9-12 MATH
PERFORMANCE TASK
TEACHER INSTRUCTIONS

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TASK OVERVIEW

TITLE	GRADE LEVEL	SUBJECT AREA	INSTRUCTIONAL UNIT	TIME FRAME: HOW LONG TO ADMINISTER THE TASK?
The Perfect Storm (Name): Gale vs. Gail	9-12	Mathematics	Descriptive Statistics Analysis of Statistical Data: Graphically, Numerically, Algebraically, Verbally, Technologically, and Analytically	As an Extended Task: 1-3 weeks after material required to complete task is learned. As a Short Task or Common Task: 1-2 class periods depending on whether class period is a block period or not.

CONTENT AREA[1]
PROFICIENCIES AND PERFORMANCE INDICATORS

GRADUATION PROFICIENCY	GRADUATION PROFICIENCY DESCRIPTION	PERFORMANCE INDICATOR	PERFORMANCE INDICATOR DESCRIPTION
#6 Data, Statistics, and Probability	Students will apply principles of statistics and probability to analyze and interpret data, reach and justify conclusions and make inferences and predictions.	A	Summarize, represent, and interpret data. (HS.S-ID.A, B, C)
#1 Mathematical Reasoning and Communication	Students will reason mathematically to solve problems and communicate with others.	B	Select strategies and appropriate tools to develop and implement a plan to solve a problem. (MP1, 5)
#1 Mathematical Reasoning and Communication	Students will reason mathematically to solve problems and communicate with others.	E	Precisely communicate mathematical understandings and connections using a variety of representations. (MP1)

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[1]Modifications were made to the Content Performance Indicators (PIs) after the task was administered. These modifications were based on a more thoughtful interpretation of the relevant CCSS standards. The modified versions are shown below.

GRADUATION PROFICIENCY	GRADUATION PROFICIENCY DESCRIPTION	PERFORMANCE INDICATOR	PERFORMANCE INDICATOR DESCRIPTION
#1 Mathematical Reasoning and Communication	Students will reason mathematically to solve problems and communicate with others.	B	Select strategies and appropriate tools to develop and implement a plan to solve problems. (MP1, 5)
#1 Mathematical Reasoning and Communication	Students will reason mathematically to solve problems and communicate with others.	E	Precisely communicate mathematical understandings and connections using a variety of representations. (MP1, 3, 6)

CROSS-CURRICULAR
PROFICIENCIES AND PERFORMANCE INDICATORS

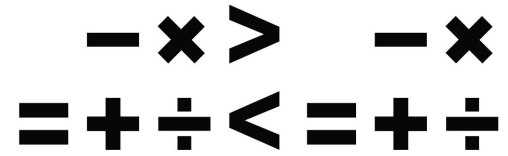| GRADUATION PROFICIENCY	GRADUATION PROFICIENCY DESCRIPTION	PERFORMANCE INDICATOR	PERFORMANCE INDICATOR DESCRIPTION
Communication	Students will demonstrate communication through using a variety of modes to convey meaning to and seek understanding from others.	3	Choose and apply an appropriate communication strategy according to audience and purpose.

SCORING CRITERIA[2 and 3]

PERFORMANCE INDICATOR	BEGINNING	DEVELOPING	PROFICIENT	EXPANDING

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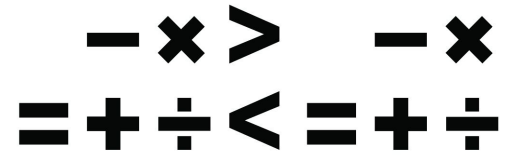
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#6 Data, Statistics, and Probability: A Summarize, represent, and interpret data. (HS.S-ID.A, B, C)	Construct a representation of data and identify a distribution or pattern of the data.	Construct a representation of data, identify the distribution or pattern of the data, and communicate the meaning of the data.	Construct an appropriate representation of data, describe the distribution or pattern of the data, and communicate the meaning of the data.	Construct and use appropriate representation(s) of data to make predictions and justify conclusions.
#1 Mathematical Reasoning and Communication: B Select strategies and appropriate tools to develop and implement a plan to solve a problem. (MP1, 5)	Identify strategies and/or tools that could be used to solve a problem.	Select strategies and tools to solve a problem and apply initial strategies to attempt to solve a problem.	Design and implement a plan, including appropriate tools and strategies, to solve a problem	Design, implement, and refine a plan including appropriate tools and strategies, to solve a problem.
#1 Mathematical Reasoning and Communication: E Precisely communicate mathematical understandings and connections using a variety of representations. (MP1)	Communicate understanding using language and representations.	Communicate mathematical understanding and connections using mathematical language and representation(s).	Clearly and logically communicate mathematical understanding and connections using technical mathematical language and appropriate representation(s).	Enhance communication through the intentional sequencing and presentation of ideas and the strategic selection and use of representations.
Communication: 3 Choose and apply an appropriate communication strategy according to audience and purpose.	Identify audience and purpose of communication. Use a method of communication (e.g., written, oral, visual, graphic, audio,	Use some appropriate aspects of style, tone and language to partially address the needs of the audience and purpose. Select and use a	Use appropriate style, tone, and language to address intended audience and purpose. Select and use a method of communication (e.g.,	Use strategic, engaging, and creative style, tone, and language to effectively address the intended audience and purpose. Select and use a

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	and/or interactive) to present ideas.	method of communication (e.g., written, oral, visual, graphic, audio, and/ or interactive) to present ideas.	written, oral, visual, graphic, audio, and/or interactive) that fits the audience and purpose.	strategic method of communication (e.g., written, oral, visual, graphic, audio, and/or interactive) that effectively addresses the audience and purpose.

2 The scoring team did not use the cross curricular scoring criteria *Communication (3. Choose and apply an appropriate communication strategy according to audience and purpose)* during their calibration session since they did not witness the student presentations.

When scoring they considered the other criteria in this order:
- #1 Mathematical Reasoning and Communication: B
- #1 Mathematical Reasoning and Communication: E
- #6 Data, Statistics, and Probability: A

3 Modifications were made to the Scoring Criteria after the task was administered. These modifications were based on those made to the Performance Indicators. The modified versions are shown below.
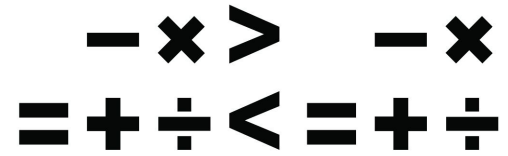
If the decision is made to use this task, we advise using the modified Scoring Criteria. This may require the user to make adaptations to the task before administering it to students.

PERFORMANCE INDICATOR	BEGINNING	DEVELOPING	PROFICIENT	EXPANDING
#1 Mathematical Reasoning and Communication: B Select strategies and appropriate tools to develop and implement a plan to	Identify strategies and/or tools that could be used to solve problems.	Select strategies and tools to solve a problem and apply initial strategies to attempt to solve problems.	Select strategies and appropriate tools to develop and implement a plan to solve problems.	Design, implement, and refine a plan including appropriate tools and strategies, to solve problems.

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solve problems. (MP1, 5)				
#1E Precisely communicate mathematical understandings and connections using a variety of representations. (MP1, 3, 6)	Communicate understandings or connections using at least one representation.	Communicate understandings and connections using appropriate representation(s).	Precisely communicate mathematical understandings and connections using a variety of representations.	Precisely communicate mathematical understandings and connections in an organized way using appropriate mathematical language and a variety of representations.

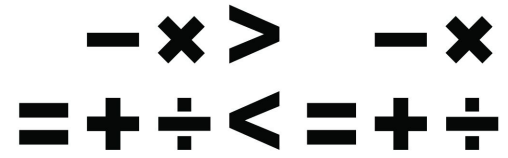## CONNECTIONS TO INSTRUCTIONAL UNIT

UNIT SUMMARY
May include big ideas, authentic context, enduring understandings, essential questions.

This instructional unit on Descriptive Statistics/Data Analysis will initially equip students with the essential mathematical/statistical concepts and formulas necessary to solve real-world problems involving raw data. The collection, organization, analysis, and representation of data through various descriptive statistics methods will be learned with and without the use of technology as necessary throughout the unit. Students will be given numerous opportunities throughout the unit to collect, analyze, represent, and interpret sets of raw data graphically, numerically, algebraically, verbally, technologically, and analytically as it applies to many diverse contexts. Once students are comfortable with the aforementioned, students will begin to analyze relationships, trends, associations, and correlations that exist between sets of data. Students will then have the necessary tools to solve relevant, real-world problems involving raw data. Students can then make predictions and informed decisions when confronted with a novel situation involving raw data utilizing the skills and concepts acquired in this unit.

What will students know as a result of instruction in this unit in order to complete the task?	What will students be able to do as a result of instruction in this unit in order to complete the task?
Students will know how to analyze a given set of raw data in its most simple form. They will know how to organize, represent, and interpret the data. They will	Students will be able to analyze a set of data in its most simple form and through a variety of representations have the ability to represent, summarize, and interpret data sets.

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know how to represent data in a variety of ways. Students will have been instructed on measures of center, spread, dispersion, and position of univariate data. Students will have the knowledge to make comparisons and contrasts between sets of data graphically, numerically, and verbally through a variety of representations.	Students will "produce" relevant ways to illustrate their findings through graphs, technology, articles, announcements, or infomercials.

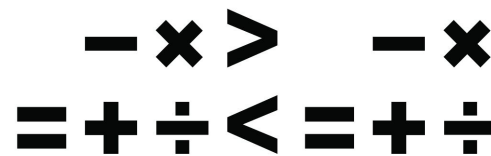| **How will teachers know what students know and can do prior to the task? Which relevant concepts and skills have students struggled with, had misconceptions about or missed entirely?**	**What background knowledge do students need (cultural, language, etc)? Have both content goals and language demands for ELL students been considered? Have the needs of diverse learners been considered?**
Teachers will be able to determine what students know and can do prior to the task through several formative assessments concentrated on plotting points; determining positive, negative, or no correlation between variables; creating a bar chart or organizational table of data, etc.	Background knowledge that is required of all students includes the mathematical and statistical vocabulary associated with the descriptive statistics previously addressed in grade 8. Grade 8 standards focus on the organization and representation of data and the ability to select a plan to solve a problem in its earliest stages.

CULMINATING TASK

TASK SUMMARY
Students will defend or refute the argument that female named hurricanes are more dangerous using a valid, well-constructed statistical argument. Students will plan how to best analyze and present their findings.

STUDENT ACTIVITY
- In writing, students will share with their teacher any personal experiences they have with catastrophic events such as hurricanes.   - Students will be provided with raw data related to Male and Female named hurricanes occurring in the United States between the years 1950-2012.   - On their own, students create a list considering the manner in which they could organize the data and then

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represent it graphically, numerically, verbally, and algebraically. They may do this on white lined paper or on mini whiteboards.
- As a whole class, students share their responses and teacher creates an anchor chart for future reference.
- In a whole class discussion, students share ways they could present their final project.
- Individually, students will represent the data graphically. They will choose and create an appropriate graph to compare the data. They can use the Four Quadrant Math Problem planning sheet to help them formulate their solution plan.
- Individually, students will perform calculations to support their observations and summarize their findings using the graph they created.
- Individually, students will "produce" an artifact of their choice that best represents and supports their findings.
- Students self-reflect on their process and product so far using the self-assessment form. They make adjustments to their product accordingly.
- Students present their final project to their peers.
- Students complete the final reflection.

CONSIDERATIONS FOR DIFFERENTIATION AND ACCESSIBILITY

- Some students may prefer to share this information in conversation with the teacher instead of in writing.[4]
- Students may be provided with a hard copy of the data or a link to the **Hurricane Data Sheet**
- Provide a template for initial brainstorming of ways to represent data. You may also have some students access their notes to complete this portion of the task.
- Time considerations for students who struggle to create graphs given a time constraint (smaller sample size?).
- Provide template or partially created graph for students who qualify for extra time.
- Provide a student guided flowchart or graphic organizer to assist students who have difficulty with the steps in problem solving of this type.
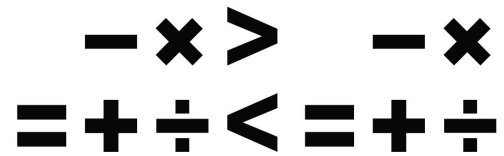- Provide a student guided flowchart or graphic organizer to assist ELL students.

[4] Prior to the introduction of the task, a general class discussion should occur in which students share their knowledge and personal experiences with hurricanes.. Some students may elect to share their personal connections in private with the teacher.

Time should also be dedicated to discussing how and why hurricanes are named as they are. The article Hurricane

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Names - How Are Hurricanes Named? is a useful resource. As stated in the article, it is important to note that "using names for these storms makes it much easier for meteorologists, researchers, emergency response workers, ship captains and citizens to communicate about specific hurricanes and be clearly understood."

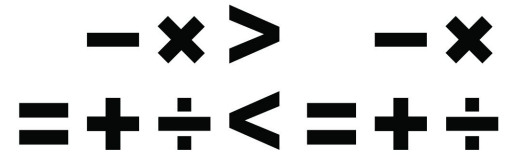**ADMINISTRATION NOTES AND DIRECTIONS**[5]

- Prior to task administration, provide students the opportunity to share any personal connections they may have with catastrophic events such as hurricanes.
- Provide students with the handout showing the hurricane data. Provide some context as to how hurricanes receive their names. Hurricane Names - How Are Hurricanes Named?
- With the whole class, brainstorm ways that students can organize their data and represent it.
- Display a four square chart with the headings: Organize, Graphical Representations, Numerical/Algebraic Representations, and Verbal Representations.
- Direct students to generate their own lists of ways to organize the data and then represent it. (Teachers have the option of collecting this from students.)
- Ask students to share their thoughts with the whole class and record results of whole class share out and create an anchor chart for reference.
  Possible responses include:
- Organize:
  stem and leaf plots, tally charts, frequency tables and frequency charts, graphing calculator lists
- Graphical representation:
  bar charts, line plots, circle graphs, box and whisker plots, scatter plots
- Numerically/Algebraically:
  mean, median, mode, range, mean deviation, sample variance, sample standard deviation, quartiles, percentiles, deciles, outliers, influential points, interquartile range
- Verbally:
  center (central tendency), spread (variability or dispersion), shape, skewness, outliers, trends, predictions, informed decisions, correlations, and associations via a paragraph summary and/or journal reflection
- Have a class discussion about ways the final product could be presented to substantiate their claim (e.g. youTube video, weather report, weather blog post, etc.). Chart student responses for future reference.
- Provide students with the Four Quadrant Math Problem planning sheet to assist students in developing and executing their solution plan. During the solution process students should self-assess their work at least once while working on the performance task. They should use the scoring criteria to self-assess and identify areas to improve. See self-assessment form.
- Provide time for students to present their final projects to their peers.

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● Provide time for students to complete the final reflection.

5 The team felt it is important that students should be responsible for digitizing their final products. There should be a specific effort for developing a protocol or executable way that teachers can have their students put their work in one location. This will facilitate the scoring process and eventual analysis. Guidance and additional scaffolds for some students should be considered.

MATERIALS AND RESOURCES

- **Hurricane Data Sheet**
- 4 Quadrant Math Problem planning sheet
- Student self-assessment form
- Various Statistics Texts

- Hurricane Names - How Are Hurricanes Named?
- College Board: AP Free Response Question Samples for AP Statistics Examinations
- www.stattrek.com
- www.education.ti.com
- www.collegeboard.com
- www.goformative.com
- Mathematics Assessment Resource Service
- http://www.map.mathshell.org/lessons.php

- Definition of Rigor (Achieve the Core)
- Achieve the Core Coherence Map
- Standards for Mathematical Practice
- Progressions for the Common Core Math Standards

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