Integrating Climate Justice with Modelling Absolute Value, Piecewise, and Absolute Value Functions in North Carolina Math 3

by Dalton Cooper, 2019 CTI Fellow
West Charlotte High School

This curriculum unit is recommended for North Carolina Math 3

Keywords: North Carolina Math 3, Piecewise Equations, Absolute Value Inequalities, Exponential Equations, Climate Change, Environmental Justice

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: Climate change is one of the most pressing issues of the 21st Century; however, its inclusion in the North Carolina high school curriculum is limited to science content knowledge and does not address the cultural, economic, and social costs of climate change. While the consequences of climate change are global, the effects have already been seen in the Southeast United States with the increasing intensity and regularity of extreme weather events, such as hurricanes. Furthermore, the adverse effects of such extreme weather are disproportionately felt by marginal populations, such as the working-class and poor, elderly, and minority communities. This was realized in the aftermath of Hurricane Katrina in 2005 when suffering was concentrating in working-class black communities; furthermore, these same communities were gentrified in the aftermath of the storm as a result of preexisting inequality and well-intentioned recovery efforts. Viewed through the lens of environmental justice, the pressing question becomes: "how can the powers that be ensure climate change mitigation and solution strategies avoid exacerbating existing inequality along the lines of socioeconomic status?" This curriculum unit will present students with this aspect of climate change in order to expand understanding of the issue, as well as make relevant and concrete the content and skills of North Carolina Math 3.

I plan to teach this unit during the coming year to 68 students in North Carolina Math 3

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Introduction

Background

Anthropogenic climate change has shaped the geographic, political, economic, cultural, and social landscape of the 20th and 21st Century. Due to the scope and scale of the issue, climate change discussion is often interdisciplinary; however, the standards of the North Carolina Department of Public Instruction (NCDPI) currently only include the topic within science standards despite its implications in the social sciences and necessary mathematical foundations for analysis. In order to effectively bring climate change to North Carolina students, I posit that it is critical to address interdisciplinarity of the issue by considering it in all courses. The benefits of such an approach would not only enhance students' understanding of the effects of climate change on society, but also integrate skills outside of the sciences necessary to understanding the problem and empowering students to conceive and champion solutions.

Currently, the only NCDPI high school standards including climate change are from Earth and Environmental Science are those encapsulated under EEn2.6: Analyze patterns of global weather and climate over time. Within this standard, students are expected to differentiate between weather and climate (EEn.2.6.1), explain natural processes contributing to climate change (EEn.2.6.2), analyze the impacts that human activities have on climate change (EEn.2.6.3), and attribute changes in Earth systems to climate change (EEn.2.6.4)[1]. Additionally, discussion of climate change can occur within the standards of EEn2.8: Evaluate human behaviors in terms of how likely they are to are to ensure the ability to live sustainably on earth; however, these standards are primarily scientific and do not consider the social, economic, and political ramifications of climate change that can happen or are already in progress.

This unit serves to supplement students' knowledge of climate change from NC Earth and Environmental Science in three primary ways. First, my unit will re-loop content regarding the greenhouse effect, greenhouse gas (GHG) emissions, and how this can create long-term global changes to weather and climate patterns so that all students have a core understanding on the scientific basis to the problem. Second, my unit will include a strong focus on environmental justice, the intersection between existing societal inequality and environmental issues, and how it relates to climate change. Finally, both the scientific and social considerations will be viewed through mathematical analysis that is grade-level appropriate and aligned to the standards of North Carolina Math 3. Climate change does not exist in a vacuum, practically or academically, and my curriculum unit seeks to address the intersectionality for both of these considerations.

Demographics

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[1] North Carolina Department of Instruction "North Carolina Essential Standards Earth/Environmental Science" (State Board of Education, 2012)

My unit will be taught at West Charlotte High School; a public school with 2019-20 enrollment of 1,456 students serving northwest Charlotte. West Charlotte is a Title 1 high school; 98% of student qualify for free or reduced lunch. Despite its storied history as an integrated school, currently West Charlotte is primarily attended by students of color: in the 2019-20 school year 80.3% of students enrolled are black, 13.0% hispanic, 2.7% asian, and 1.5% white.

West Charlotte High School's instructional staff of 96 teachers consists of 63 (65.6%) highly-qualified teachers, and 45 (46.9%) with advanced degrees. A significant contingency of West Charlotte teachers are beginning teachers, with 33 (34.4%) having 0-3 years of teaching experience.

During the 2015-16, 2016-17, and 2017-18 school years, West Charlotte had achieved a "passing" school performance grade (SPG) of "C" and met or exceeded EVAAS growth; however, in the 2018-19 school year, West Charlotte regressed to an SPG grade of "D" and did not meet or exceed EVAAS growth. On the Math 3 NC end-of-course (EOC) exam, 26.8% of students achieved grade level proficiency, with 8.8% of students scoring in the college and career readiness range. West Charlotte High School sponsors Advanced Placement (AP), International Baccalaureate (IB), and career and technical education (CTE) classes; as a result, West Charlotte's Math 3 courses are taught to be aligned with not only state standards, but also fulfil IB Middle Years Program (MYP) requirements.

Objectives

Math 3 is an integrated math course, including standards in polynomial functions, modeling functions, geometry, statistical methods, and trigonometric functions. This unit's primary objective is the North Carolina Math 3 standards related to modelling and solving functions, including exponential equations (NC.M3.F-LE.3, NC.M3.F-LE.4), absolute value inequalities (NC.M3.A-REI.1), and piecewise functions (NC.M3.F-IF.2).

Additionally, this unit will re-loop supporting material from previous standards, such as intersections of functions (NC.M3.A-REI.11) and key features of function in context (NC.M3.F-IF.4, NC.M3.F-IF.7, NC.M3.F-IF.9) and can be used to preview content for statistics (NC.M3.S-IC).

With this unit, it is my expectation that students will be able to show mastery on the primary objectives with respect to mastery, proficiency, and growth. Secondarily, it is my goal for students to have an increased understanding of climate change and its impacts, including those on marginal populations. Finally, with the inclusion of appropriate scaffolds, I hope to provide teachers with an opportunity to remediate previous standards related to the primary objectives of the unit.

Content Research

Climate change has been understood by the community for over half a century, dating back to the work of Charles Keeling in 1958. Keeling's data collected from atmospheric carbon concentrations at the Mauna Loa observatory suggested that, in spite of natural variation in carbon dioxide concentration, an excess of emitted carbon dioxide had caused atmospheric concentrations to increase over time; in conjunction with knowledge of the greenhouse effect, which had been understood since the 19th century, scientists such as Keeling became concerned that human activities emitting GHGs could affect the long-term weather and climate patterns of the earth[2]. Keeling's data, however, was only limited to atmospheric measurements and it wasn't until historic carbon concentrations were measured in ice cores that the scope and scale of anthropogenic carbon emissions were placed into context.

The so-called Keeling Curve (Appendix 2, Figure 1), which plots carbon concentrations over time, shows a nonlinear increase in concentrations since the Industrial Revolution. The scientific community is essentially in consensus that human activities which emit GHGs, such as the burning of fossil fuels, is responsible for this trend and that it has shaped the trend in general warming of the planet, which can be measured with variables such as mean temperature anomaly (Appendix 2, Figure 1). The overall warming patterns attributed to climate change have been linked to a number of concerning outcomes, such as extreme weather and storm events, ocean acidification, species extinction, and sea level rise[3]. As such, concerned scientists, industrialists, citizens, and political leaders have undertaken an environmental movement in order to address climate change, as well as its effects.

Environmentalism in the United States has organized prior to the Civil War across multiple movements with diverse goals. The earliest environmental movements in the 19th century were largely comprised of wealthy sportsmen concerned with the depletion of wildlife from hunting and lobbied for bag limits on fish and game, as well as increasing the supply of these animals, with organizations such as the Audubon Society and the Boone and Crockett Club forming at this time[4]. Shortly thereafter, environmentalists became active in protecting land from overexploitation.

Environmentalists were split into two camps. Conservationists, such as the American Forestry Association and president Theodore Roosevelt and his creation of national forests, sought to manage natural resources for sustainable use by regulating mining and logging operations in conjunction with the expertise of competent profession. Preservationists, such as the Sierra Club, sought to preserve and restore "natural" wilderness areas without the intent of utilizing natural resources[5].

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[2] Farmer, G. Thomas. *Modern Climate Change Science An Overview of Today's Climate Change Science* . 1st ed. 2015. Cham: Springer International Publishing, 2015. Web.
[3] Ibid.
[4] Brulle, Robert J. "U.S. Environmental Movements" in *Twenty Lessons in Environmental Sociology*, ed. Kenneth A. Gould and Tammy L. Lewis (New York: Oxford University Press, 2009), 212.
[5] Bruelle, 213-14.

The 1960's and 1970's, however, saw the marriage of social justice and environmentalism, known as the environmental justice movement. The environmental justice movement was not concerned with wilderness, rather the unequal burden of pollution placed on poor and minority communities and saw environmental degradation as a result of the social order: during this time grassroots organizations, as well as national ones like Greenpeace and the Environmental Defense Fund, worked to end toxic waste dumping and hold corporations accountable through lawsuits[6]. Events such as Love Canal, New York; Three Mile Island, Pennsylvania; Woburn, Massachusetts; and Warren County, North Carolina all brought awareness to the disparity between access to pollution-free communities for working-class and minority communities[7]. While the scope and goals of environmental activists vary greatly, the focus on inequity of environmental "goods" and "bads" is a dramatic departure from the wilderness-oriented environmentalism (sometimes called "mainstream environmentalism") of the 19th Century.

Environmental "bads" are unevenly distributed within specific locales (for example, a landfill built near a poor neighborhood), at the state level (e.g. passing environmental regulations or loosening them in a "race to the bottom"), or globally (e.g. the "Global South" being nations more likely to extract natural resources and accept waste). As such, it is necessary to pick a clearly-defined scope for the environmental justice implications of climate change for the unit as the entire topic is simply too broad.

This unit will focus on city-level environmental justice concerns of American cities, specifically New Orleans post-Hurricane Katrina, Houston post-Hurricane Harvey, and eastern North Carolina post-Hurricane Matthew and Florence. Narrowing the scope serves to make concrete the effects of a global issue and provide more specific, relatable examples that parallel phenomenons happening within the city of Charlotte, such as environmental racism, gentrification, and pollution.

Due to its scope and severity, climate change may appear to be a so-called "Transcendent Risk", in that its repercussions will transcend divisions of race, class, and nationality; however, sociologists Margarita Alario and William Freudenburg use the sinking of the RMS Titanic as a metaphor against the transcendent nature of environmental crises. When the Olympic-class ocean liner RMS Titanic sank, it was one of the worst maritime disasters and saw an estimated death toll of 1490 people; however, the wealthy first-class passengers were notified of the sinking within an hour while most of the poor steerage passengers chose to remain on board, misinformed to the situation and believing the skip to be "unsinkable"[8]--while the entire ship did sink, the death rate was significantly higher among passengers who could not afford a first-class ticket, hence the namesake of the "Titanic Rick" theory. This parallels environmental issues thought to be equally catastrophic for all, such as climate change. Although climate change cannot be said to have "caused" Hurricane Katrina, most climate scientists agree that initially small increases in global and ocean temperatures can increase the probability of Katrina-type storms. While the storm destroyed property for both rich and poor New Orleneans, most of its

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[6] Bruelle, 218.

[7] Mascarenhas, Michael. "Environmental Inequality and Environmental Injustice" in *Twenty Lessons in Environmental Sociology*, ed. Kenneth A. Gould and Tammy L. Lewis (New York: Oxford University Press, 2009), 127.

[8]Alario and Freudenburg.

negative effects were brought onto elderly, black, and poor residents, including a diaspora following the storm[9]. While the pattern of Titanic Risks can certainly be applied to other climate change-related phenomena, the local nature of recent storm events in the Southeast serve as an excellent case study for West Charlotte students.

A case study for the Titanic Risk theory can be found in the city of Houston during Hurricane Harvey, when the storm-related flooding exacerbated pre-existing environmental justice issues and disproportionate allocation of environmental risk within the city. Due to its proximity to the Gulf of Mexico and topography, Houston is vulnerable to flood events, having experienced widespread flooding during Tropical Storm Allison (2001), Hurricanes Rita and Katrina (2005), and Hurricane Ike (2008); additionally, flood events such as the Memorial Day (2015) and Tax Day (2016) floods saw property damage and loss of life[10]. When Hurricane Harvey flooded Houston in 2017, both race/ethnicity and socioeconomic status were found to be statistically significant explanatory variables for the flooding across neighborhoods, even after adjusting for geospatial factors like clustering[11]. As such, the extent of flooding from Harvey was greater in predominantly black, hispanic/Latino, and low-income neighborhoods; given the documented physical and mental health problems attributable to flooding, disadvantaged residents in these neighborhoods bore the greater share of the storm's adverse health outcomes[12]. Pre-existing disparities in healthcare, as well as social and financial capital were exacerbated by the job loss, property destruction, health problems, and other postevent experiences: furthermore, even prior to the storm, flood risk was disproportionately distributed throughout Greater Houston, as one study found that despite being unable to afford homes near water-based amenities, Hispanic residents of Houston faced the highest probability of experiencing a 100-year flood[13]. This misallocation of systemic risk will only increase as climate change intensifies: storms bringing more than 20 inches of rainfall to Houston are 6 times more likely now than they were in 2000 and the annual odds of such an event is expected to increase 20% for the period 2081 to 2100[14]. Clearly, climate change can exacerbate preexisting inequality and the disproportionate share of systemic environmental risk placed on vulnerable minority and lower-class communities.

A penultimate consideration of the unit, are the unintended consequences of well-intentioned recovery efforts after hurricanes. Following Hurricane Katrina, Congress appropriated $85 billion, in addition to $100 million in aid from foreign governments; however, the allocation of this funding throughout federal agencies such as FEMA, HUD, and EPA, among others, was inefficient, with large amounts of relief money going unused[15]. Additionally, documented instances of giving contracts only to connected contractors to clear debris and repair

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[9] Ibid.
[10] Chakraborty, Jayajit, Collins, Timothy, and Grineski, Sara. "Exploring the Environmental Justice Implications of Hurricane Harvey Flooding in Greater Houston, Texas." *American Journal of Public Health* 109.2 (2019). 245.
[11] Chakraborty et al., 249.
[12] Ibid.
[13] Ibid, 246.
[14] Ibid, 250
[15] Bullard, Robert D. , and Wright, Beverly. *Race, Place, and Environmental Justice after Hurricane Katrina Struggles to Reclaim, Rebuild, and Revitalize New Orleans and the Gulf Coast* . Boulder, CO: Westview Press, 2009, 168-69.

infrastructure, rather than local minority-owned enterprises, fueled a sense of cronyism, injustice, and profiteering post-Katrina. Following the immediate aftermath, focus shifted towards rebuilding the New Orleans economy. Prior to the storm, tourism, fishing, and oil and gas comprised most of the jobs available for New Orleanians; however, these sectors are, by nature, highly cyclical and unstable. As such, many working-class people were unsure of whether or not to move back due to the uncertainty surrounding their employment: similarly, businesses were unsure of their ability to hire employees and as a result many poor and working-class residents faced even greater economic marginality than before the storm[16]. This contributed to a post-Katrina diaspora that disproportionately affected New Orleans's residents of low SES compared with those in the middle or upper classes.

The post-Katrina diaspora further affected the landscape of the city by driving gentrification. Prior to the storm, there was a strong association between African American communities being located in low-lying areas in New Orleans, which significantly would complicate the original residents' ability to return to their neighborhoods in addition to the aforementioned economic considerations[17]. Unlike gentrification under normal circumstances, which requires developers taking a significant risk investing in a neighborhood affected by urban blight, the complete destruction of sections of New Orleans necessitating new construction created a proverbial *terra nova*[18]. Although the city's recovery efforts have yet to restore the housing stock or population to pre-storm levels as of October 2019, the housing stock has recovered significantly faster than the population, even in spite of the 2007-2008 Financial Crisis[19]. This may be measured through a number of variables, including the median house price index (Appendix 2, Figure 3). Furthermore, due to the targeted funding towards neighborhoods most heavily affected by the storm, the local and federal government inadvertently incentivized developers to gentrify originally inhabited by lower and working-class minorities[20].

Storm risk and climate change is a concrete, tangible intersection of the scientific aspect of climate change, one risk factor, and the social implications of the issue. As such, this will not only provide students with a more tangible example of how climate change currently affects society, but also allows them to study it with the truly multidisciplinary approach that is required for an effective climate risk mitigation strategy that balances a sustainable long-term solution with the shorter-term considerations of systemic inequity that frequently complicate action.

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[16] Ibid, 198-99.
[17] Holm, Eric Joseph van, and Christopher K Wyczalkowski. "Gentrification in the Wake of a Hurricane: New Orleans after Katrina." *Urban Studies* 56, no. 13 (October 2019): 2763–78., 2764.
[18] Ibid, 2766.
[19] Ibid, 2768.
[20] Ibid, 2775.

Instruction

As a unit with interdisciplinary elements, one goal is to provide a diverse assortment of instructional opportunities for students. Central to the success of the unit is framing the content, with respect to both climate and environmental justice considerations not-aligned with NC Math 3 and the standards of the course. When introducing the unit, it is critical that math is used to serve the conversation about environmental justice and climate change, not the other way around.

For most days, there will be a hook in the form of readings and viewing from the news of these events, virtual reality (VR) tour of storm-struck cities, and considerations of existing inequality in Charlotte, both environmental and otherwise, or general discussion pertaining to an aspect of the content.

The unit outline will give a more granular description of the content connections to the standards. Absolute value inequalities will be taught in tandem with temperature anomaly following a short overview of the issue of climate change to introduce students to the concepts of variability and error as they pertain to climate science. The Keeling Curve and CO2 concentration will be taught after a day spent on exponential equations so that students will have more capacity to focus on the climate science aspects than the math; the goals of this particular lesson are to interpret exponential growth in context.

The environmental justice considerations of the unit will be split into multiple days. The first day will focus on existing inequity in Charlotte and elsewhere in the housing market, for which students will write and solve exponential equations to understand trends of gentrification. A second day will be spent on gentrification after Hurricane Katrina when we discuss piecewise functions so that students can understand housing growth can change over time and that climate events like Katrina can exacerbate existing inequalities in society. As the unit concludes, students will begin working on a project connecting all standards with all the climate and environmental justice content, as well as beginning an exploration of solution strategies to climate science and inequality.

As West Charlotte is an International Baccalaureate Middle Years Program school, the unit will be taught as part of the Math 3 professional learning community's resource management theme for functions and will include two summative assessments: the first being a project that will require students to utilize mathematical content from NC Math 3 in order to support their arguments and claims, the second being a multiple choice and free-response question simple test focused on the skills and content knowledge outlined for student success in NC Math 3 by the NCDPI in the same format as the final assessment.[21]

Finally, the unit will conclude with some aspect towards solutions; however it is yet to be determined if these will be scientific solutions aimed at reducing carbon emissions and GHG concentrations or the role social, economic, and political institutions in reducing disproportionate environmental risk among vulnerable populations.

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[21] North Carolina Department of Instruction "North Carolina Essential Standards Math 3 (State Board of Education, 2016)

Unit Outline			
Day	**Standard(s)**	**NC Math 3 Objective(s)**	**Activities**
1	A-REI.1	Students Will Be Able To (SWBAT) write and interpret absolute value inequalities* *because this is an easier standard, more time can be spent on applications, or time can be allocated to remediation of previous standards	-Warm-up (10') • Review question to re-loop previous content, or as part of a remediation for a data-driven instruction (DDI) action plan. • Preview question is prerequisite knowledge for daily object and/or the daily objective with appropriate scaffolds. -Introduction to Error (5') • Students should already be familiar with margin of error to some degree from science coursework; however, it is necessary to explain that there is a degree of uncertainty to all measurement called error. • Can be made concrete by showing a video with an application, such as a news segment on error in polls from the 2008 Election (see Appendix 3, Item 1.) -Direct Instruction: Absolute Value Inequalities Guided Notes (10') • Notes will cover using the formula $\lvert x - center \rvert \leq change$, where center is the average and change is the margin of error. • Additionally, students will be instructed on using the formula or context to state a range of possible values.

2			-Aggressively-monitored Independent Practice (10’) • Between 3 and 4 questions asking students to model absolute value inequalities in context. • Grade for accuracy as students work -Introduction to climate change and temperature anomaly (15’) • Temperature fluctuates about a trend, students should be made aware that although there is variability due to natural processes in the earth, a trend in temperature can be observed. • A video, such as Item 2 in Appendix 3 may be used. To help illustrate that temperatures fluctuate around a mean within a certain margin of error. -Temperature anomaly residuals analysis guided investigation (25’) -Exit ticket (5’)
2	NC.M3.F-LE.3	SWBAT write and interpret an exponential equation* *because exponential equations have so many topics, this day will depart from the unit’s overall theme so as to best expose students to as many potential scenarios as possible. The car depreciation activity will also practice requisite skills needed to examine the Keeling Curve.	-Warm up (10’) • Review/Preview Format -Hook: Compound interest (5’) • A clip, such as Item 3 in Appendix 3, can be used to illustrate concrete examples of exponential growth. • The teacher must iterate that exponential growth, such as compound interest, grows faster than linear and polynomial functions as that standard isn’t in Math 1 or 2.

			-Direct Instruction: Guided Notes (20') • Students will receive instruction in the I do, we do, you do format on the four formats of exponential equations: $f(x) = a(b)^{\frac{x}{n}}$, $f(t) = P(1 \pm r)^t, f(t) = P(1 \pm \frac{r}{n})^{nt}$, and $f(t) = Pe^{rt}$ -Guided investigation: Depreciation of a car (40') • Student will use Kelly Blue Book to look up 10 years' worth of price data on the same make and model of a used car. • Student will calculate the depreciation, the calculate % change, and finally calculate an average rate of depreciation. • With the rate, students can write an exponential equation to the model the car's value in a given year and answer problems about it. -Independent Practice: Writing Exponential Equations (10') • Student will read scenario, determine which equation format is best, define variables, and write equation -Exit Ticket (5')
3	NC.M3.F-LE.3	SWBAT interpret the key features of an exponential equation in context	-Warm up (10') • Review/Preview Format -Hook: GHG Emissions and Global Warming (20') • A video clip from "An Inconvenient Truth" (2006)

			can be used to introduce the Greenhouse Effect and climate science (Appendix 3, Item 4) • Depending on your class, the rigor of this instruction may be adjusted; however, in my opinion it is important not to overreach on climate science and use discussion of current events, news, and students' personal experience to keep them engaged. -Guided Investigation: The Keeling Curve (55') • Use data set (Appendix 3, Item 4) to have students model carbon concentration and/or temperature anomaly using exponential equations. • Depending on your class, the rigor may be adjusted by restricting the data set yourself and having students calculate a rate by hand as they did the prior day on the car value modelling, or use technology (e.g. TI-84, Excel, Google Sheets) to run linear and exponential equations and characteristics, including r-value, analyzed. • Student should be able to identify key features and answer discussion questions on extrapolation, interpolation, and the rate of change relative to other families of functions. -Exit Ticket (5')
4	NC.M3.F-LE.4	SWBAT solve exponential equations (non-word problems)	-Warm up (10') • Review/Preview

			-Direct instruction: guided notes (20’) • Students will re-write exponential and logarithmic equations in I do, we do, you do format. • To solve exponential equations, students will re-write as a logarithm, then evaluate using technology (TI-84), change of base formula, or as a simplified log in I do, we do, you do format. -Group practice (15’) • On solving exponential equations only (no word problems) -Independent practice (25’) • On solving exponential equations only (no word problems) -Re-loop writing exponential equations and absolute value inequalities (15’) • Can be included on Independent practice -Exit Ticket (5’)
5	NC.M3.F-LE.4	SWBAT solve exponential equations (focus on word problems)	Warm up (10’) • Review/Preview -Direct instruction: guided notes (10’) • Model writing, then solving exponential equations in the context of a word problem. -Aggressively-monitored independent practice (15’) • Check answers for accuracy

			as students work. -Hook: The Housing Market, Gentrification (15') • Historically black neighborhoods in Northwest Charlotte, such as Biddleville and Seversville, are being gentrified. • Students are West Charlotte may already be familiar with the issue; however, they may not be as well-versed in the underlying causes or efforts to create affordable housing. • See Appendix 3, Item 6 for WFAE's Finding Home podcast, which addresses the affordable housing crisis in Charlotte, which may be used as a hook for a discussion. -EJ Part 1: Modeling the growth of a home in New Orleans and Charlotte (40') • Students will write and solve exponential equations pertaining to the appreciation of homes in a market. • Depending on the appropriate rigor for a class, students may be given the parameters in context of a word problem, data pulled from a real estate website such as Zillow or Redfin, or be guided through researching property values themselves in order to answer questions requiring exponential modeling to solve.

<table>
<tr><td>6</td><td>NC.M3.F-BF.4</td><td>SWBAT write the inverse of a given function (including exponential and logarithmic)</td><td>Warm up (10’)
Review/Preview
-Direct instruction: guided notes (10’)
Re-loop solving inverses of linear, polynomial, and root functions.
Model finding the inverse of exponential and logarithmic functions by re-writing the equation in I do, we do, you do format.
-Aggressively-monitored independent practice (10’)

-Scavenger Hunt (60’)
Include one station for inverses of exponential functions and another for inverses of logarithmic functions
Stations on solving exponential equations (word and regular), writing exponential equations, and absolute value inequalities from the unit are strongly encouraged
This is also an opportunity to remediate previous standards as part of a DDI action plan</td></tr>
<tr><td>7</td><td>NC.M3.F-IF.2</td><td>SWBAT evaluate a piecewise function (no operations with functions)

SWBAT demonstrate mastery on summative assessment</td><td>Warm up (10’)

-Hook: Marginal taxes (10’)
Marginal tax rates are a great concrete example of piecewise functions: depending on one’s income, the rate at which their income is taxed will vary.
See Appendix 3, Item 7 for a short video to show students</td></tr>
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			explaining marginal tax rates. -Direct Instruction: Piecewise Functions (15') • Model evaluating single outputs (e.g., given a function f(x), find f(3)) using I do, we do, you do format. -Independent Practice: Piecewise Functions (25') -Summative assessment: absolute value inequalities and exponential equations (30')
8	NC.M3.F-IF.2	SWBAT evaluate a piecewise function (operations with functions included)	Warm up (10') -Direct Instruction: Piecewise Functions (10') • Model piecewise equations with several terms (e.g., given g(x), find 4g(1)-g(2)+g(5)) -Independent Practice (15') -Hook: Hurricane Katrina, recovery efforts, and gentrification (10') • Students should understand gentrification, but perhaps not arrive at the counter-intuitive conclusion that after Hurricane Katrina, there is evidence that some neighborhoods were gentrified. • See Appendix 3, item 8 for a video to show. -Guided Investigation: Housing Market before and after Katrina (30') • Students will compart the

			appreciation of the New Orleans house index (Appendix 3, Item 9) from Q1 2000-Q2 2005 to get a sense of the pre-storm market. This should include calculating an average rate of change as was done in the used car and Keeling Curve activities. • Students will then do the same in the post-Katrina timeframe, ending with the 2008 Financial Crisis, Q4 2005-Q3 2007. • Context on the housing crisis may be important for students to understand the domain; however, this issue may be tabled for the subsequent discussion -Discussion (10') • Teacher will create discussion questions for students. • Make sure that students understand that in addition of the effects of the storm, the aftermath's consequences was disproportionately felt by working-class New Orleanais. • This is an opportunity for a culture-builder with students as it will allow them to express themselves on very serious issues that parallel some of Charlotte's most pressing concerns.

9	NC-M3.F-IF.2 A-REI.1	SWBAT describe the key features of a piecewise function SWBAT interpret piecewise functions in context (i.e. word problems) SWBAT show mastery on project	Warm-up (10’) -Direct instruction: guided notes (20’) • Model interpreting, writing piecewise equations in context in I do, we do, you do format. -Independent Practice (25’) -Introduce Climate Change project (30’) • Depending on appropriate rigor of your class(es), your project may end up looking very different; however, it will push students to consider one aspect of environmental justice. • The lowest rigor would be to write word problems with given parameters. • Middle rigor would be to select data sets and have students model these sets. • The highest rigor would include a research piece for data sets. • All aspects of the project should have students: 1.) write, solve, and justify equations in context for absolute values, piecewise, and exponential functions and 2.) use the implications of their numerical analysis to provide analysis and/or solutions for environmental justice issues. -Exit Ticket (5’)

10	PK	SWBAT show mastery on summative assessment	Warm up (10’) • Review/Preview -Summative assessment on piecewise equations (20’) -Work on climate change project (60’)

Appendices

Appendix 1: Teaching Standards

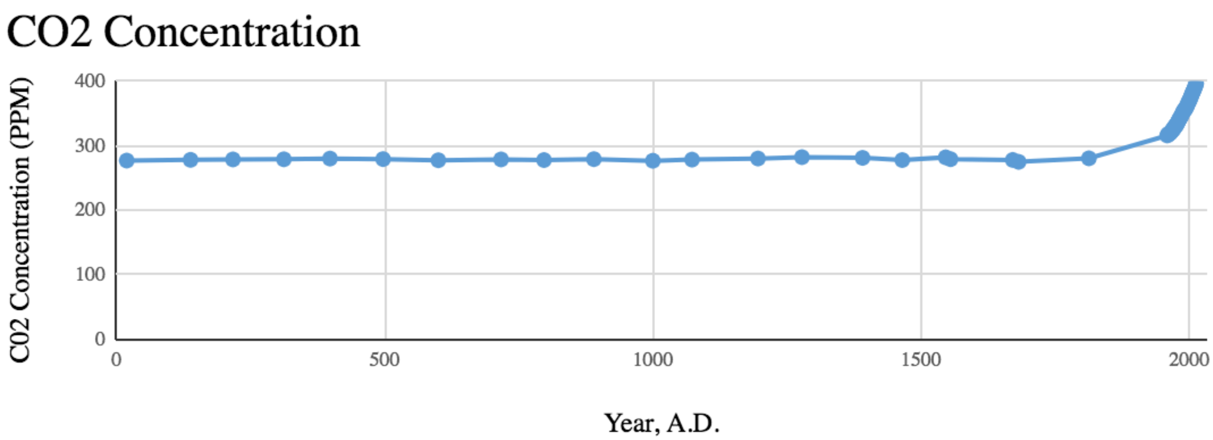
The primary objective of my curriculum unit is to provide instruction, practice, and assessments on the following standards, including prerequisite knowledge:

- NC.M3.F-LE.3: Compare the end behavior of functions using their rates of change over intervals of the same length to show that a quantity increasing exponentially eventually exceeds a quantity increasing as a polynomial function.
    - This effectively applies prerequisite knowledge of key features of functions, including end behavior, such that students will recognize exponential functions grow faster than linear and polynomial functions.
    - According to the state's resources provided in the unpacking document, this comparison is to be done using a comparison of the average rate of change, which is a standard from Math 1 and Math 2 and is not taught in Math 3.
- NC.M3.F-LE.4: Use logarithms to express the solution to $ab^{cx}=d$, where a, b, c, and d are numbers and evaluate the logarithm using technology.
    - Students are effectively asked to solve exponential equations.
    - This standard is closely related to two Math 3 standards taught in the course: finding inverse equations of functions, including exponential equations (NC.M3.F-BF.4) and representing scenarios in context using functions (NC.M3.A-REI.1)
    - While students should be familiar with exponential equations from Math 2, my unit will cover the aforementioned prerequisite knowledge from scratch.
    - Also worth noting is that my unit assumes that the teacher will wait until teaching solving exponential equations to introduce the conceptual and procedural knowledge of a logarithm to students.
- NC-M3.A-REI.1: Justify a solution method for equations and explain each step of the solving process using mathematical reasoning.
    - This is will primarily focus on absolute value functions, including absolute value inequalities, including expressing margin of error as an absolute value inequality.
    - Closely related is NC-M3.A-CED.1 which encapsulates solving inequalities; however, for the sake of simplicity I will be consolidating the conceptual and skills goals for absolute value equations.
- NC.M3.F-IF.2: Use function notation to evaluate piecewise defined functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
    - Students will understand the concept of a piecewise-defined function; practically speaking, they will be able to read its notation and answer questions about key features (F-IF.7), intersections (A-REI.11), and interpretations in context (A-REI.1) with these equations.

Additionally, this unit's discussion of data and error will provide the teacher opportunities to foreshadow standards related to statistics (NC.M3.S-IC) that will taught in future units; however, neither statistical methods nor analysis are an explicit goal or objective for this specific unit.

Appendix 2: Graphs and Data

Figure 1: The Keeling Curve and Carbon Dioxide Emissions

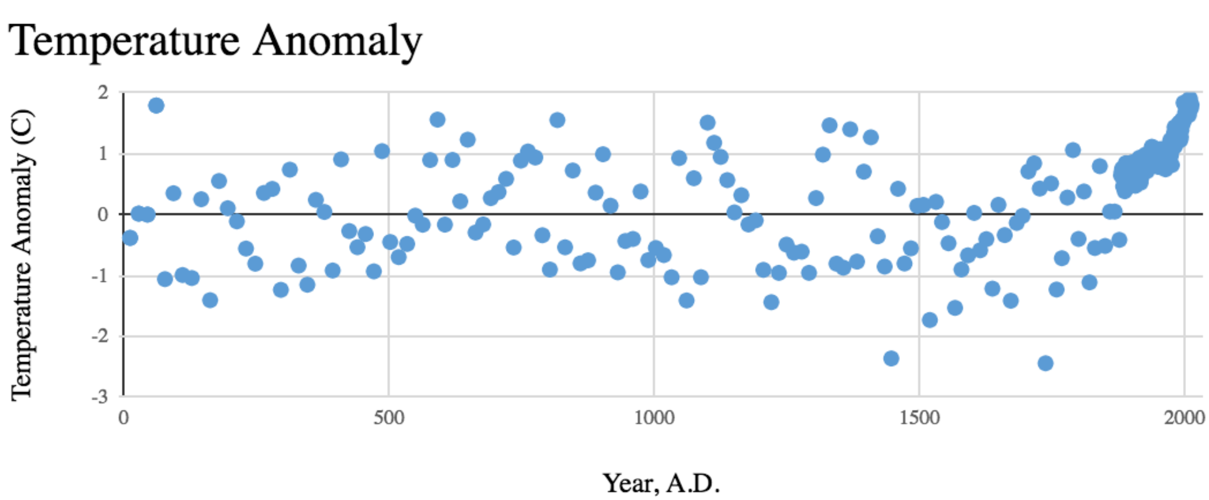


Source: "http://www.ncdc.noaa.gov/paleo/icecore/antarctica/domec/domec_epica_data.html", "https://esrl.noaa.gov/gmd/ccgg/data-products.html", courtesy of Dr. Brian Magi

The graph of nonlinear growth of global CO2 concentration following the Industrial Revolution is known as the "Keeling Curve". Note that the increase in CO2 concentration is a rapid departure from the pre-industrial baseline (prior to about the year 1800), which is relatively static.

The dataset may be found in Appendix 3, Item 5

Figure 2: Mean Temperature Anomaly Since 1938



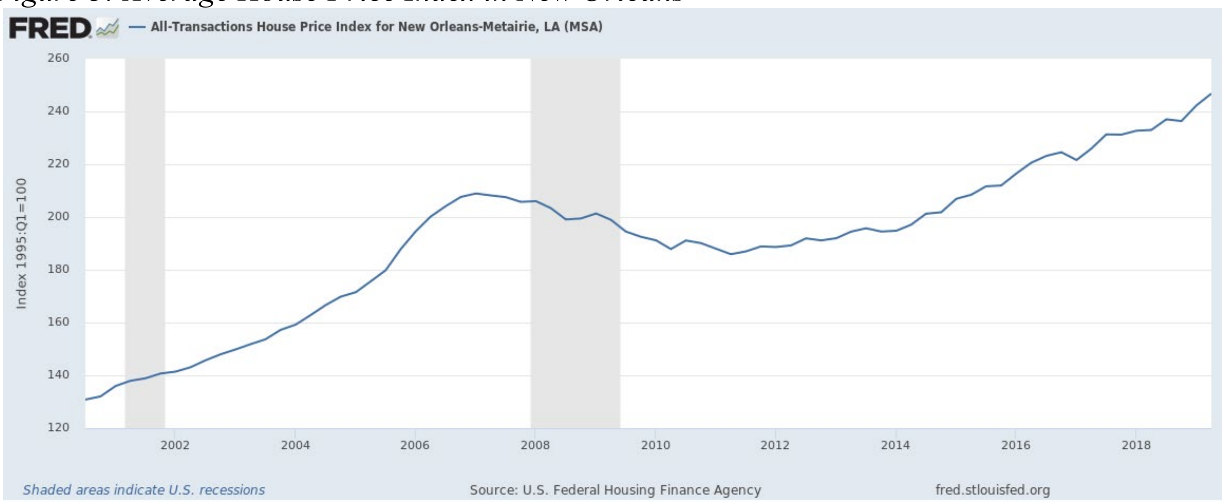
Source: "https://data.giss.nasa.gov/gistemp/", courtesy of Dr. Brian Magi

Figure 2 shows the residual plot of the temperature anomaly relative to the global baseline. Evidence of anthropogenic climate change can be found by looking at the residuals of the post-

Industrial Revolution years, which are all positive. This indicates a trend and suggests that instead of randomly being warmer or colder than the global baseline average, that there is a warming trend as the points indicate warmer extremes.

The dataset may be found in Appendix 3, Item 5

Figure 3: Average House Price Index in New Orleans



Source: "https://fred.stlouisfed.org/series/ATNHPIUS35380Q#0"

The house price index for greater New Orleans, shown between 2000 and the present day. All shaded areas on the graph represent economic recessions. Note that between 2005 and 2007, the rate of growth increases from the previous years. This is a result of the gentrification outlined in the content section; however the rapid appreciation was curbed by the 2007-2008 financial crisis. Admittedly, this is a limited measure of gentrification as it views the city as a whole, as opposed to specific neighborhoods; however, for the purposes of creating instructional materials aligned to standards it will be sufficient.

The dataset may be found in Appendix 3, Item 9

Appendix 3: Supplemental Instructional Materials

Item 1: Video on Error in Polls

“Margin of Error”, YouTube video, 2:15, posted by “CBS,” 30 October, 2008.
https://www.youtube.com/watch?v=3_aIR-NjYSY

This clip discusses error in polling and explains how electoral blowouts can occur in states that appear to be close calls in the polls due to imperfections in the polling process

Item 2: Temperature Anomaly Class Video Resources

“Daily Average Temperature Anomaly, 1990-2010” You Tube video, posted by Berkely Earlth, 4:06, https://www.youtube.com/watch?v=CA9kRmoRGO8

“Long-Term Warming Trend Continued in 2017: NASA, NOAA,” video, posed on NASA website, 1:09, posted by “NASA” https://climate.nasa.gov/news/2671/long-term-warming-trend-continued-in-2017-nasa-noaa/

This first clip characterizes deviation from historic baseline as temperatures rise and fall seasonally and with some error; however, despite the fluctuation, students should be able to observe an upwards (warming) trend.

Item 3: Compound Interest

“‘Carl Nassib, Financial Advisor’ Ep. 1 Clip | Hard Knocks | HBO”, You Tube video, 1:45, posted by “HBO”, posted 13 August, 2018, https://www.youtube.com/watch?v=uN9WSgeETCo

Exponential equations grow very quickly relative to the families of functions in the Math 3 standards. A short, humorous video featuring a casual explanation of compound interest, which follows exponential trends, can serve as a concrete example of the speed at which exponential equations grow. While this is good for money, it is not good for carbon dioxide or temperature anomaly, which appears to be the trend climate phenomena are best modelled with.

Item 4: The Greenhouse Effect

“An Inconvenient Truth (2/10) Movie CLIP - None Like it Hot (2006) HD,” You Tube video, 2:12, posted by “MovieClips” on October 9, 2011,
https://www.youtube.com/watch?v=OqVyRa1iuMc&disable_polymer=true

This short clip provides a humorous summary of the Greenhouse Effect and will allow as a launch point for more substantial direct instruction on climate science, primarily the connection between burning fossil fuels, increased GHG concentration, and rising temperatures.

Item 5: Data tables for Temperature Anomaly and CO2 Concentration

CO2 Concentration Table:

CO2 gas age years AD	CO2 (ppm)
2006.0	378.7
2005.0	376.7
2004.0	374.7
2003.0	372.8
2002.0	370.5
2001.0	368.3
2000.0	366.8
1999.0	365.5
1998.0	363.6
1997.0	361.1
1996.5	359.5
1996.0	359.8
1995.0	358.3
1994.5	356.9
1994.0	356.3
1993.0	354.9
1992.4	353.6
1992.0	354.1
1991.0	352.6
1990.0	351.0
1989.8	349.7
1989.0	349.5
1988.0	348.3
1987.0	346.1
1986.0	344.5
1985.0	343.2
1984.0	341.8
1983.7	341.2
1983.0	340.1
1982.0	338.1
1981.0	337.6
1980.0	336.6
1979.0	332.0
1979.0	335.2
1979.0	335.3
1978.0	333.5
1977.0	331.7
1976.0	331.2
1974.0	328.1
1973.0	326.4
1973.0	329.2
1972.0	324.1
1971.2	325.2
1970.7	324.7
1970.0	323.2
1970.0	324.8
1969.0	323.7
1967.0	322.9
1966.0	318.8
1966.0	319.5
1964.0	318.2
1964.0	319.0
1963.0	317.0
1963.0	317.0
1963.0	318.7
1963.0	319.4
1960.7	315.7
1959.0	316.3
1958.0	314.4
1957.0	314.0
1956.1	316.3
1955.2	313.6
1955.2	314.1
1955.2	314.7
1955.0	313.5
1955.0	313.8
1954.0	311.0
1954.0	311.9
1954.0	312.7
1954.0	311.7
1953.0	312.1
1950.0	312.6
1949.3	311.4
1949.0	309.9
1949.0	311.2
1948.0	310.5
1947.0	310.8
1947.0	310.0
1947.0	311.5
1946.0	311.5
1945.0	309.6
1945.0	309.7
1944.0	311.4
1944.0	312.1
1944.0	311.3
1943.0	310.5
1943.0	311.0
1942.1	312.3
1942.0	310.9
1942.0	311.6
1941.5	310.3
1941.0	310.5
1941.0	310.7
1940.0	311.9
1940.0	311.0
1939.1	309.2
1939.0	310.5
1939.0	310.9
1938.0	309.6
1937.2	307.9
1936.5	309.0
1935.0	309.2
1934.5	307.8
1933.0	307.8
1933.0	307.2
1929.0	305.7
1928.8	307.8
1927.8	305.2
1927.2	305.0
1925.0	304.1
1925.0	304.8
1923.6	305.2
1923.0	303.2
1919.0	303.6
1918.6	303.3
1916.0	301.3
1914.0	300.0
1914.0	300.7
1913.0	300.7
1911.5	298.4
1909.0	300.4
1906.0	296.9
1906.0	298.5
1904.8	299.0
1904.0	295.1
1902	295.7
1902	295.0
1900.8	296.5
1899.0	294.7
1899.0	296.0
1899.0	296.2
1896.0	298.2
1894.0	293.8
1893.0	294.6

1892.1	294.7
1889.0	291.5
1889.0	292.2
1887.0	293.7
1886	290.6
1884.4	289.0
1884.0	289.8
1883.0	291.9
1878.0	288.8
1874.0	290.5
1873	287.2
1870.0	287.4
1869.1	287.7
1867	285.2
1864.0	285.4
1862.0	286.6
1859.0	286.5
1855.0	284.9
1854.0	287.0
1852.3	288.6
1851.0	285.2
1849.0	287.7
1847.5	286.1
1846	283.3
1846	285.0
1844.0	286.5
1841.0	283.0
1838.0	284.1
1834.5	283.7
1833.0	284.5
1826.9	285.1
1826.2	281.3
1814.2	284.3
1799.6	281.1
1799.3	283.7
1796.1	281.6
1794.4	281.5
1780.6	276.8
1779.6	279.5

1773.7	277.8
1763.5	276.3
1762.8	276.7
1752.2	277.2
1752.0	276.4
1749.2	276.9
1742.7	276.7
1734.1	278.2
1722.9	277.5
1722.8	276.9
1694.1	276.5
1689.6	276.3
1681.9	275.9
1649.2	277.2
1640.1	276.6
1628.9	274.5
1610.4	271.8
1603.4	274.3
1591.1	278.7
1588.3	281.0
1573.0	281.9
1560.4	281.7
1549.7	282.8
1529.7	283.2
1501.5	282.4
1469.5	279.6
1449.1	281.7
1431.0	282.5
1429.3	279.5
1411.3	279.6
1390.5	280.0
1390.5	280.4
1349.7	280.1
1330.1	283.4
1306.5	281.5
1275.8	281.1
1257.6	282.1
1246.3	281.7
1207.4	283.6

1192.6	283.9
1159.6	283.9
1136.8	283.8
1105.4	282.8
1087.5	282.4
1058.0	282.8
1036.8	280.3
1025.2	280.8
1005	280.5
1005.0	279.4
968.2	278.5
944.2	279.1
897.4	278.9
857.3	279.3
799.2	278.5
764.5	278.5
729.7	278.5
698.4	279.7
667.9	279.4
632.0	278.3
595.6	276.9
572.0	277.6
536.7	276.0
499.8	276.4
461.2	276.7
428.4	276.9
364.6	277.0
329.2	278.9
302.3	279.8
274.2	280.1
227.9	281.5
202.5	280.7
168.2	280.1
136.0	278.1
104.5	277.5
56.0	277.4
29.5	277.9
13.3	276.7

Source: "http://www.ncdc.noaa.gov/paleo/icecore/antarctica/domec/domec_epica_data.html", "https://esrl.noaa.gov/gmd/ccgg/data-products.html", courtesy of Dr. Brian Magi

year	temperature anomaly relative to past 1000 year average
2013	1.8
2012	1.74
2011	1.75
2010	1.9
2009	1.78
2008	1.63
2007	1.84
2006	1.76
2005	1.86
2004	1.67
2003	1.76
2002	1.78
2001	1.67
2000	1.56
1999	1.58
1998	1.83
1997	1.53
1996	1.47
1995	1.55
1994	1.38
1993	1.27
1992	1.22
1991	1.51
1990	1.5
1989	1.36
1988	1.48
1987	1.38
1986	1.23
1985	1.19
1984	1.2
1983	1.37
1982	1.12
1981	1.43
1980	1.34
1979	1.19
1978	1.14
1977	1.2
1976	0.81
1975	1.02
1974	0.96
1973	1.22
1972	0.96
1971	0.92
1970	1.07
1969	1.02
1968	0.91
1967	0.99
1966	0.93
1965	0.83
1964	0.74
1963	1.01
1962	1.01
1961	1.08
1960	0.97
1959	1.03
1958	1.06
1957	1.04
1956	0.77
1955	0.89
1954	0.87
1953	1.07
1952	1
1951	0.94
1950	0.78
1949	0.88
1948	0.92
1947	1.06
1946	0.93
1945	0.93
1944	1.05
1943	1.01
1942	1.06
1941	1.06
1940	1.1
1939	0.92
1938	1.11
1937	1.05
1936	0.94
1935	0.81
1934	0.92
1933	0.77
1932	0.92
1931	0.95
1930	0.89
1929	0.71
1928	0.92
1927	0.86
1926	0.98
1925	0.78
1924	0.81
1923	0.78
1922	0.82
1921	0.86
1920	0.74
1919	0.84
1918	0.59
1917	0.52
1916	0.71
1915	0.93
1914	0.91
1913	0.66
1912	0.66
1911	0.65
1910	0.67
1909	0.61
1908	0.62
1907	0.47
1906	0.77
1905	0.67
1904	0.5
1903	0.62
1902	0.66
1901	0.85
1900	0.85
1899	0.67
1898	0.6
1897	0.77
1896	0.7
1895	0.67
1894	0.59

1893	0.49
1892	0.51
1891	0.43
1890	0.47
1889	0.84
1888	0.64
1887	0.38
1886	0.45
1885	0.56
1884	0.46
1883	0.75
1882	0.75
1881	0.7
1880	0.64
1876.849228	-0.416279616
1868.067558	0.047049877
1859.240746	0.046791464
1850.029694	-0.516391806
1840.111214	0.791263129
1830.741119	-0.550066848
1820.596222	-1.113263334
1810.061111	0.376498157
1799.897949	-0.401940417
1789.419952	1.054765845
1778.981659	0.27641621
1768.555344	-0.717164259
1758.517166	-1.230612618
1748.12767	0.507577727
1737.813736	-2.439638204
1726.837082	0.424362106
1716.26091	0.838048578
1705.359268	0.705377961
1694.500275	-0.023313597
1683.387909	-0.139366748
1672.229034	-1.414330144
1660.749939	-0.338325473
1648.95697	0.158212686
1637.558228	-1.216096392
1626.145477	-0.405006146
1614.421753	-0.58728448
1603.118713	0.025129511

1591.491791	-0.670389374
1579.098877	-0.902302828
1567.125641	-1.531564542
1554.814423	-0.472096148
1542.534424	-0.124525475
1531.245087	0.206493463
1519.602264	-1.730670087
1507.59082	0.156616366
1495.900848	0.139954555
1483.874817	-0.555573442
1471.785675	-0.804115053
1459.602814	0.420827526
1446.942688	-2.360794084
1434.348999	-0.854408108
1421.235779	-0.35794057
1408.391418	1.264337502
1395.068787	0.701226779
1382.245789	-0.772623716
1369.400146	1.395822684
1356.488647	-0.872734134
1343.526123	-0.806902851
1330.533936	1.460880369
1317.951294	0.980369877
1305.012878	0.268069311
1291.742432	-0.957470418
1277.871643	-0.610007203
1263.348938	-0.626703341
1249.320679	-0.494396153
1234.972961	-0.95810078
1220.72229	-1.438365202
1205.761353	-0.908723606
1191.256592	-0.097634354
1177.592529	-0.164226686
1164.163818	0.31536658
1151.099487	0.033392756
1137.692627	0.562652504
1125.189331	0.942941938
1112.899963	1.17424034
1100.620972	1.504873714
1088.03009	-1.028648817
1074.631653	0.59349102

1060.907593	-1.410019883
1046.833801	0.92407612
1032.668274	-1.029764976
1018.024841	-0.665810943
1003.018066	-0.550191529
988.772949	-0.749130093
974.235107	0.376292216
959.841919	-0.40222513
945.45996	-0.435739338
931.2149	-0.949366233
917.61853	0.142910117
903.33545	0.986854836
889.41089	0.357370007
875.20398	-0.752251727
860.9231	-0.802322884
846.2948	0.720381011
831.84021	-0.538252597
817.34814	1.547327255
803.20911	-0.903343425
789.07751	-0.340902224
775.60645	0.933286005
761.88794	1.032015878
748.50171	0.882425093
734.96375	-0.541941783
720.67786	0.583226867
706.39612	0.367394281
691.77759	0.267447499
677.40845	-0.163577013
663.02039	-0.29659519
648.29065	1.225905255
634.13049	0.215427912
619.5459	0.893604121
605.29077	-0.166531513
591.3783	1.554637362
577.38428	0.891888937
563.38489	-0.168168657
549.37927	-0.019689535
534.07935	-0.483790134
518.09949	-0.699590025
502.10974	-0.451838581
486.73145	1.03759316

471.26489	-0.93297854
455.78418	-0.320940641
440.32153	-0.536667779
424.91394	-0.272291603
409.48804	0.902614905
393.66248	-0.918954776
378.01306	0.040797939
361.98389	0.239013501
345.91748	-1.152068443
329.42017	-0.837993221
312.89343	0.734256655

295.98523	-1.236274853
279.82141	0.418759109
263.98254	0.352069334
247.74658	-0.807252564
230.23218	-0.559416579
213.02502	-0.112916811
195.83105	0.101820236
179.39917	0.548357535
162.59814	-1.4055721
145.76904	0.24946345
128.02551	-1.042294866

110.65527	-0.993099056
93.50171	0.347354767
77.43347	-1.060453283
61.01184	1.786308341
44.54138	-0.002276148
27.9884	0.013606097
11.79126	-0.384380884
61.01184	1.786308341
44.54138	-0.002276148
27.9884	0.013606097
11.79126	-0.384380884

Source: "https://data.giss.nasa.gov/gistemp/", courtesy of Dr. Brian Magi

Item 6: Affordable Housing Crisis in Northwest Charlotte

Worf, Lisa. "Finding Home: Efforts To Counteract Displacement In West Charlotte" Finding Home, January 7, 2019. https://www.wfae.org/post/finding-home-efforts-counteract-displacement-west-charlotte

Boraks, David, "Finding Home: Land Trust Raising Money, Acquiring Property To Preserve West Charlotte" Finding Home, June 3, 2019. https://www.wfae.org/post/finding-home-land-trust-raising-money-acquiring-property-preserve-west-charlotte

Both episodes are short and discuss the issues behind the gentrification of West Charlotte, as well as efforts that are underway to hedge displacement despite the rapidly appreciating property values. Although this isn't entirely related to the gentrification described post-Katrina, it's an issue the students can relate to and for when discussion inevitably turns to New Orleans.

Item 7: Marginal Tax Brackets

"How tax brackets actually work", You Tube Video, 2:47, posted by "Vox" on January 18, 2019. https://www.youtube.com/watch?v=VJhsjUPDulw&disable_polymer=true

Marginal tax brackets are an excellent, concrete example of piecewise functions as most students in high school either work or understand that their income is taxed. What students might be less familiar about, however, is that in a progressive tax scheme, such as an income tax, that the rate paid is determined by one's income and thus is effectively a piecewise function since different inputs will be placed into different equations to calculate taxes owed (most students should have a conception that higher-income Americans will pay higher taxes).

Item 8: Post-Katrina Gentrification

"10 Years After Katrina, Has New Orleans Been Rebuilt, or Just Gentrified?", You Tube Video, 4:54, posted by "AJ+" on August 25, 2015. https://www.youtube.com/watch?v=QW3tV4C8IGM

Video discusses the counter-intuitive conclusion that well-intentioned recovery efforts actually gentrified primarily working-class and/or black neighborhoods in New Orleans. This is far more accessible than the academic material discussed in the curriculum unit and pairs nicely with the data for the investigation.

Item 9: Katrina Housing Data Table

Date	House Index
2000-01-01	128.53
2000-04-01	129.15
2000-07-01	130.80
2000-10-01	132.01
2001-01-01	135.97
2001-04-01	137.93
2001-07-01	138.87
2001-10-01	140.68
2002-01-01	141.40
2002-04-01	143.04
2002-07-01	145.67
2002-10-01	147.96
2003-01-01	149.81
2003-04-01	151.79
2003-07-01	153.64
2003-10-01	157.20
2004-01-01	159.21
2004-04-01	162.82
2004-07-01	166.60
2004-10-01	169.81
2005-01-01	171.50
2005-04-01	175.60
2005-07-01	179.78
2005-10-01	187.83
2006-01-01	194.62
2006-04-01	200.16
2006-07-01	204.08
2006-10-01	207.59
2007-01-01	208.91

Source: "https://fred.stlouisfed.org/series/ATNHPIUS35380Q#0"

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North Carolina Department of Instruction "North Carolina Essential Standards Math 3 (State Board of Education, 2016)

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