance formula, applications based on graphs of quadratic and exponential functions, quadratic and exponential regression, inverse variation, scientific notation, operations with polynomials, factoring (stressing the relationship between factors, x-intercepts, and solutions), and algebraic approaches to solving quadratic equations.

Lesson 4-1: Is That Normal? (Standard Deviation and Normal Distributions) 233
Objective 1: Compute and interpret standard deviation.
Objective 2: Use a normal distribution to find probabilities.
Objective 3: Recognize some common misuses of statistics.

Lesson 4-2: A Road Map to Success (The Pythagorean Theorem and Distance) 245
Objective 1: Understand and use the Pythagorean theorem.
Objective 2: Read contour maps and calculate grade.
Objective 3: Develop and use the distance formula.

Lesson 4-3: Irate Ducks (Graphs of Quadratic Equations) 253
Objective 1: Recognize when a graph is parabolic.
Objective 2: Solve problems using the graph of a quadratic equation.

Lesson 4-4: Sit Back and Watch Your Money Grow (Exponential Growth Equations) 263
Objective 1: Revisit exponential growth.
Objective 2: Solve problems using graphs representing exponential growth and decay.

Lesson 4-5: Where’s My Jetpack? (Inverse vs. Direct Variation) 275
Objective 1: Recognize inverse variation.
Objective 2: Solve problems involving direct and inverse variation.

Lesson 4-6: Attraction and Melted Chocolate (Using Scientific Notation) 285
Objective 1: Write large and small numbers in scientific notation.
Objective 2: Use scientific notation.

Lesson 4-7: Minding Your Business (Add, Subtract, and Multiply Expressions) 295
Objective 1: Combine expressions using addition, subtraction, and multiplication.
Objective 2: Apply multiplication techniques to genetics.

Lesson 4-8: The F Word (Factoring and Function Notation) 307
Objective 1: Understand what factoring is and why it’s useful in algebra.
Objective 2: Use function notation.
Objective 3: Study the connection between zeros and x intercepts.
Objective 4: Factor expressions.

Lesson 4-9: Going...Going...GONE! (The Quadratic Formula and Max/Min) 319
Objective 1: Solve equations using the quadratic formula.
Objective 2: Find the vertex of a parabola.
Objective 3: Study physical phenomena using quadratic functions.

Lesson 4-10: Follow the Bouncing Golf Ball (Exponential Curve Fitting) 329
Objective 1: Find an exponential curve of best fit for data.
Objective 2: Study the decay rate for exponential decay.
Lesson 3-1  A Coordinated Effort

Learning Objectives

☐ 1. Use a rectangular coordinate system.
☐ 2. Connect data to graphs.
☐ 3. Interpret graphs.

Believe you can and you’re halfway there.
– Theodore Roosevelt

We’ve already used the word “graph” in this book, when referring to bar graphs. The bar graphs we looked at weren’t just pretty pictures, or bars drawn at random heights for no particular reason: they were used to illustrate and understand real data. But the types of graphs we’ll study in this unit might be the most misunderstood feature of math: people tend to think of them as just “plotting points and connecting the dots.” Nothing could be further from the truth! Just like bar graphs, the graphs that illustrate connections between two variables are all about a visual representation of useful information. So before we talk about the mechanics and terminology involved, we’ll use unemployment numbers to vividly illustrate what it’s really all about.

0. After reading the opening paragraph, what do you think the main topic of this lesson will be?

Class

If you’ve been paying attention to the news at all for the last several years, you know that the unemployment rate in the United States has been a big story. But what did unemployment look like before the economic crisis of the late 2000s? These tables display the average annual unemployment rate for the years from 1992 to 2011.

<table>
<thead>
<tr>
<th>Year</th>
<th>‘92</th>
<th>‘93</th>
<th>‘94</th>
<th>‘95</th>
<th>‘96</th>
<th>‘97</th>
<th>‘98</th>
<th>‘99</th>
<th>‘00</th>
<th>‘01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate (%)</td>
<td>7.5</td>
<td>6.9</td>
<td>6.1</td>
<td>5.6</td>
<td>5.4</td>
<td>4.9</td>
<td>4.5</td>
<td>4.2</td>
<td>4.0</td>
<td>4.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>‘02</th>
<th>‘03</th>
<th>‘04</th>
<th>‘05</th>
<th>‘06</th>
<th>‘07</th>
<th>‘08</th>
<th>‘09</th>
<th>‘10</th>
<th>‘11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate (%)</td>
<td>5.8</td>
<td>6.0</td>
<td>5.5</td>
<td>5.1</td>
<td>4.6</td>
<td>4.6</td>
<td>5.8</td>
<td>9.3</td>
<td>9.6</td>
<td>8.9</td>
</tr>
</tbody>
</table>

1. Use the table to write a verbal description of trends in the unemployment rate over that 20-year period.

With enough effort, you were probably able to write a reasonable description. But because there’s so much data in the table, spotting the trends isn’t exactly a simple thing to do. Next, let’s look at the same data displayed in graphical form.
When I look at this graph, two things occur to me: it’s a lot easier to see the trends than it was from looking at the table, and the graph looks a whole lot like a dinosaur, which is totally irrelevant but still pretty cool.

2. Use the graph to write a verbal description of trends in the unemployment rate, then explain why the graph makes it easier than the table did.

Without the numbers running along the bottom side of the graph and down the left side, we wouldn’t be able to understand any of the information the graph provides. Those numbers provide the scale for the graph, and they’re ALWAYS crucial in drawing a graph. Each of the number lines that we write the scale on is called an axis (the plural of this word is axes).

In preliminary numbers released in early 2013, the average unemployment rate for 2012 was listed as 8.1%. We can add that piece of information to the graph by finding 2012 on the horizontal axis and 8.1 on the vertical axis, then drawing imaginary lines up from 2012 and right from 8.1 until the lines meet: that’s where we put the point corresponding to 2012 and 8.1%.
Notice that when we found the location to indicate that the unemployment rate was 8.1% in 2012, the imaginary lines we drew formed a rectangle with the two axes. That’s why we call this system of graphing a **rectangular coordinate system**. Each of the numbers we used to locate that point are called **coordinates**. The horizontal axis is usually called the **x axis** and the vertical axis is usually called the **y axis**. The point where the two axes meet is called the **origin**.

Since we didn’t need to worry about negative years or negative unemployment rates, the graph we drew earlier only showed positive values along each axis. But there are plenty of examples of data where negative values make perfect sense, so a rectangular coordinate system is often set up like this:

![Graph of a rectangular coordinate system with axes labeled x and y, and coordinates marked (4, 0), (0, -8), (-3, -4), (2, 7).](image)

The process of locating information on a rectangular coordinate system, like the 8.1% unemployment rate in 2012, is called **plotting points**. We identify locations by writing the two coordinates together inside parentheses, like this: (2012, 8.1).

3. What are the coordinates of the origin in the rectangular coordinate system above?

4. Look carefully at the numbers on each axis. What distance does each box on the grid represent along the **x axis**? What about the **y axis**?

5. Plot each of the following points on the rectangular coordinate system above.
   Label the coordinates of each point.
   a. (4, 0)
   b. (0, -8)
   c. (-3, -4)
   d. (2, 7)
If it doesn’t make you uncomfortable, exchange the following information with the classmates in your Unit 3 group. This will be your small group for the third unit. It would be a good idea to schedule a time for the group to meet to go over homework, ask/answer questions, or prepare for exams. You can use this table to help schedule a mutually agreeable time.

<table>
<thead>
<tr>
<th>Name</th>
<th>Phone Number</th>
<th>Email</th>
<th>Available times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Being able to understand the connection between a graph and the information that it illustrates is by far the most important skill in graphing. If you can’t interpret the meaning of a graph, it’s just really bad art!

1. A small plane takes off from a regional airport; its altitude at various times is recorded in the table below. Write ordered pairs of the form (Flight time, Altitude) for each pair of values, then plot the points on the graph.

<table>
<thead>
<tr>
<th>Flight time ( x ) (minutes)</th>
<th>Altitude ( y ) (feet)</th>
<th>Ordered pair ((x, y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4,000</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

2. Connect the points you plotted to draw a graph, and describe what that graph illustrates. Then add a verbal label to each axis that describes the information it represents.
For Questions 3-8, explain how you got your answer using BOTH the table and the graph.

3. What was the highest altitude reached by the plane? (Is the answer based on your graph different? Why?)

4. How long after the flight began did the plane reach its highest altitude? (Again, you may have two slightly different answers.)

5. When was the plane flying level?

6. How long did the flight last?

7. When was the altitude of the plane increasing?

8. When was the altitude of the plane decreasing?

9. Explain why we didn’t bother to include negative values along either axis when drawing the rectangular coordinate system for the altitude graph.
10. When we plot points on a coordinate system that correspond to pairs of data, we call the result a scatter diagram or scatter plot. For the bank accounts in the two tables below, create a scatter diagram for each. First, you’ll need to complete the table using skills we practiced earlier in the course. After writing ordered pairs, decide on an appropriate scale for each axis, then plot each point. It would probably be a good idea to use different colors for each account. (Note: We do NOT connect the points on a scatter plot!)

<table>
<thead>
<tr>
<th>Time (yrs)</th>
<th>Account 1</th>
<th>Ordered pair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>$1,000.00</td>
<td></td>
</tr>
<tr>
<td>After 1 year</td>
<td>$1,060.00</td>
<td></td>
</tr>
<tr>
<td>After 2 years</td>
<td>$1,120.00</td>
<td></td>
</tr>
<tr>
<td>After 3 years</td>
<td>$1,180.00</td>
<td></td>
</tr>
<tr>
<td>After 4 years</td>
<td>$1,240.00</td>
<td></td>
</tr>
<tr>
<td>After 5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 6 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 7 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 8 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 9 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time (yrs)</th>
<th>Account 2</th>
<th>Ordered pair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>$1,000.00</td>
<td></td>
</tr>
<tr>
<td>After 1 year</td>
<td>$1,050.00</td>
<td></td>
</tr>
<tr>
<td>After 2 years</td>
<td>$1,102.50</td>
<td></td>
</tr>
<tr>
<td>After 3 years</td>
<td>$1,157.63</td>
<td></td>
</tr>
<tr>
<td>After 4 years</td>
<td>$1,215.51</td>
<td></td>
</tr>
<tr>
<td>After 5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 6 years</td>
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<tr>
<td>After 7 years</td>
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<tr>
<td>After 8 years</td>
<td></td>
<td></td>
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<tr>
<td>After 9 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11. Explain why you chose the scale that you did for each axis.

12. Use the two scatter plots to write a verbal description of the differences between the growth of the two accounts. More detail is better!

13. In some cases, if the pattern of points in a scatter plot is relatively clear, we can connect the points to complete a graph. Do that now, drawing two graphs that represent the growth of the two accounts in Question 10. How would you describe the two graphs verbally?

### Using Technology: Creating a Scatter Diagram

To create a scatter diagram in Excel:

1. Type the values that will go on the x axis in one column. (This would correspond to the number of years in Question 10.)
2. Type the values that will go on the y axis in one column. (This would correspond to the value of the account in Question 10.)
3. Use the mouse to drag and select all the data in those two columns.
4. With the appropriate cells selected, click the Insert tab, then Charts, and click on Scatter. Then choose the type of scatter diagram you want. Options include plotting only the points, connecting the points with curves, and connecting the points with line segments.

You can add titles and change colors and other formatting elements by right-clicking on certain elements, or using the options on the Charts menu. Try some options and see what you can learn!

*See the Lesson 3-1 video in class resources for further information.*
14. What temperature is this thermometer displaying?

15. Explain why the thermometer is pretty much useless.

16. What are the coordinates of the point drawn on the graph?

17. Explain why the graph is pretty much useless.

**Important Features of a Good Graph**

1. EVERY graph has to have a clearly-labeled scale on each axis. A graph with no scale labeled is every bit as useless as a thermometer with no numbers on it.

2. There’s no reason the scale has to be the same on both axes. The first graph in this group activity contained points like (10, 4,000) and (20, 3,000); using the same scale on the x and y axes would lead to a graph that’s very difficult to read (try it!).

3. If there are certain points on a graph that are important for some reason, you should label the coordinates of those points right on the graph.
Check each box when you’ve completed the task. Remember that your instructor will want you to turn in the portfolio pages you create.

**Technology**
1. ☐ Use Excel to create two different scatter diagrams for the ordered pairs in the table on the next page. The first should just have the points; the second should connect the points with curves. A template to help you get started can be found in the online resources for this lesson.

**Skills**
1. ☐ Include any written work from the online skills assignment along with any notes or questions about this lesson’s content.

**Applications**
1. ☐ Complete the applications problems.

**Reflections**
Type a short answer to each question.
1. ☐ If someone says that the point of graphing is plotting points and connecting the dots, how would you explain to them how very, very wrong that they are? It’ll be tough, but try to be nice.
2. ☐ Why do you think we use the word “ordered” in “ordered pair”?
3. ☐ Explain the advantages of graphed data over data in table form.
4. ☐ Take another look at your answer to Question 0 at the beginning of this lesson. Would you change your answer now that you’ve completed the lesson? How would you summarize the topic of the lesson now?
5. ☐ What questions do you have about this lesson?

**Looking Ahead**
1. ☐ Read the opening paragraph in Lesson 3-2 carefully, then answer Question 0 in preparation for that lesson.
The hourly temperatures for Champaign, Illinois on October 8, 2012 are given in the table. Use hours after midnight (NOT the actual time) as first coordinates, and the temperature as second coordinates.

<table>
<thead>
<tr>
<th>Time</th>
<th>Temperature</th>
<th>Ordered Pair</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00 AM</td>
<td>34°</td>
<td></td>
</tr>
<tr>
<td>1:00 AM</td>
<td>34°</td>
<td></td>
</tr>
<tr>
<td>2:00 AM</td>
<td>34°</td>
<td></td>
</tr>
<tr>
<td>3:00 AM</td>
<td>36°</td>
<td></td>
</tr>
<tr>
<td>4:00 AM</td>
<td>35°</td>
<td></td>
</tr>
<tr>
<td>5:00 AM</td>
<td>33°</td>
<td></td>
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<td>6:00 AM</td>
<td>32°</td>
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<td>7:00 AM</td>
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<td>8:00 AM</td>
<td>37°</td>
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</tr>
<tr>
<td>9:00 AM</td>
<td>42°</td>
<td></td>
</tr>
<tr>
<td>10:00 AM</td>
<td>48°</td>
<td></td>
</tr>
<tr>
<td>11:00 AM</td>
<td>51°</td>
<td></td>
</tr>
<tr>
<td>12:00 PM</td>
<td>54°</td>
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<td>11:00 PM</td>
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<tr>
<td>12:00 AM</td>
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</table>

1. Write an ordered pair for each time and temperature pairing. Remember, the first coordinate is hours after midnight.

2. Decide on an appropriate scale for each axis and create a scatter plot for this data on graph paper. Then connect the points with a smooth curve. If you don’t have graph paper, you can easily find printable graph paper online. Make sure that the lowest height on the graph corresponds to zero degrees.

3. What do you need to find in the table to find when the temperature was highest during the day?

4. What do you need to look for on the graph to find when the high temperature was reached?

5. Use your graph to estimate time spans when the temperature was increasing.

6. Use your graph to estimate time spans when the temperature was decreasing.

7. Draw a second graph for the data: this time make the lowest height on the graph correspond to 30°. Why is this second graph deceiving in terms of how much the temperature varies?
MTH 120: Quantitative Literacy

There is a growing nationwide movement toward replacing courses at the level of College Algebra with something more applied and useful for non-STEM students that won’t be taking further classes that require specific algebra skills beyond the developmental level. Quantitative Literacy is designed to show students how mathematical thinking is useful in their lives with less focus on skills problems and formulas, and more on applications, problem solving, an critical thinking. In that regard, the course is a natural follow-up to Math Literacy for College Students, but could also be taken by students coming out of MTH 102 that decided on a non-STEM track. Ideally, MTH 120 would be approved to satisfy the Miami Plan formal reasoning requirement: in fact, it’s ideally suited to meet the goals of a liberal education. (In fact, “Liberal Arts Mathematics” is a very common name for similar courses.)

I would plan on making the course 4 credit hours. The pedagogical style could either be a combination of traditional lecture with worksheets and group activities, or we could go all in and arrange it like MTH 109, with every lesson based on group work and instructors acting as coaches rather than lecturers. There are merits to each approach, so we’d need to work this out.

A sample TOC is included below.

**Unit 1: Mathematical Reasoning and Problem Solving**
- 1-1 The Nature of Mathematical Reasoning
- 1-2 Estimation and Interpreting Graphs
- 1-3 Problem Solving Strategies

**Unit 2: Consumer Mathematics**
- 8-1 Budgeting
- 8-2 Simple Interest
- 8-3 Compound Interest
- 8-4 Installment Buying
- 8-5 Student Loans and Home Buying
- 8-6 Investing in Stocks and Bonds

**Unit 3: Probability**
- 11-1 The Fundamental Counting Principle and Permutations
- 11-2 Combinations
- 11-3 Basic Concepts of Probability
- 11-4 Tree Diagrams, Tables, and Sample Spaces
- 11-5 Probability Using Permutations and Combinations
- 11-6 Odds and Expectation
- 11-7 The Addition Rules for Probability
- 11-8 The Multiplication Rules and Conditional Probability
- 11-9 The Binomial Distribution

**Unit 4: Statistics**
- 12-1 Gathering and Organizing Data
- 12-2 Picturing Data
- 12-3 Measures of Average
- 12-4 Measures of Variation
- 12-5 Measures of Position
- 12-6 The Normal Distribution
- 12-7 Applications of the Normal Distribution
- 12-8 Correlation and Regression Analysis

Summary
Chapter 12 Supplement: Misuses of Statistics