

Performance Based Learning and Assessment Task

Animal Decline

I. ASSESSMENT TASK OVERVIEW & PURPOSE:

Throughout the “Animal Decline” Project, students will be studying the population of different species of animals, specifically those that are in decline at a more alarming rate during the current time from a predetermined list. Students will research the population over past years of a species of animal in small groups. Using the data, students will model graphically, make predictions about the population in years to come, create a presentation for the class to display their findings, and create a quiz using the provided template for their classmates using their particular data. The students will be responsible for creating the key to their quiz and will take the quiz of another group as well. This project is meant to deepen and assess the students’ understanding of curves of best fit.

II. UNIT AUTHOR:

Rachel Grzech, Bayside High School, Virginia Beach City Public Schools.

III. COURSE:

Algebra 2

IV. CONTENT STRAND:

Algebra: Functions

V. OBJECTIVES:

The learner will be able to...

- Collect and analyze data.
- Recognize graphs of parent functions.
- Based on the collected data, find an equation for the curve of best fit, using a graphing calculator.
- Investigate and analyze exponential functions using the graphing calculator.
- Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically.
- Describe restricted domains and ranges, given a real world situation.

VI. REFERENCE/RESOURCE MATERIALS:

- Project handout sheet (1 per student- attached pg. 7)
- Animal species suggestion list (attached pg. 8)
- Project quiz template (1 per student- attached pg. 9)
- Assessment and rubric sheet (1 per student- attached pg. 10-11)
- Laptops or tablets (for research and quiz creation)
- Notes on the differing functions
- School-issued graphing calculators
- Poster board or 11”x14” brochure paper (1 per group)
- Poster decorating materials as provided or requested per group.

VII. PRIMARY ASSESSMENT STRATEGIES:

Attached is the Assessment List and Rubric for the Animal Decline Project. The goal of the activity is to deepen and assess the students' understanding of exponential growth and decay by modeling and analyzing real and relevant animal population data. Using the attached documents, student assessment will focus on the completion of the task, how the work has been presented, if the student is able to explain their work, process and results through the products created, and the accuracy of their graph and formula. Whether or not the students' understanding of exponential functions has changed (from their previous knowledge assessed on Unit Assessments) will be measured using the presentation of findings, their visual representation and all mathematical work. A portion will also come from the quiz they create and complete. Each group will create a quiz for their classmates using a given template and the corresponding key. Each student will be asked to complete a different group's quiz and will receive a portion of their overall score from that piece.

VIII. EVALUATION CRITERIA:

Students will be evaluated on the correctness of their graphs, equations, and/or tables for their species' population, their ability to present their findings in a meaningful and coherent manner, and their individual performance on the quiz. Further description can be found in the attached Project Rubric. The quiz will be graded using a key, created by the corresponding group. All other portions will be evaluated using the Rubric.

IX. INSTRUCTIONAL TIME:

The instructional time will be four 90-minutes blocks. The first will be research and organization. The second will be design and creation of group presentations and quiz. The following two blocks will consist of presentations and the quiz. Students would have already had their lessons on all families of functions in previous class blocks.

Animal Decline Project

Strand

Algebra: Functions

Mathematical Objective(s)

The learner will be able to...

- Collect and analyze data.
- Recognize graphs of parent functions,.
- Based on the collected data, find an equation for the curve of best fit, using a graphing calculator.
- Investigate and analyze functions using the graphing calculator.
- Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically.
- Describe restricted domains and ranges, given a real world situation.

Further, the student will be able to...

- Organize their work in a presentable fashion for presentation to classmates.
- Make predictions based on current trends

The goal of this task is for students to deepen their understanding of curves of best fit. Students will be using their mathematical knowledge of growth and decay to research the population decline of a species of animal. Their research will then be modeled and explained to their classmates through small group presentations. The project reinforces the students' ability to use and understand curve of best fit, cooperatively work with other students, complete accurate research, organize their resulting data, and accurately answer questions based on a given data set other than their own.

Related SOLs

- **AII.6** (shape of functions and conversion between graphic and symbolic forms of functions)
- **AII.7** (investigate and analyze functions algebraically and graphically)
- **AII.9** (collect and analyze data, determine the equation of the curve of best fit, make predictions)

NCTM Standards

- Generalize patterns using explicitly defined functions.
- Use symbolic algebra to represent and explain mathematical relationships.
- Use mathematical models to represent and understand quantitative relationships.
- Solve problems that arise in mathematical and other contexts.
- Organize and consolidate their mathematical thinking through communication.
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.
- Use the language of mathematics to express mathematical ideas precisely.
- Recognize and apply mathematics in contexts outside of mathematics.
- Create and use representations to organize, record, and communicate mathematical ideas.
- Select, apply, and translate among mathematical representations.
- Use representations to model and interpret physical, social, and mathematical phenomena.

Additional Objectives for Student Learning:

- **BIO.1** (graphing and arithmetic calculations are used as tools in data analysis)
- **BIO.7** (how populations change through time)

Materials/Resources

- Project handout sheet (1 per student- attached pg. 7)
- Animal species suggestion list (attached pg. 8)
- Project quiz template (1 per student- attached pg. 9)
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- Laptops or tablets (for research and quiz creation)
- Notes on differing functions
- School-issued graphing calculators
- Poster Board or 11"x14" brochure paper (1 per group)
- Poster decorating materials as provided or requested per group.

The teacher needs to be sure to procure the appropriate computers for use ahead of this task.

Assumption of Prior Knowledge

Prior knowledge:

- Students should have an understanding of absolute value, linear, quadratic, polynomial, exponential and logarithmic functions. They should know and understand the characteristics of these functions and their graphs. Students should understand how to find a curve of best fit. Students should understand decline, population and endangered species.
- Students should have some experience exploring the graphs of all functions.

Background:

- Students will not be creating situations to fit information previously discussed in class; students will need to be ready to step beyond the old information to create modeling situations for a new set of data.
- Students should be showing success with problems at the Procedures with and without connections levels. This task will push them to a new level of independent mathematical processing.

Possible Difficulties:

- Students may have issues developing the formula to model their researched data. This will include, remembering that in the final equation x and y should remain variables, while any other letter will be replaced with their number representative of the data set evaluated.

Relevance:

- Students should consider how the decline and possible loss of their assigned species can affect the world and the human race. Students should discuss any ideas they have of how to help with the loss of their species.

Introduction: Setting Up the Mathematical Task

- Briefly discuss functions to refresh what the students already know. Specifically, ask about the population growth/decay formula to determine if they remember what the variables stand for. Ask for situations that could be modeled using this equation.
- The teacher will hand out the Animal Decline Project Handout; introduce the assignment, and then read through the handout.
 - ❖ “In this task/activity, you will research the growth or decline in a species of animal in small groups. Each group will get to choose an animal from a small list. No two groups may choose the same animal. You will use functions and graphs to correctly model your research findings and present them to the class. Each group will create a quiz on the mathematics behind your findings on your animal from a template for your classmates to complete. You will complete a quiz from one of the other groups to ensure you fully understand the material and participated in your group’s project.”
 - ❖ Make the students aware of the timeline.
 - Day 1 and will consist of researching all data needed for the group’s animal.
 - Day 2 will be all about working as a group to put together their findings into a cohesive project, visual for presentation and quiz.
 - Day 3 is for the quiz and presentations.
 - Day 4 is all presentations.
 - ❖ “If your group cannot finish the project within the time limits given in class, then they will need to arrange time out of school to finish it together.”
- Take questions about the handout, timeline, and purpose.
- See the Animal Decline Handout for further details about the task.
- Assign groups and allow a few moments for each group to decide on an animal before releasing students to working independently of the class.

Student Exploration

Research – Day 1 (*approximately 60 minutes*)

- Assign laptops to students without assigned tablets or take class to the computer lab.
- Have students work with their small groups and use the laptops to look up population information about their animal species.
- Assist students as needed to find and make decisions about what information is relevant and needed to the project.
- To integrate technology, students will be researching on their laptops, using graphing calculators and possibly excel for calculations.

Preparation – Day 2 (*90 minutes*)

- For a clearer outline on the expectations of day 2, please see the project handout.
- Have students get out what they completed the previous class and begin working on their presentations and quizzes. Remind students that their quiz and key is due before the end of the block.
 - As a start to the class, hold a quick discussion about the equations they should be finding. Have students discuss what the variables should be in their groups and which two variables should not be substituted in for in the final equation. Have a short discussion about the coefficient of determination of their equations (r^2 value): How do they find it, which one do they use?
- As students begin to work in groups, visit each group asking how they plan to go about organizing their information, what they plan to say and do during their presentation. Assist students in making the correct assessments regarding their equations and graphs as needed.
- Collect quizzes and keys from groups. They may be electronic copies.
- If students finish with all tasks early, they may begin to practice their presentation.

Quiz and Presentations – Days 3 and 4 (180 minutes)

- Have students prepare for their presentation. Students may prepare as they see fit. This could include: practicing their presentations quietly in groups, double checking the flow of posters, etc.
- Each small group will present their visuals and their findings. Groups will take questions from their peers and teacher.
- Students will complete a short quiz created by one of the other groups using the template the teacher provided.

Monitoring Student Responses

- Students are expected to communicate their findings and thought process by writing down their research, keeping track of their work and creating models of the animal's population within their small groups. They are then expected to present their research and results to the class both orally and pictorially. Each student is expected to do equal amounts of the work within the group.
- If students finish early, the teacher should ask additional questions about the population of their animals. For example, what do you think could cause a greater decrease? What can humans do to assist the efforts to save the species?

Summary (*approximately 5 to 10 minutes at the beginning of the 5th day*):

- Once the teacher grades the quizzes using the group provided keys, hand them back to the students. Allow for a short discussion of the open ended 5th question about the impact humans are having on these animals.

Assessment List and Benchmarks

- The required assessment list, rubric and benchmarks are attached.
 - The assessments for each task are described above in the daily plan. The way those assessments will be graded is included within the Animal Project Handout.

Accommodations:

- Students in need of read-aloud services will be sent to resource to have their quiz read to them, if an inclusion teacher is not available.

Animal Decline Project Handout

This project has two separate parts. It will be completed over 2 days in class, followed by 2 days of presentations. Each student will be a portion of a three person team.

Part 1: This portion of your project will count for 60% of the project grade. Your group will create a presentation to display the results of your research. The product should be a brochure, poster or tri-fold board (non-electronic). This part of your project will be graded using the included rubric.

Reminder for the Presentation: You are to tell us about the trends and significant changes in the population. This must have some reasoning and explanation. DO NOT just recite the numbers!

You and your partners will be assigned an animal whose population is struggling. Your task is to research, analyze and organize the data regarding your animal. Then, your group will create a table, graph, and equation that model your data. Be ready to present your findings to the class during the 3rd class period of the assignment. After presentations are completed, you will each take a quiz on your own, given information about another species.

Your species is the _____.

You will conduct appropriate research to find the population as of certain years. While you may choose the years that you include, please be sure you go back in time far enough to ensure that you can make accurate predictions.

Needed for your visual and presentation:

1. Basic information about the species you have been assigned (type of animal, habitat, lifespan, current threat level).
2. Use the skills taught in class to develop the proper equation that accurately describes the population. Use discussions in class to help make the correct decisions to model your data.
3. Create a table of your data. Please include a justification of how and why you chose the equation stemming from your table of data.
4. Create a graphical representation of your data. This should include the equation you have found.
5. Predict your animal's population this year. Predict the population in 2020. Be able to explain how you made these predictions.
6. Consider the importance of tracking the population of your animal. How will the population growth or decay affect the world? Do you think the model you have created will remain valid for years to come (meaning will the pattern continue)? Explain why or why not.

Part 2: There will be an in-class assessment that will be graded on the correctness of your mathematical understanding of population growth and decay. You will be assisting in writing this assessment. This will be 40% of the overall project grade.

- You are to fill in the provided quiz template with your species' data and complete a key for your version of the quiz. Please change the name to reflect your animal. (20% of the Project grade)
- You will be taking a different version of the same quiz using another group's animal. For the quiz, be sure you can use given data and write an equation modeling it, graph the data, make predictions, and write about the importance of monitoring population change.

Suggested List of Animals

1. African Elephant
2. Reindeer
3. Porbeagle Shark
4. Wandering Albatross
5. Blue Whale
6. Turtle dove
7. Harbour Seal
8. Black Rhino
9. Tiger
10. Leatherback Turtle

Any other suggestions must be approved by the instructor.

Animal Decline Quiz Template

(Grade is 40% of overall test grade- 10% for your quiz and key, 30% for your work on the quiz in class)

Your created quiz is due at the end of day 2

The population of the (***insert your animal name here***): (Choose 6 of the years of data that you used for your project for this top section)

Date 1: *insert data here*

Date2: *insert data here*

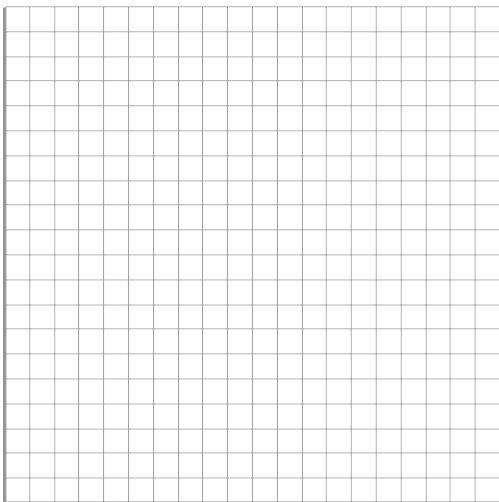
Date 3: *insert data here*

Date 4: *insert data here*

Date 5: *insert data here*

Date 6: *insert data here*

1. Develop an equation modeling the (*insert your animal name here*)'s population change from *first to last date*.
2. Develop an equation modeling the (*insert your animal name here*)'s population change from *the last two dates*.
3. Use both models to predict what the current population of the (*insert your animal name here*) is.
4. Using the 2nd model, predict what the population will be in 2020. Sketch a graph of the second model with the predicted data point included.



5. Based on what you have learned from this project, discuss why you think it may be important to track species data.

Animal Decline Visual and Presentation Rubric
Assessment List and Possible Points

Name: _____

Item Number	Description	Points Possible	Student Score of Him/Herself	Teacher Score of Student
1	Student was an equal participant in all aspects of the project: research, visual /quiz creation and presentation.	6		
2	Math work was included to back up all stated calculations (could be turned in separately and not be seen on the visual).	6		
3	Math work is neat and organized.	6		
4	Student completed a visual as requested on the project handout.	6		
5	The correct table of values was included.	6		
6	The correct graphical model was included.	6		
7	The equation is the correct model of their data.	6		
8	The student's presentation was neat, well-organized and engaging.	6		
9	The student could explain their process, thoughts and reasoning well.	6		
10	The student could answer the questions posed by classmates and teacher in a coherent, well-thought-out manner.	6		
Total Points Possible:		60		

Animal Decline Quiz Rubric ** This Rubric is for the quiz you create**
Assessment List and Possible Points

Item Number	Description	Points Possible	Student Score of Him/Herself	Teacher Score of Student
1	Student's quiz was created and turned in on time. (*Due end of day 2*)	2		
2	Key to quiz is accurate.	4		
3	Quiz is created as per the given template with the correct data values.	4		
Total Points Possible:		10		

Animal Decline Rubric

Item #	Description	0 points	3 points	6 points
1	Student was an equal participant in all aspects of the project: research, visual /quiz creation and presentation.	Student did not participate.	Student contributed less than their third.	Student completed their full third.
2	Math work was included to back up all stated calculations (could be turned in separately and not be seen on the visual).	No additional math work included.	Some of the work was included.	All of the math work was included.
3	Math work is neat and organized.	Work is not organized and lacks neatness.	Work is partially organized.	Work is neat, legible, easy to follow and organized.
4	Student completed a visual as requested on the project handout.	No visual created.	Visual is partially complete.	Visual is complete with all needed information.
5	The correct table of values was included.	No table of data included.	Table included has some data.	Table of data included is complete.
6	The correct graphical model was included.	No graph included.	Some of the graph is accurate. Some parts are labeled.	Graph is included, accurate, and fully labeled.
7	The equation is the correct model of their data.	No equation created.	Equation is present, but not accurate.	Equation is present and accurate.
8	The student's presentation was neat, well-organized and engaging.	Presentation was not organized, lacked neatness, and was not engaging.	Presentation was difficult to follow, sometimes engaging. Lacked organization.	Presentation was easy to follow, neat and engaging.
9	The student could explain their process, thoughts and reasoning well.	Student provides no explanation.	Student provides explanation, but is mostly inaccurate.	Student explanation is accurate and flows.
10	The student could answer the questions posed by classmates and teacher in a coherent, well-thought-out manner.	Does not answer questions.	Answers questions, but is not accurate or confident with responses.	Accurately answers questions.

Animal Decline Quiz Rubric

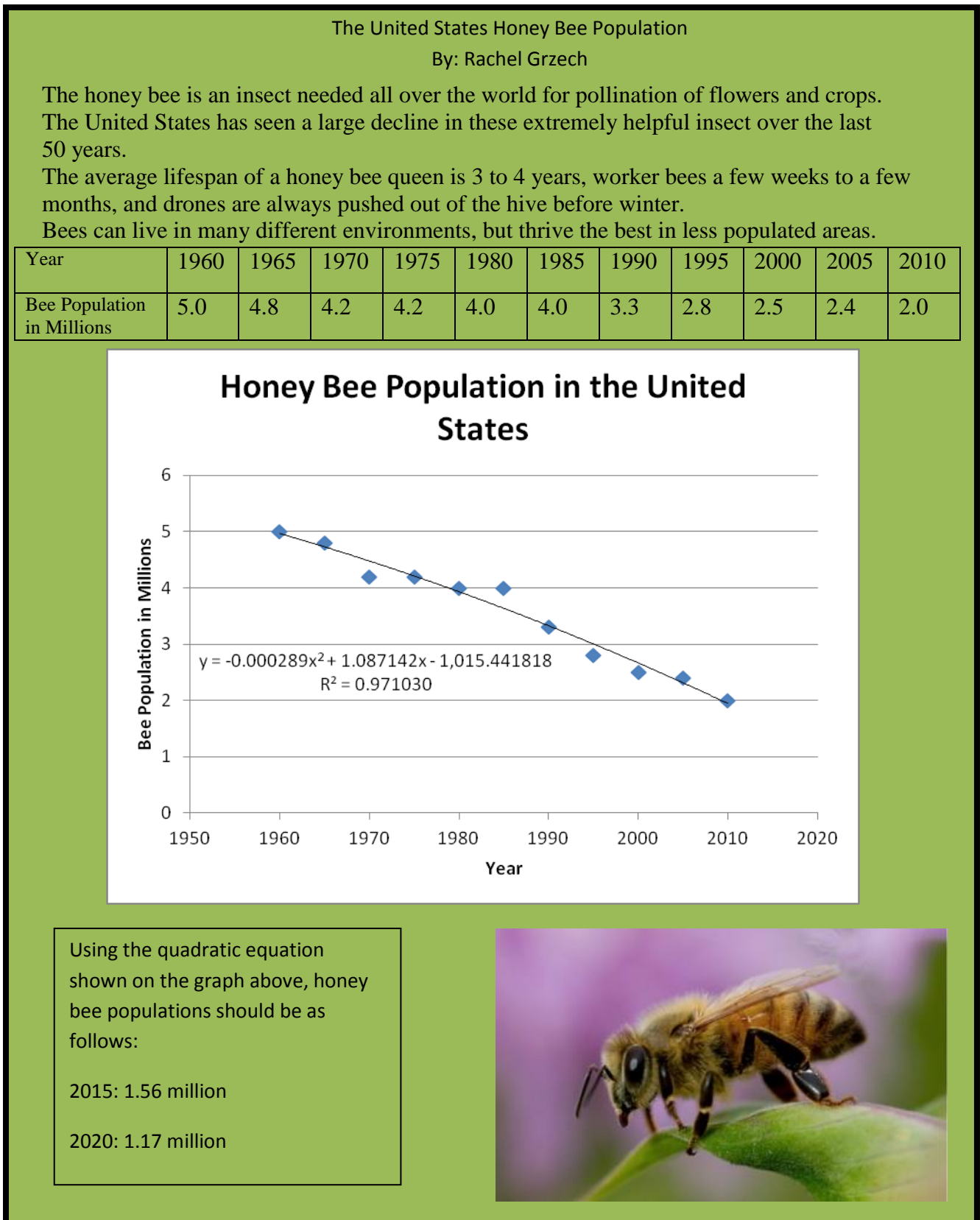
Item Number	Description	0 points	2 points	4 points
1	Student's quiz was created and turned in on time.	Quiz not turned in on time.	Quiz is completed and turned in on time.	
2	Key to quiz is accurate.	Key not turned in.	Key is turned in, but is not accurate.	Key is accurate and complete.
3	Quiz is created as per the given template with the correct data values.	Quiz not turned in.	Quiz turned in, but not created using given template.	Quiz is created using the given template and the correct data.

The quiz you take in class will be graded using a key and will account for 30% of your project score.

Benchmark

“Hypothetical Student Work Example”

Sample Visual:



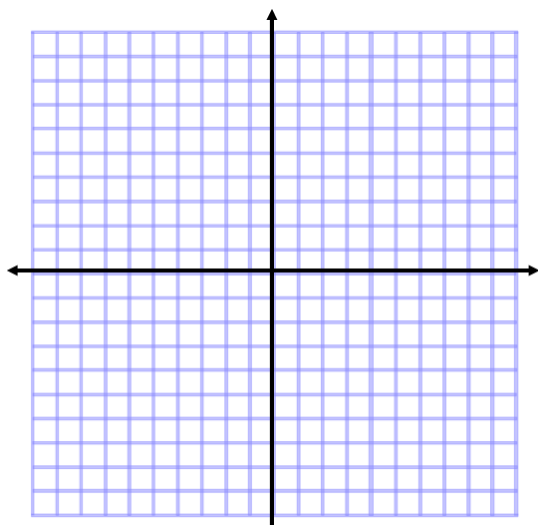
Sample Created Quiz:

Animal Decline Quiz

The population of the Honey Bee in the United States:

1960: 5.0 million	1970: 4.2 million	1980: 4.0 million
1990: 3.3 million	2000: 2.5 million	2010: 2.0 million

1. Develop an equation modeling the Honey Bee's population change from 1960 to 2010. You may need to determine the curve of best fit in order to model this appropriately.
2. Develop an equation modeling the Honey Bee's population change from 2000 to 2010.
3. Use both models to predict what the current population of the Honey Bee is.
4. Using the 2nd model, predict what the population will be in 2020. Sketch a graph of the second model with the predicted data point included.



5. Based on what you have learned from this project, discuss why you think it may be important to track species data.

Animal Decline Project Part 2

The population of the Honey Bee in the United States:

1960: 5.0 million **1970:** 4.2 million **1980:** 4.0 million

1990: 3.3 million **2000:** 2.5 million **2010:** 2.0 million

1. Develop an equation modeling the Honey Bee's population change from 1960 to 2010. You may need to determine the curve of best fit in order to model this appropriately.

$$y = -0.0001607x^2 + .578607x - 511.7378571$$

2. Develop an equation modeling the Honey Bee's population change from 2000 to 2010.

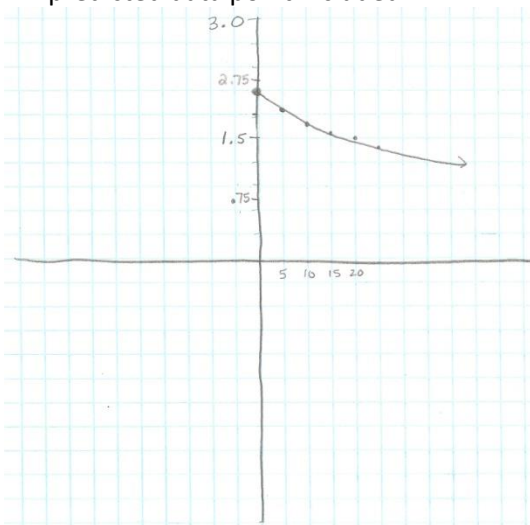
$$y = 0.0015x^2 - 6.065x + 6132.5$$

3. Use both models to predict what the current population of the Honey Bee is.

Model 1: 2015 population is 1.62 million

Model 2: 2015 population is 1.86 million

4. Using the 2nd model, predict what the population will be in 2020. Sketch a graph of the second model with the predicted data point included.



Population in 2020 is 1.80 million bees

5. Based on what you have learned from this project, discuss why you think it may be important to track species data.

Opinion based question. Could have answered with things like, this species is important to food production and human survival. This is important for indicators of how the planet is doing. Things like that.

Example of Student math work to be turned in:

