

## Numbers: Zero to Infinity (NUMR) CTY Course Syllabus

|                             | WHAT (skills, goals, knowledge, concepts, readings)  | HOW (activities)   |
|-----------------------------|--|--|
|                             | * * * * WEEK ONE * * * *   |  |
| <b>DAY 1</b>                | Quantitative Observations and the Metric System, Part 1  |  |
| Morning                     | <ol style="list-style-type: none"> <li>1. Create a classroom number line</li> <li>2. Powers of 10 video</li> <li>3. Introductions, rules, honor code</li> <li>4. Pre Assessment Test</li> <li>5. Estimating metric volume</li> </ol> | <ol style="list-style-type: none"> <li>1. Break in groups to cover sections</li> <li>2. Show video and get student reactions</li> <li>3. Names and math background, discuss rules and honor code, etc.</li> <li>4. Pre Assessment Test</li> <li>5. Liter box activity</li> </ol> |
| Afternoon                   | <ol style="list-style-type: none"> <li>1. Using reference tables</li> <li>2. Using appropriate units</li> <li>3. Using appropriate units and reasonable quantities</li> </ol>  | <ol style="list-style-type: none"> <li>1. “Handy Tables Handout” scavenger hunt</li> <li>2. Little Millie metric worksheet</li> <li>3. Metric Mad Libs</li> </ol>  |
| Late Afternoon/<br>Homework |  | “How would you measure?” worksheet<br>Summary of “Handy Tables” and what info it contains  |
| Supplement                  |  | Read <i>Millions to Measure</i> by David M. Schwartz, or read this tomorrow morning.   |
| <b>DAY 2</b>                | Quantitative Observations and the Metric System, Part 2  |  |
| Morning                     | <ol style="list-style-type: none"> <li>1. Convert from and within the metric system</li> <li>2. Use instruments to measure</li> <li>3. Use benchmarks to estimate</li> </ol>   | <ol style="list-style-type: none"> <li>1. Unit conversion clinic—lecture and handouts</li> <li>2. Metric Instruments scavenger hunt</li> <li>3. Benchmark measurements—group activity</li> </ol>   |
| Afternoon                   | <ol style="list-style-type: none"> <li>1. Find volume of regular solids</li> <li>2. Find volume of a space</li> <li>3. Find volume of the body</li> </ol>  | <ol style="list-style-type: none"> <li>1. Overview of finding volume for regular solids</li> <li>2. How much space is in this room?—measuring activity</li> <li>3. What is your volume?—activity to model the body and calculate volume</li> </ol>                               |
| Late Afternoon/<br>Homework |  | <ol style="list-style-type: none"> <li>1. “Say It Metric” worksheet</li> <li>2. Creating a measuring scale and instrument</li> </ol>   |
| Supplement                  |  | Read a story from <i>Fractals, Googols, and Other Mathematical Tales</i> by Theoni Pappas  |

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| <b>DAY 3</b>                | Large Numbers in Life: What is large?  |   |
| Morning                     | <ol style="list-style-type: none"> <li>1. Conceptualize a million</li> <li>2. Calculate large numbers</li> <li>3. Exponential growth</li> </ol>  | <ol style="list-style-type: none"> <li>1. Graphing, time it takes to count to a million or a billion, how long is a billion minutes?</li> <li>2. Heartbeats in a Lifetime activity</li> <li>3. Grains of rice story</li> </ol>  |
| Afternoon                   | <ol style="list-style-type: none"> <li>1. Introduction to Scientific notation, “Dealing with very large quantities” (part 1)</li> <li>2. Calculate with scientific notation</li> </ol>   | <ol style="list-style-type: none"> <li>1. Use previous activities to spring board into why writing and working with large numbers in scientific notation is so powerful and efficient.</li> <li>2. Density of the planets activity</li> </ol>   |
| Late Afternoon/<br>Homework | What is large?   | <ol style="list-style-type: none"> <li>1. Describe what a large number looks like in decimal form as well as in scientific notation.</li> <li>2. Describe what a small number looks like in decimal form as well as in scientific notation.</li> </ol>  |
| Supplement                  |  | Read <i>On Beyond a Million: An Amazing Math Journey</i> by David M. Schwartz   |
| <b>DAY 4</b>                | Small Numbers in Life: What is small?  |   |
| Morning                     | <ol style="list-style-type: none"> <li>1. Conceptualize small numbers</li> <li>2. Writing small numbers with decimals and fractions—when to use each, usefulness and efficiency of each</li> <li>3. Practicing decimals and fractions</li> <li>4. Find very small numbers in life</li> </ol> | <ol style="list-style-type: none"> <li>1. Plate movement rate of the Earth’s Crust (per year, per day, per hour, per second)</li> <li>2. Lecture and writing exercise (Describe what a small fraction/decimal looks like)</li> <li>3. Worksheet</li> <li>4. Student research and presentations</li> </ol> |
| Afternoon                   | <ol style="list-style-type: none"> <li>1. <i>Gulliver’s Travels</i></li> <li>2. How to deal with small numbers, scientific notation part 2</li> <li>3. More on Powers of 10</li> <li>4. Calculations with small numbers</li> </ol>   | <ol style="list-style-type: none"> <li>1. Read chapter 1.</li> <li>2. Lecture and worksheet</li> <li>3. Lecture and Graph activity</li> <li>4. Volume of one atom, gravitation force exerted by two small objects</li> </ol>  |
| Late Afternoon/<br>Homework | What is small?   | <ol style="list-style-type: none"> <li>1. Describe what a small number looks like in decimal form as well as in scientific notation.</li> <li>2. Scientific notation practice problems with small numbers (2)</li> </ol>  |
| Supplement                  |  | Read <i>Horton Hears a Who!</i> By Dr. Seuss  |

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|---------------------------------|--|--|
| <b>DAY 5</b>                    | Describing and Measuring Motion  |  |
| Morning                         | <ol style="list-style-type: none"> <li>1. Measure motion</li> <li>2. Describe motion</li> <li>3. <i>Gulliver's Travels</i></li> <li>4. Measure motion</li> <li>5. Measure motion</li> </ol>              | <ol style="list-style-type: none"> <li>1. Kilometer Walk activity</li> <li>2. Write journal entry on what they have learned about motion</li> <li>3. Read chapter 2.</li> <li>4. 100-m Dash activity</li> <li>5. Stepping Up to the Challenge worksheet</li> </ol> |
| Afternoon                       | <ol style="list-style-type: none"> <li>1. Research motion</li> <li>2. Interpret motion</li> </ol>  | <ol style="list-style-type: none"> <li>1. What is fast? Research activity and problem solving on fastest animals, jets, speed of sound and light</li> <li>2. Lecture with graph examples</li> </ol>  |
| Late Afternoon/<br>Homework     |  | What are the consequences of the universe's speed of light speed limit? What can happen in a millisecond?  |
| Supplement                      | <ol style="list-style-type: none"> <li>1. Research motion</li> <li>2. Interpret motion</li> </ol>  | <ol style="list-style-type: none"> <li>1. What is fast? Research activity and problem solving on fastest animals, jets, speed of sound and light</li> <li>2. Lecture with graph examples</li> </ol>  |
| * * * * <b>WEEK TWO</b> * * * * |  |  |
| <b>DAY 6</b>                    | Using Functions to Make Predictions  |  |
| Morning                         | <ol style="list-style-type: none"> <li>1. Creating functions</li> <li>2. Representing functions</li> <li>3. Graphing functions</li> </ol>  | <ol style="list-style-type: none"> <li>1. Amazing Function Machines—develop “function machines” that perform an operation</li> <li>2. Lecture</li> <li>3. Presentation and practice</li> </ol>   |
| Afternoon                       | <ol style="list-style-type: none"> <li>1. <i>Gulliver's Travels</i></li> <li>2. Modeling with functions</li> <li>3. Exponential growth and decay</li> </ol>  | <ol style="list-style-type: none"> <li>1. Read chapter 3</li> <li>2. Lecture and worksheet</li> <li>3. Lecture and worksheet</li> </ol>  |
| Late Afternoon/<br>Homework     |  | <ol style="list-style-type: none"> <li>1. Functions and Graphs, follow-up questions</li> <li>2. Exponential growth and decay problem set</li> </ol>  |
| Supplement                      |  | Read a story from <i>Fractals, Googols, and Other Mathematical Tales</i> by Theoni Pappas  |
| <b>DAY 7</b>                    | Numbers, Theoretically Speaking  |  |
| Morning                         | <ol style="list-style-type: none"> <li>1. Classifying number sets</li> <li>2. Fundamental number properties</li> <li>3. Exploring 0 and 1</li> <li>4. Prime numbers</li> </ol>                           | <ol style="list-style-type: none"> <li>1. Presentation and student-created visuals</li> <li>2. Lecture and practice</li> <li>3. Discussion and writing assignment on why these numbers are special</li> <li>4. Prime Time! worksheet</li> </ol>                    |
| Afternoon                       | <ol style="list-style-type: none"> <li>1. <i>Gulliver's Travels</i></li> <li>2. Other interesting numbers</li> <li>3. Other classifications of numbers</li> <li>4. Mid-Course Self-Evaluation</li> </ol> | <ol style="list-style-type: none"> <li>1. Read chapter 4</li> <li>2. Lecture and practice</li> <li>3. Number Safari—research and presentations</li> <li>4. Daily Journal time</li> </ol>   |

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| Late Afternoon/<br>Homework |   | <ol style="list-style-type: none"> <li>1. Mad Lib on checking answers' reasonableness</li> <li>2. Assign "Number Children's Story" writing and research assignment (story due Friday of week 2 and may present stories on Friday of week 3)</li> </ol> |
| Supplement                  |   | Read a story from <i>Fractals, Googols, and Other Mathematical Tales</i> by Theoni Pappas  |
| <b>DAY 8</b>                | Ratios and Proportional Thinking, Part 1  |  |
| Morning                     | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Ratios and proportions overview</li> <li>3. Expressing ratios as decimals, fractions, and percents</li> <li>4. Setting up and solving proportions</li> </ol> | <ol style="list-style-type: none"> <li>1. Does Lady Liberty have a big nose?</li> <li>2. Lecture</li> <li>3. Danny is going to post this lecture and practice worksheet</li> <li>4. Two worksheets for practice</li> </ol>                             |
| Afternoon                   | <ol style="list-style-type: none"> <li>1. <i>Gulliver's Travels</i></li> <li>2. Proportions with time</li> <li>3. Scaling with proportions</li> </ol>   | <ol style="list-style-type: none"> <li>1. Read chapter 5</li> <li>2. Gulliver timeline</li> <li>3. Start Mildendo project</li> </ol>   |
| Late Afternoon/<br>Homework |   | <ol style="list-style-type: none"> <li>1. Proportions and repeating decimals handout</li> <li>2. Continue working on children's story</li> </ol>   |
| Supplement                  |   | More on percents, Repeating decimals   |
| <b>DAY 9</b>                | Ratios and Proportional Thinking, Part 2  |  |
| Morning                     | <ol style="list-style-type: none"> <li>1. Using proportions to predict unknowns</li> <li>2. Proportions and metric measurements</li> <li>3. Scaling</li> </ol>  | <ol style="list-style-type: none"> <li>1. How long would it take to walk home?</li> <li>2. Metric cookie recipe</li> <li>3. Dino-Dogs: If your dog were the size of a dinosaur, how much dog food would you need?</li> </ol>                           |
| Afternoon                   | <ol style="list-style-type: none"> <li>1. Gulliver's clothes and Lilliputian self</li> <li>2. If Barbie and Hulk/GI Joe were human...</li> <li>3. Scaling with proportions</li> </ol>   | <ol style="list-style-type: none"> <li>1. Create your own Lilliputian project</li> <li>2. Measuring activity</li> <li>3. Mildendo project</li> </ol>   |
| Late Afternoon/<br>Homework |   | <ol style="list-style-type: none"> <li>1. Create two other Lilliputian sized objects due Monday of week 3</li> <li>2. Finish children's story (due tomorrow!)</li> </ol>   |
| Supplement                  |   | One Inch Tall poem   |

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| <b>DAY 10</b>               | Scale Drawings  |   |
| Morning                     | 1. Scale drawings: people<br>2. Scale drawing: places<br>3. Scale drawing: structures   | 1. Does the camera add 10 pounds?<br>2. Scale drawing of Mildendo<br>3. Research and presentations  |
| Afternoon                   | 1. Scale drawings: maps   | 1. Create a campus map  |
| Late Afternoon/<br>Homework |   | 1. Continue working on Lilliputian sized objects (due Monday!)  |
| Supplement                  |   | Read a <i>Sir Cirumference</i> book   |
|                             | * * * * <b>WEEK THREE</b> * * * *   |   |
| <b>DAY 11</b>               | Mental Math   |   |
| Morning                     | 1. Some fun and very powerful mental math strategies<br>2. Sharing mental math tricks<br>3. Calculating square numbers<br>4. Calculating square roots<br>5. Rounding and estimating | 1. Mental Math Power Builder worksheets<br>2. Discussion<br>3. Mental trick and number patterns worksheet<br>4. Chinese method<br>5. Worksheet  |
| Afternoon                   | 1. Estimeasure<br>2. Estimating time and distance<br>3. Estimating distances  | 1. Worksheets<br>2. Waiting in Line problem<br>3. Amazon measuring  |
| Late Afternoon/<br>Homework |   | Grocery Store estimating activity (in supplements folder) or any worksheets from the Estimating section of the supplements folder   |
| Supplement                  |   |   |
| <b>DAY 12</b>               | Measuring Uncertainty   |   |
| Morning                     | 1. Introduction to probability<br>2. Overview of probability and counting principles<br>3. Calculating probabilities<br>4. Interpreting probabilities                               | 1. SKUNK, a game of chance and choice<br>2. Lecture<br>3. Worksheet<br>4. Discussion (what is fair? What is highly likely, unlikely, impossible, certain, etc?)                             |
| Afternoon                   | 1. Applications of probability<br>2. Using factorials   | 1. Research and group activity on big number problems (planets all lining up, chance of rain, chances of being born a US citizen, Chinese citizen, etc)<br>2. Fun with Factorials worksheet |
| Late Afternoon/<br>Homework |   | 1. Student-created problems and games   |

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| Supplement                  |   | More on factorials, and student-created problems and games   |
| <b>DAY 13</b>               | Systematic Summation: Sequences, Series, and Surface Area   |  |
| Morning                     | <ol style="list-style-type: none"> <li>1. Introduction to sequences</li> <li>2. Sierpinski Carpet</li> <li>3. Introduction to series</li> <li>4. Area under a curve</li> </ol>  | <ol style="list-style-type: none"> <li>1. Lecture</li> <li>2. Coloring activity</li> <li>3. Lecture</li> <li>4. Hands-on activity</li> </ol>   |
| Afternoon                   | <ol style="list-style-type: none"> <li>1. Surface area</li> </ol>   | <ol style="list-style-type: none"> <li>1. Mouse and Elephant activity</li> </ol>   |
| Late Afternoon/<br>Homework |   | <ol style="list-style-type: none"> <li>1. How are surface area and area under a curve related? Write a reflection paragraph drawing connections between these two ideas in math.</li> <li>2. What if you wanted to find the area under an infinite curve? What would you do?</li> </ol>  |
| Supplement                  |   | Dealing with large sets of numbers<br>Other number systems   |
| <b>DAY 14</b>               | General Problem-Solving Techniques (integrating ideas)  |  |
| Morning                     | <ol style="list-style-type: none"> <li>1. Temperature ranges of planets and what they mean to life</li> <li>2. Translating verbal models into variable expressions</li> <li>3. Synthesizing</li> </ol>  | <ol style="list-style-type: none"> <li>1. Worksheet</li> <li>2. Lecture and worksheet</li> <li>3. How long will it take to wear out your shoes?</li> <li>4. What would it look like if Earth were a doughnut?</li> </ol>   |
| Afternoon                   | <ol style="list-style-type: none"> <li>1. How to model the very big</li> <li>2. How to model the very small</li> </ol>  | <ol style="list-style-type: none"> <li>1. Model solar system in the field with various shaped spheres</li> <li>2. Model the atom</li> </ol>  |
| Late Afternoon/<br>Homework |   | <ol style="list-style-type: none"> <li>1. Be prepared to read your number children's story aloud and answer questions about the number you chose.</li> </ol>   |
| Supplement                  |   | Intro to the books <i>Flatland/Flatterland</i>   |
| <b>DAY 15</b>               | "Closure"   |  |
| Morning                     | <ol style="list-style-type: none"> <li>1. Student presentations</li> <li>2. Pass back/discuss all remaining work/break down the classroom</li> <li>3. Reading list</li> <li>4. Post-assessment</li> <li>5. Course and instructor review</li> <li>6. Certificates</li> </ol> | <ol style="list-style-type: none"> <li>1. Students present number children's story</li> <li>2. Clean up, gather students' work</li> <li>3. Pass out and discuss, students may want to add their own recommended books to it.</li> <li>4. Instructor &amp; TA hand out; those who finish early can start on final journal entry for the summer</li> <li>5. Course and instructor review</li> <li>6. Pass out certificates.</li> </ol> |
| Supplement                  |   | Choose a book from the in-class Math Literature Library to read and write a reflection on  |