Inspect

CCR Performance Task

Algebra I: Extended Performance Task
Designing Zoo Exhibits

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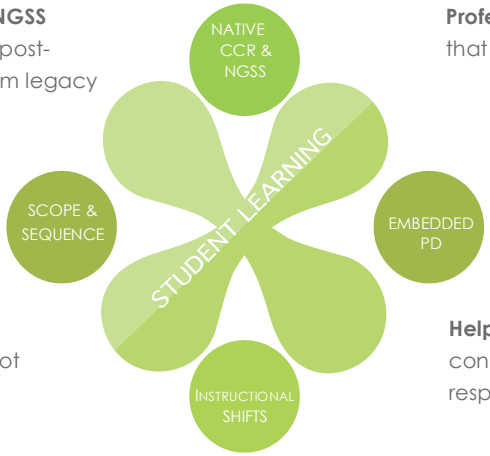

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CCR Performance Tasks

Algebra I: Extended Performance Task
Designing Zoo Exhibits

Student Test Booklet

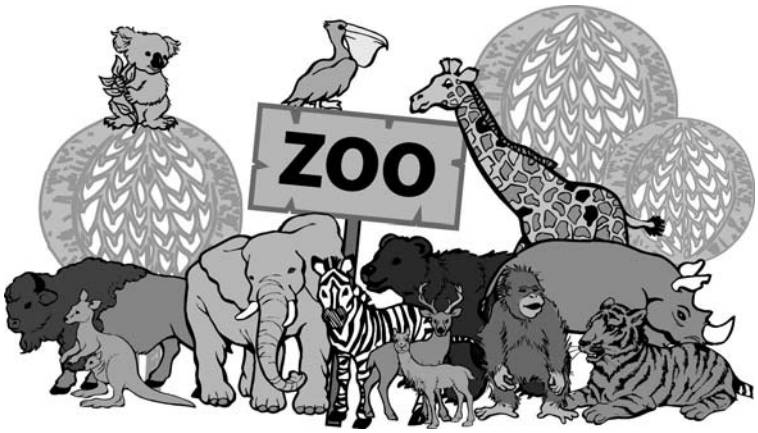
Name:

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Complete all the tasks in the test booklet.

You have been hired to assist with the renovations of your local zoo. The budget for the renovations will allow for some new exhibits for the animals to live in. Since the animals will be placed in new locations throughout the zoo, your manager has requested that you develop three new exhibits that will both educate and entertain visitors. The zookeepers expect these new exhibits to have a theme. At the entrance of each exhibit will be a lighted board that displays an educational aspect of the animals.



The animals that live at the zoo are listed below. All of the animals have a place to live at the zoo, so not all of them need to be included in the three new exhibits. The zookeeper would like to have at least 5 animals in each exhibit.

elephant	giraffe	lion
cheetah	tiger	grizzly bear
ostrich	wolf	bald eagle
hummingbird	fox	panther
hyena	deer	rhinoceros
hippopotamus	coyote	leopard
panda bear	tortoise	falcon
parrot	jaguar	penguin
zebra		

Before construction begins, the zoo manager has asked you to develop a plan for the zoo's board of directors that outlines your strategy for each exhibit, including the educational aspect that you plan to present. After surveying different visitors of varying ages, you have decided that visitors are most interested in the fastest speed at which each animal travels, and therefore this will be the primary focus of the lighted boards at the entrance of each exhibit. Your manager has asked that you use your creativity in helping to make these the best exhibits at the zoo.

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part A: Organize the Data Required for Your Exhibits

The first part of your task is conducting online research to determine the fastest speed for each animal at the zoo.

1. List the animals and their fastest speeds in the table below. Depending on which website you used, make sure the speeds listed in the table are all the same units. Use the box below the table to show any unit conversions.

Animal	Fastest Speed	Animal	Fastest Speed

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

2. Which animals belong in an exhibit together? What are the three exhibits that you plan to create for this project? How should they be set up in the exhibit? Is there a theme? Explain why you chose your groupings of the animals.

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Research Organizer for Part A: Questions 1 and 2

Which websites did you use to find your information?

Use the table below to record your findings for all the animals that will be included in the exhibits.

Fastest Speeds for Animals

Animal	Fastest Speed	Animal	Fastest Speed

What animals do you plan to group together in your exhibits? Explain why you chose these animals.

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

What will be the titles of your three exhibits? Explain why you chose these titles.

What are the themes of your three exhibits? Explain in detail how you plan to set up each of the exhibits.

Name:_____

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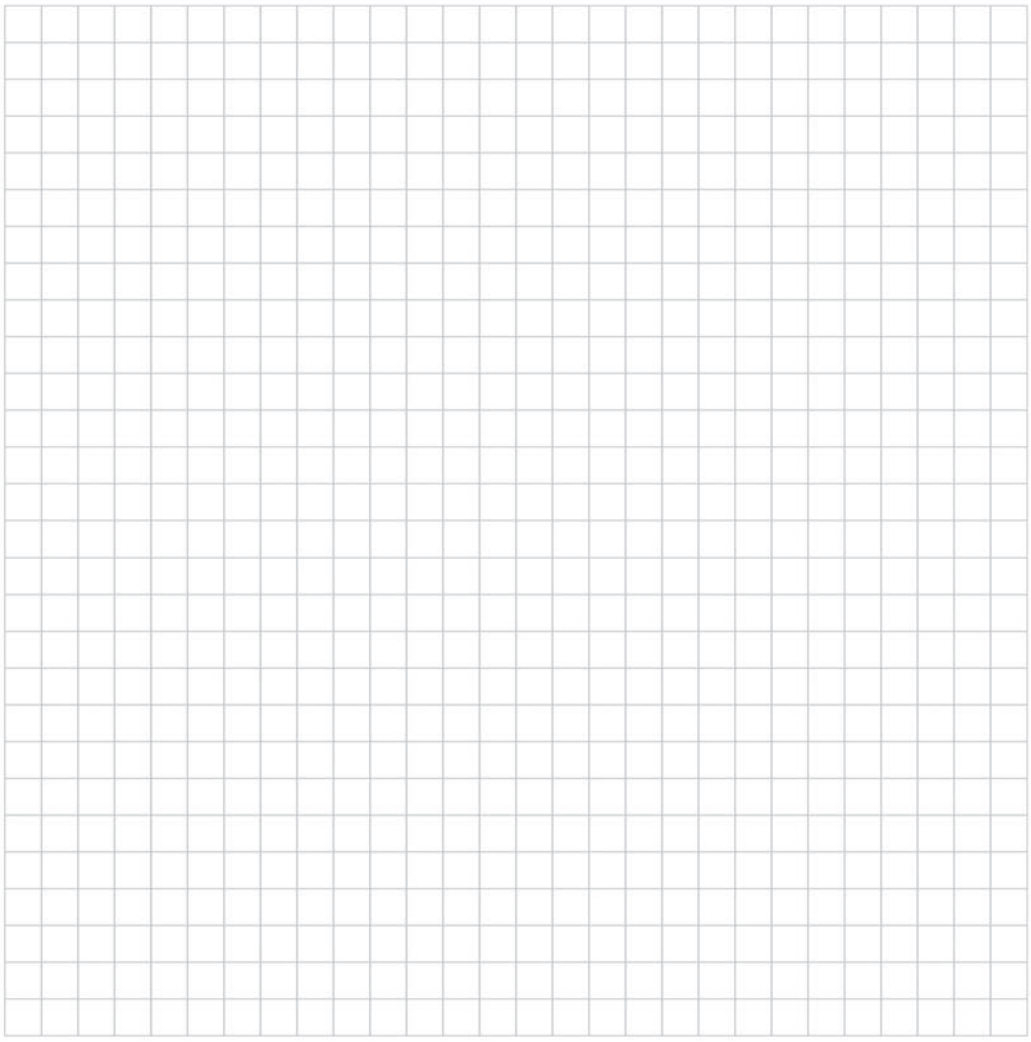
3. Now that you have collected all of your data on the animals for your three exhibits, you are ready to design the large display boards that will be placed at each entrance. Use the graph paper below to create three graphs that will best compare the fastest speeds (using distances traveled in a given amount of time) for the animals in each exhibit.

Show your work in the box below each graph.

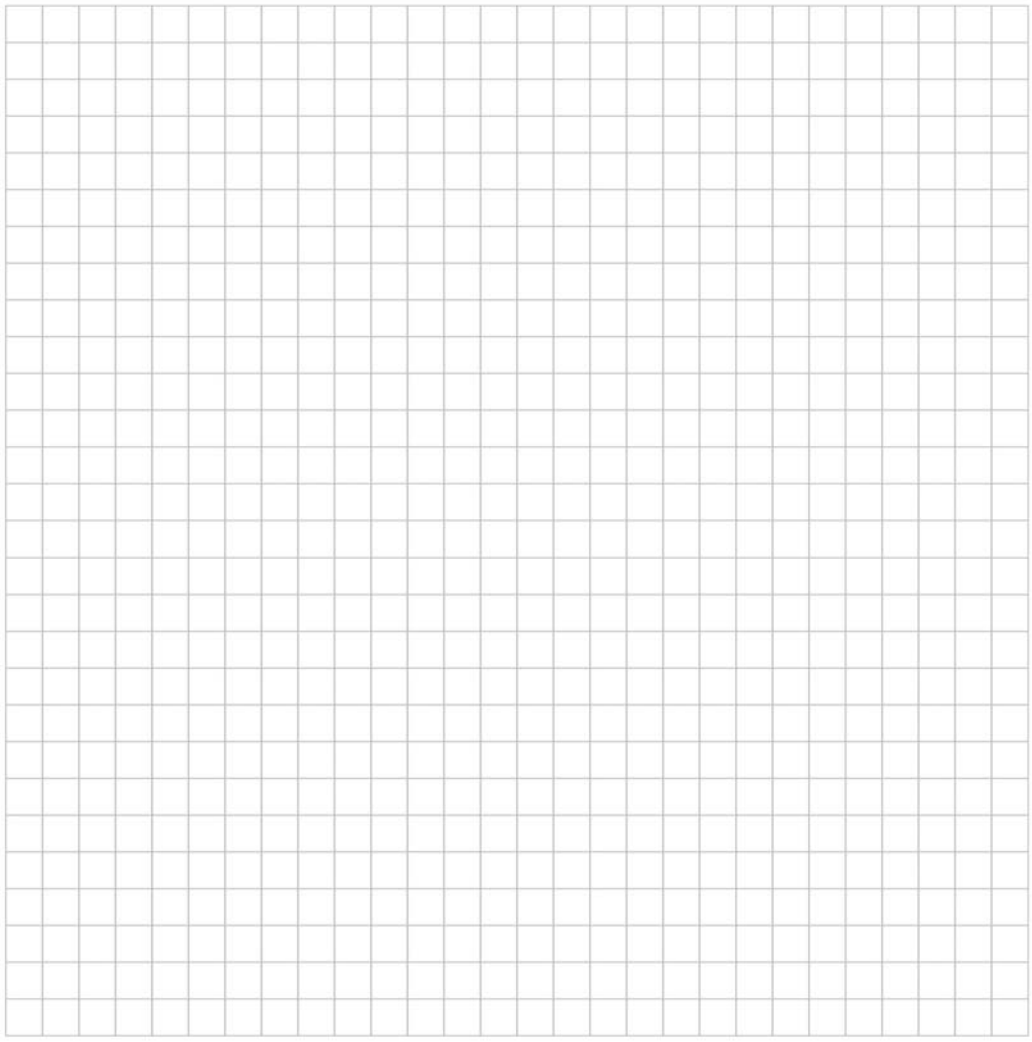
Title of Exhibit 1: _____



Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Title of Exhibit 2: _____



Name:_____

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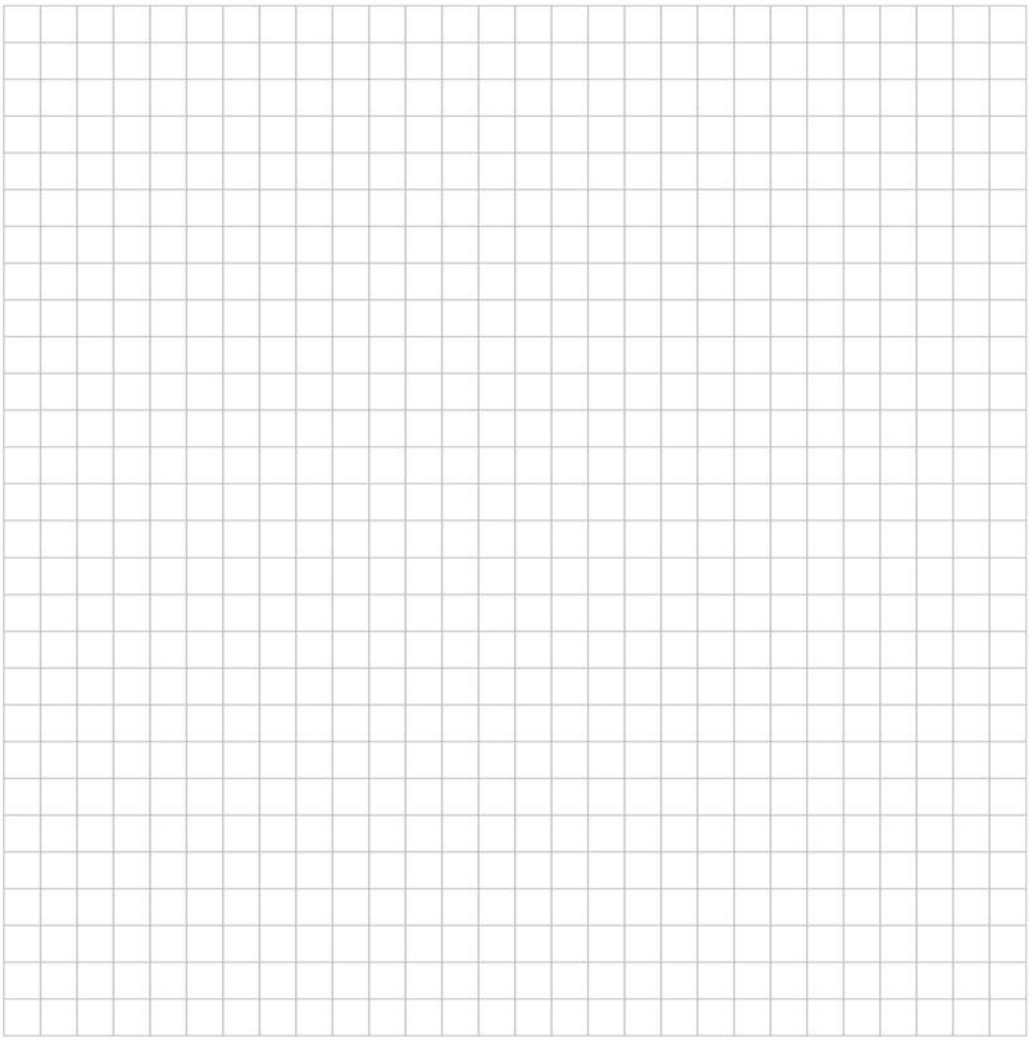
Title of Exhibit 3: _____



Name:_____

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Support Worksheet for Part A: Question 3

What is the best type of graphical representation to show a comparison of distance and time? Explain your reasoning.

How is the animal's distance (in miles) related to the number of minutes it has been traveling at its fastest speed? Show this relationship for each of the animals that will be included in your exhibits using the tables below.

Exhibit 1:

Animal	Speed (mph)	Distance Traveled in 15 minutes	Distance Traveled in 30 minutes	Distance Traveled in 60 minutes

Exhibit 2:

Animal	Speed (mph)	Distance Traveled in 15 minutes	Distance Traveled in 30 minutes	Distance Traveled in 60 minutes

Name:_____

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Exhibit 3:

Animal	Speed (mph)	Distance Traveled in 15 minutes	Distance Traveled in 30 minutes	Distance Traveled in 60 minutes

If each animal starts at a distance that equals 0, what are the equations needed to graph the linear functions that represent their speeds?

Exhibit 1:

Animal	Linear Equation

Exhibit 2:

Animal	Linear Equation

Name:_____

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Exhibit 3:

Animal	Linear Equation

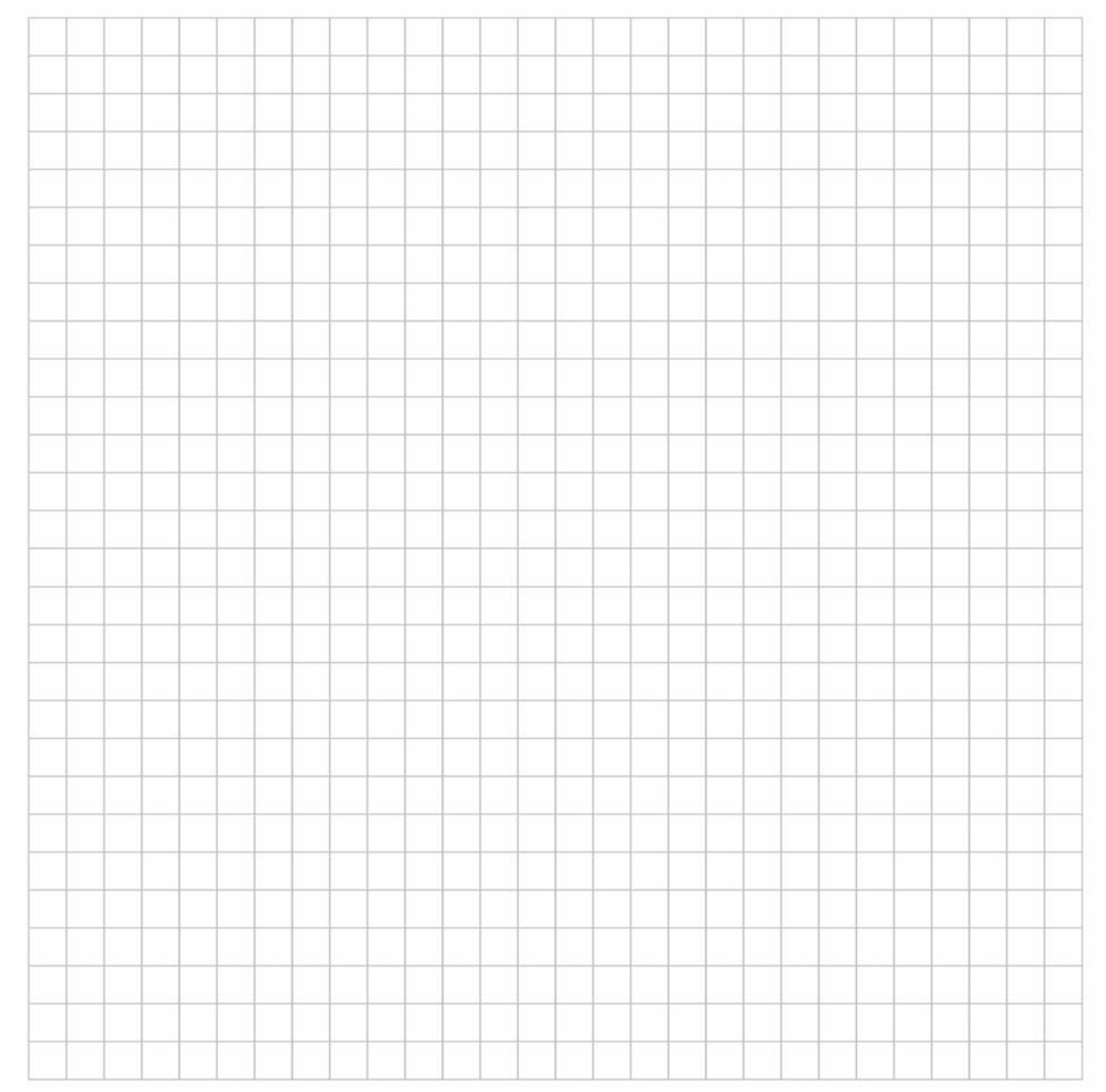
What are the labels and scales that you will use for the axes for each graph? Where will each graph begin? Will the graphs clearly show the lines?

Sketch your graphs for each exhibit's board on the graph paper provided. You may need to adjust your graphs so that they clearly show each animal's speed. Use a pencil to draw the graphs for each of the animals in each group. Clearly label each graph with the animal's name.

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

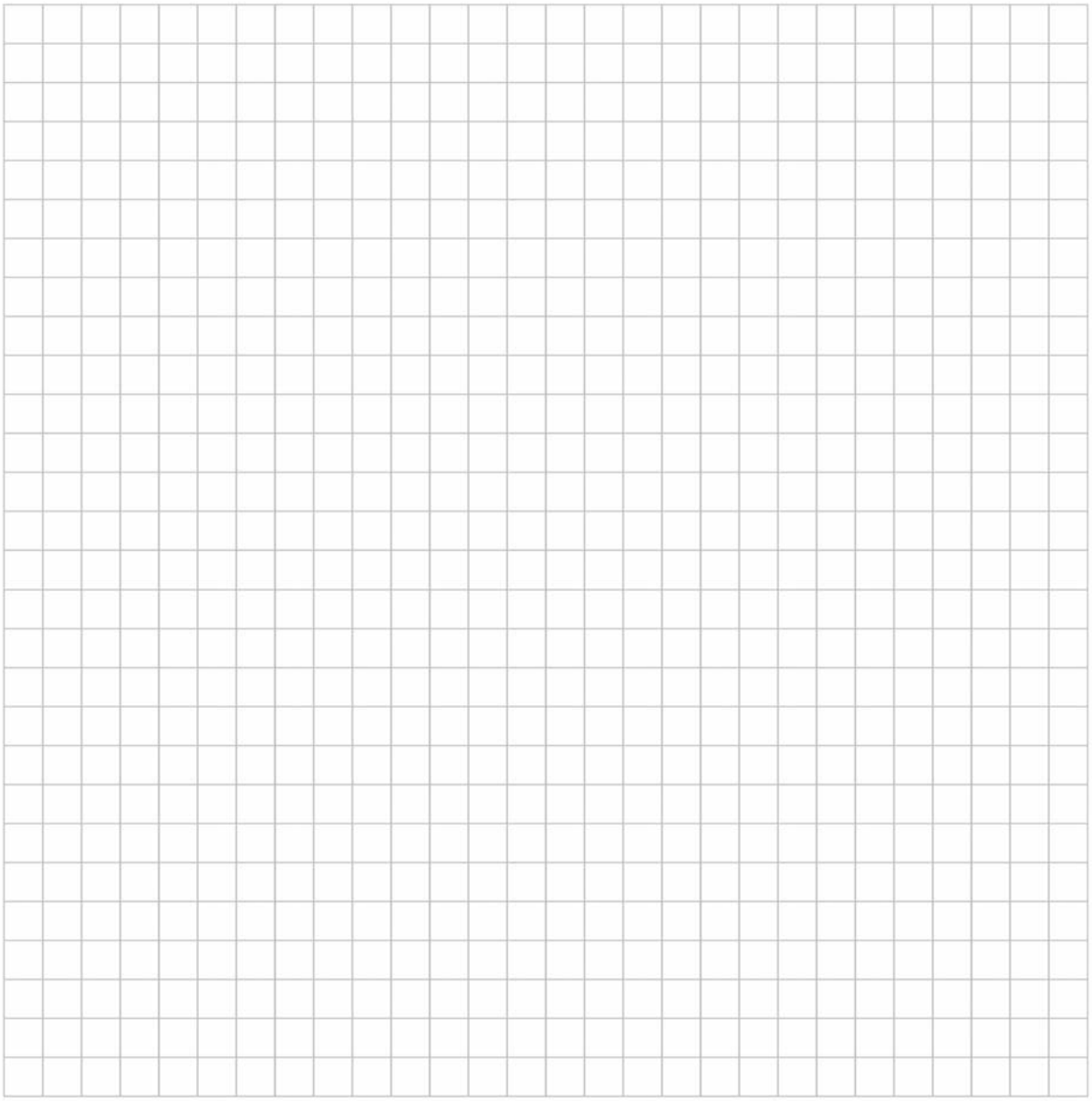
Exhibit 1:



Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

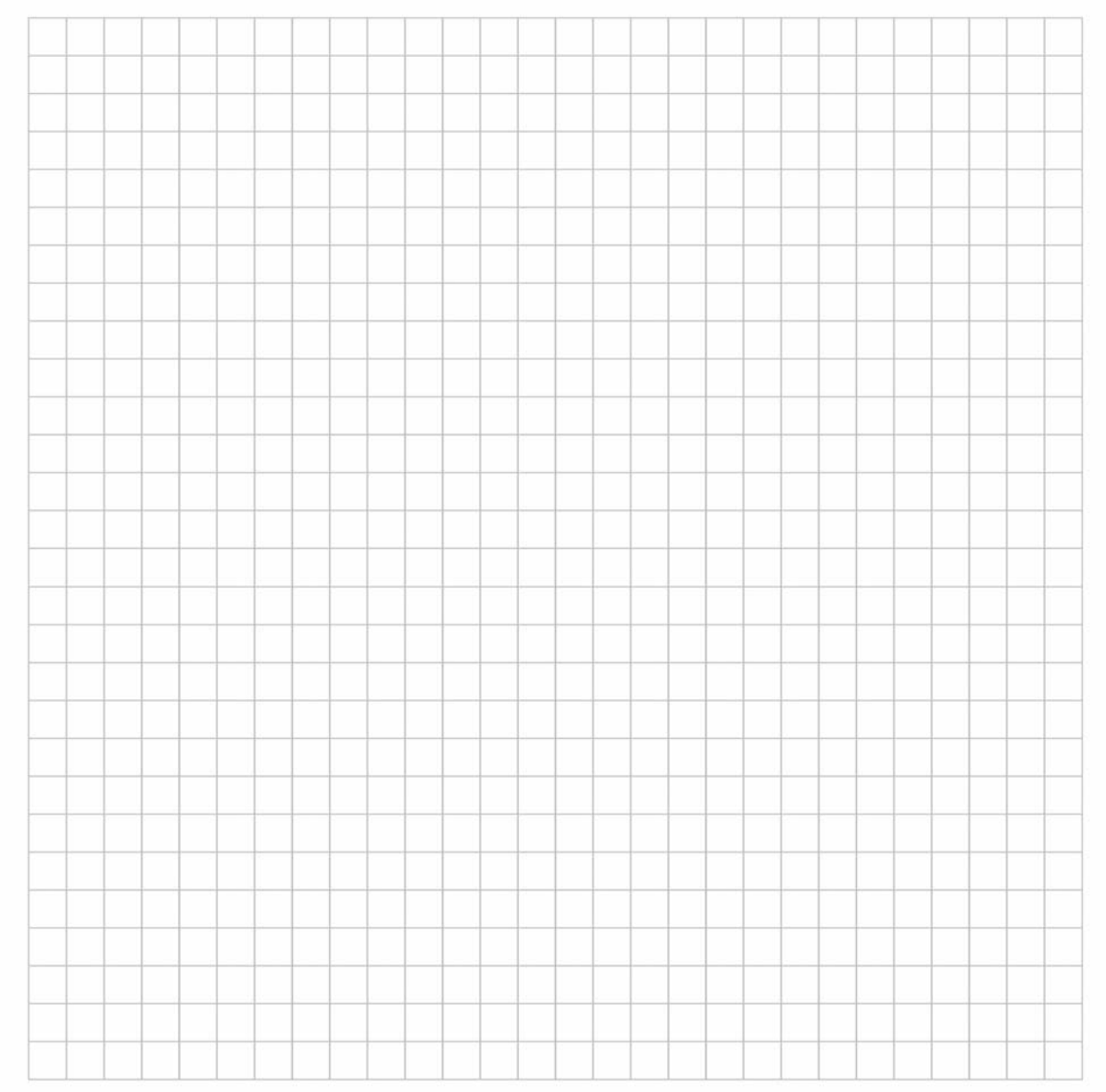
Exhibit 2:



Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Exhibit 3:



Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

For the display, you think it will be interesting to visitors to see a comparison of the animals' speeds with a human's speed. You plan to include this comparison by showing the fastest speed reached by a human with the fastest speeds of the animals in each of your exhibits.

4. Look online to find the fastest speed reached by a human. Record the data below, and include your source.

5. On the three graphs that you have created for the displays, compare the fastest speed of the human to that of the other animals in the exhibit by including a graphical representation of his/her speed. Write the equation that represents the speed of the fastest human.

6. Explain how visitors to the zoo will be able to use the graphs to determine which of the animals can run faster than the fastest human and which cannot.

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part B: Facts for the Exhibits

7. On the display, you plan to have some facts about the speeds shown on the graph. The facts should be about the speed of the animals compared to each other and compared to the fastest human. Write 3 facts for each exhibit. Your facts should be mathematically based and interesting. Make sure the facts are different for each exhibit. (You don't want to bore the visitors.)

Write your facts on the blanks below. Use the boxes below the blanks to show how you determined each fact mathematically.

Exhibit 1:

Fact #1

_____
_____
_____
_____

Fact #2

_____
_____
_____
_____

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Fact #3

_____
_____
_____
_____

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Exhibit 2:

Fact #1

Fact #2

Fact #3

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Exhibit 3:

Fact #1

Fact #2

Fact #3

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part B (optional): Group Work

Using the information you have for your display board, compare your designs for each of your three exhibits, including the information that will be provided on your displays, with the other students in your group.

Include your findings from these questions in the box below:

- How did each student divide and categorize the animals into three exhibits? What was their reasoning?
- Review the three graphs that each student has created for the display boards for their exhibits, and check the accuracy of the steps they each took to create these graphs.
- Check the features of each graph and ensure that they are correct. Make adjustments and corrections as necessary.
- Are their graphs the same as or similar to yours?
- Are the facts interesting? Are they different and unique?
- Is the math correct for all of the facts?

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part C: Outline the Presentation for the Exhibits

8. Now you are ready to outline the formal presentation you will give to your manager and the board of directors at the zoo. Your presentation will determine if your exhibits will be implemented at the zoo and will need to be thorough and compelling. Please keep in mind the following:

a. You must clearly list which animals you have chosen to place in each of the exhibits, the reasoning behind your decisions, and the titles of each exhibit.
b. Your graphs must be neat, clearly labeled, and colorful.
c. You must explain the information on the graphs, including the fastest animal, the slowest animal, and the human's speed in relation to them. Additionally, you should explain how you derived the graphs.
d. You should describe how you collected the data for your research for these exhibits.
e. You should explain how you envision the final exhibits, including the display boards. How will your exhibits succeed in achieving the educational and entertaining aspects required for the zoo's visitors?

Report Title: _____

By: _____

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part C (optional): Verify the Outline for Your Presentation of the Exhibits

In this section, you will need to partner with another student. Exchange your answers to the questions in Parts A and B with your partner.

- Review your partner's outline for their presentation to make sure it is correct and complete.
- Prepare detailed notes for your partner. Clearly show the parts of the outline that you think are good, creative, or well communicated. Also, clearly show which parts are not clear enough, not detailed enough, or contain mistakes. Below are some questions to ask:
    - Does the presentation for the three exhibits provide all of the data required, in the appropriate units, for the zoo board?
    - Do each of the equations specifying the animals' distances as a function of time accurately represent the data researched, in the appropriate units?
    - Does the equation specifying the fastest human's distance as a function of time accurately represent the speed found, in the appropriate units?
    - Do you have any questions about the presentation?

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part C (optional): Adjust the Outline for Your Presentation of the Exhibits

In this section, you will need to continue to work with your partner from the first section in Part C. Return your partner's outline for the presentation to him/her, along with your review. Work with each other to make any needed adjustments to ensure that all of the functions and speed data researched for your presentation are accurate.

Use the response box below to revise and/or adjust your original outline for the presentation. Feel free to work with your partner to make sure your outline includes all of the details needed to show that your presentation will be accurate.

Name:_____

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part D: Write Your Plan for the Exhibits

In this section, you will need to use all of the information that you gathered in the previous sections to write your plan for the exhibits for the newly renovated zoo. This plan will be given to your manager and the zoo board at your presentation.

Your plan should contain at least 10 sentences that have detailed information, including: 1) a list of which animals will be included in each of the exhibits, including an explanation behind your decision and strategy; 2) the titles of each exhibit; 3) the final graphs that will be used on each of the display boards for the three exhibits; 4) explanations of the information found on the graphs, including an overview of the facts you will include on the boards; 5) clear explanations of how you derived each graph; 6) the resources you used to collect the data during research for the exhibits; 7) the appearance of the final exhibits, including the display boards; 8) a summary of how your exhibits will succeed in achieving the educational and entertaining goals for the zoo's visitors; 9) all supporting documents that provide the background information and work, including calculations performed, for all of the parts of your written plan that the board may use for reference.

CCR Performance Tasks

Algebra I: Extended Performance Task
Designing Zoo Exhibits

Teacher Guide

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Task Specifications

Content Area	Mathematics
Title	Designing Zoo Exhibits
Grade Level	Algebra I
Problem Type	Extended Performance Task
Standards for Mathematical Practices	**Mathematical Practice 1 (MP.1):** Make sense of problems and persevere in solving them. Mathematically proficient students: • Explain to themselves the meaning of a problem and look for entry points to its solution. • Analyze givens, constraints, relationships, and goals. • Make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. • Consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. • Monitor and evaluate their progress and change course if necessary. • Explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. • Check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” • Understand the approaches of others to solving complex problems and identify correspondences between different approaches. **Mathematical Practice 4 (MP.4):** Model with mathematics. Mathematically proficient students: • Solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. • Can apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. • Identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas and analyze these relationships mathematically to draw conclusions. • Interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
Common Core State Standards	**F.IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features, given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

Algebra I: Extended Performance Task: Designing Zoo Exhibits

	F.IF.7a Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. • Graph linear and quadratic functions and show intercepts, maxima, and minima. **F.IF.9** Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the greater maximum.*
CCSS Literacy in Writing-Grade 9-10	**W.9-10.2.a** Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. a) Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. **W.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
SBAC Assessment Claims	**Claim 2: Problem Solving**—Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem solving strategies.
PARCC Assessment Claims	**Sub-Claim D: Highlighted Practice MP.4 with Connections to Content (modeling/application)—**The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice.
Depth of Knowledge	**Level 4: Extended Strategic Thinking**—Curricular elements assigned to this level demand extended use of higher order thinking processes such as synthesis, reflection, assessment and adjustment of plans over time. Students are engaged in conducting investigations to solve real-world problems with unpredictable outcomes. Employing and sustaining strategic thinking processes over a longer period of time to solve the problem is a key feature of curricular objectives that are assigned to this level. Key strategic thinking processes that denote this particular level include: synthesize, reflect, conduct, and manage.
Task Overview	In this task you will be asked to create three exhibits for a newly renovated zoo. Your exhibits will each contain a display that will show the fastest average speeds of animals in an exhibit and provide an analysis of the information found. Then you will use the information to prepare a presentation of your plan for the exhibits, which will include a comparison of the fastest average speeds of the animals in each exhibit as well as a comparison to the speed of the fastest human. Once you have an understanding of the problem and the resources that are available, you will make a detailed outline for your plan and presentation for the zoo board. You may find that your original plan has errors, so you will be given a chance to reflect on your work and then edit it.

Student Task

You have been hired to assist with the renovations of your local zoo. The budget for the renovations will allow for some new exhibits for the animals to live in. Since the animals will be placed in new locations throughout the zoo, your manager has requested that you develop three new exhibits that will both educate and entertain visitors. The zookeepers expect these new exhibits to have a theme. At the entrance of each exhibit will be a lighted board that displays an educational aspect of the animals.

The animals that live at the zoo are listed below. All of the animals have a place to live at the zoo, so not all of them need to be included in the three new exhibits. The zookeeper would like to have at least 5 animals in each exhibit.

elephant	giraffe	lion
cheetah	tiger	grizzly bear
ostrich	wolf	bald eagle
hummingbird	fox	panther
hyena	deer	rhinoceros
hippopotamus	coyote	leopard
panda bear	tortoise	falcon
parrot	jaguar	penguin
zebra		

Before construction begins, the zoo manager has asked you to develop a plan for the zoo's board of directors that outlines your strategy for each exhibit, including the educational aspect that you plan to present. After surveying different visitors of varying ages, you have decided that visitors are most interested in the fastest speed at which each animal travels, and therefore, this will be the primary focus of the lighted boards at the entrance of each exhibit. Your manager has asked that you use your creativity in helping to make these the best exhibits at the zoo.

Part A: Organize the Data Required for Your Exhibits

The first part of your task is conducting online research to determine the fastest speed for each animal at the zoo.

1. List the animals and their fastest speeds in the table below. Depending on which website you used, make sure the speeds listed in the table are all the same units. Use the box below the table to show any unit conversions.

2. Which animals belong in an exhibit together? What are the three exhibits that you plan to create for this project? How should they be set up in the exhibit? Is there a theme? Explain why you chose your groupings of the animals.

3. Now that you have collected all of your data on the animals for your three exhibits, you are ready to design the large display boards that will be placed at each entrance. Use the graph paper below to create three graphs that will best compare the fastest speeds (using distances traveled in a given amount of time) for the animals in each exhibit.

For the display, you think it will be interesting to visitors to see a comparison of the animals' speeds with a human's speed. You plan to include this comparison by showing the fastest speed reached by a human with the fastest speeds of the animals in each of your exhibits.

4. Look online to find the fastest speed reached by a human. Record the data below, and include your source.

5. On the three graphs that you have created for the displays, compare the fastest speed of the human to that of the other animals in the exhibit by including a graphical representation of his/her speed. Write the equation that represents the speed of the fastest human.

6. Explain how visitors to the zoo will be able to use the graphs to determine which of the animals can run faster than the fastest human and which cannot.

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part B: Facts for the Exhibits

7. On the display, you plan to have some facts about the speeds shown on the graph. The facts should be about the speed of the animals compared to each other and compared to the fastest human. Write 3 facts for each exhibit. Your facts should be mathematically based and interesting. Make sure the facts are different for each exhibit. (You don't want to bore the visitors.)

Write your facts on the blanks below. Use the boxes below the blanks to show how you determined each fact mathematically.

Part B (optional): Group Work

Using the information you have for your display board, compare your designs for each of your three exhibits, including the information that will be provided on your displays, with the other students in your group.

Include your findings from these questions in the box below:

- How did each student divide and categorize the animals into three exhibits? What was their reasoning?
- Review the three graphs that each student has created for the display boards for their exhibits, and check the accuracy of the steps they each took to create these graphs.
- Check the features of each graph and ensure that they are correct. Make adjustments and corrections as necessary.
- Are their graphs the same as or similar to yours?
- Are the facts interesting? Are they different and unique?
- Is the math correct for all of the facts?

Part C: Outline the Presentation for the Exhibits

8. Now you are ready to outline the formal presentation you will give to your manager and the board of directors at the zoo. Your presentation will determine if your exhibits will be implemented at the zoo and will need to be thorough and compelling. Please keep in mind the following:

a. You must clearly list which animals you have chosen to place in each of the exhibits, the reasoning behind your decisions, and the titles of each exhibit.
b. Your graphs must be neat, clearly labeled, and colorful.
c. You must explain the information on the graphs, including the fastest animal, the slowest animal, and the human's speed in relation to them. Additionally, you should be able to explain how you derived the graphs.
d. You should describe how you collected the data for your research for these exhibits.
e. You should explain how you envision the final exhibits, including the display boards. How will your exhibits succeed in achieving the educational and entertaining aspects required for the zoo's visitors?

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Part C (optional): Verify the Outline for Your Presentation of the Exhibits

In this section, you will need to partner with another student. Exchange your answers to the questions in Parts A and B with your partner.

- Review your partner's outline for their presentation to make sure it is correct and complete.
- Prepare detailed notes for your partner. Clearly show the parts of the outline that you think are good, creative, or well communicated. Also, clearly show which parts are not clear enough, not detailed enough, or contain mistakes. Below are some questions to ask:
    - Does the presentation for the three exhibits provide all of the data required, in the appropriate units, for the zoo board?
    - Do each of the equations specifying the animals' distances as a function of time accurately represent the data researched, in the appropriate units?
    - Does the equation specifying the fastest human's distance as a function of time accurately represent the speed found, in the appropriate units?
    - Do you have any questions about the presentation?

Part C (optional): Adjust the Outline for Your Presentation of the Exhibits

In this section, you will need to continue to work with your partner from the first section in Part C. Return your partner's outline for the presentation to him/her, along with your review. Work with each other to make any needed adjustments to ensure that all of the functions and speed data researched for your presentation are accurate.

Use the response box below to revise and/or adjust your original outline for the presentation. Feel free to work with your partner to make sure your outline includes all of the details needed to show that your presentation will be accurate.

Part D: Write Your Plan for the Exhibits

In this section, you will need to use all of the information that you gathered in the previous sections to write your plan for the exhibits for the newly renovated zoo. This plan will be given to your manager and the zoo board at your presentation.

Your plan should contain at least 10 sentences that have detailed information, including: 1) a list of which animals will be included in each of the exhibits, including an explanation behind your decision and strategy; 2) the titles of each exhibit; 3) the final graphs that will be used on each of the display boards for the three exhibits; 4) explanations of the information found on the graphs, including an overview of the facts you will include on the boards; 5) clear explanations of how you derived each graph; 6) the resources you used to collect the data during research for the exhibits; 7) the appearance of the final exhibits, including the display boards; 8) a summary of how your exhibits will succeed in achieving the educational and entertaining goals for the zoo's visitors; 9) all supporting documents that provide the background information and work, including calculations performed, for all of the parts of your written plan that the board may use for reference.

Teacher Instructions

This performance task is designed to assess student understanding of a variety of content and mathematical practice standards. Students will be asked to create three exhibits for a newly renovated zoo. These exhibits will each contain a display that will show the fastest average speeds of animals in a zoo and provide an analysis of the information found. Some of this information will be presented as a graphical representation. The students will take the information to prepare a presentation of their plan for the exhibits, which will include a comparison of the fastest average speeds of the animals in each exhibit as well as a comparison to the speed of the fastest human.

Test Definition File

Item	Correct Answer	Practice Standard	Common Core Standard
1	See scoring rubric	Mathematical Practice 1 and 4	F.IF.4, F.IF.7a, F.IF.9, and F.BF.B
			CCSS ELA-Literacy Standards
			W.9–10.2.a W.9–10.7

SBAC Claims	PARCC sub-claims
4	D

Before the task:

- Introduce the concept of speed as a comparison of distance and time. The student will need to understand that Distance = Rate × Time or Rate (Speed) = Distance/Time. For example, 60 miles per hour in a car means the car is traveling 60 miles in 1 hour. This can also mean that it is traveling 60 miles in 60 minutes OR 1 mile per minute.
- Introduce the concept of finding a linear equation when the slope and *y*-intercept are given.
- Introduce the concept of drawing a line to represent a linear equation or starting at a point of origin and using slope to plot points on the line.

Vocabulary:
Ratio
Slope
Speed (as a comparison of distance and time)
Distance
Unit Conversion

Algebra I: Extended Performance Task: Designing Zoo Exhibits

Setting the Context:

Teacher: "Has anyone ever been to a zoo? At the zoo were there certain animals that were placed together in areas called exhibits?"
[Let students respond after each question. Students may have seen bird sanctuaries or reptile exhibits. So these may also be good examples if they have not been to a zoo.]

Teacher: "Do you remember seeing boards or displays that had information about the animals that you were looking at? What kind of information about animals would interest you?"
[Let students respond. Guide the discussion to consider speeds and even animal speeds compared to human speeds.]

Teacher: "These displays are supposed to show facts or something interesting about the animal. It is important that these informational displays be written so that the visitors (you) want to read more or maybe get a conversation started about the fact. The more informative and creative the board is, the more interested people will be."

Timeline:
There are two different options to choose.

Option 1: This option should take 3 days (or 3 hours with the assumption that math lessons/activities take up an hour during the school day).

Day 1: The students should complete Part A, Questions 1–3.*
Day 2: The students should complete Part A, Questions 4–6 and Part B (no optional).
Day 3: The students should complete Parts C (no optional) and D.

*Part A contains a research aspect. Students may need extra time to complete this part if researching takes longer than planned. This time could either be given as outside work (homework) or an extra day could be added to the timeline.

Option 2: This option should take 4 days (or 4 hours with the assumption that math lessons/activities take up an hour during the school day).

Day 1: The students should complete Part A, Questions 1–3.*
Day 2: The students should complete Part A, Questions 4–6 and Part B (no optional).
Day 3: The students should complete Part B (optional) and Part C (with optional parts).**
Day 4: The students should complete Part D.

*Part A contains a research aspect. Students may need extra time to complete this part if researching takes longer than planned. This time could either be given as outside work (homework) or an extra day could be added to the timeline.
**Parts B and C contain group work that may take longer than expected. You may need to plan for an extra day if needed.

Other suggestions:

- A calculator is optional and up to the discretion of the classroom teacher. This task can be completed without calculators.
- In Part A, Question 1 the following links can be provided to research animal speeds:
  - http://www.factmonster.com/ipka/A0004737.html
  - http://www.speedofanimals.com/
  - http://www.bestfunfacts.com/speeds_of_animals.html
  - http://a-z-animals.com/animals
- Most of the speeds given from these websites are in miles per hour or kilometers per hour. The students may need to do a couple of unit conversions in order to put all of the speeds into the same units. Though miles per hour will likely be the most common unit used/chosen, it is not incorrect if the student uses kilometers per hour in the table and graph.

- It is important that you stress the comparison of distance to time in the graph. The student should realize that a linear relation can be found for each animal and then represent their speed using a linear equation and graph. You may need to push the students in this direction if you see they are trying to use a bar or circle graph. Explain to them that although these graphs will show the difference in speed, they do not show the comparison or relation between the animals' distance related to time.
- When the students are ready to graph the speeds, make sure they are reminded about the importance of the scale. If they make each axis unit worth 1 hour or 1 mile, then the graphs will all be too close together and difficult to tell apart. They should be encouraged to sketch, erase, and re-sketch if this occurs.
- Within the task, there are optional support worksheets for students to use that may help to organize their thoughts and guide any students that may be struggling with how they should proceed with the task.

Extension Activity

This activity can be extended to create a representation of one of the boards that the student described in the task. The students can then each give their presentation and show their boards to the class.

Scoring Rubric

Part A

4 Point Response:

The response demonstrates a high level of understanding.

The response demonstrates:

- A strong ability to make sense of a real-world problem and develop a solution that meets given requirements;
- A strong ability to calculate accurately with an appropriate degree of precision;
- A strong ability to check work and communicate reasoning in a clear and precise way;
- A strong understanding of how to solve real-world and mathematical problems leading to writing and graphing linear equations with two variables;
- A strong understanding of how to compare two or more different functions that are shown verbally or graphically and state their differences.

A level 4 response should include:

- The table showing each animal and its speed, with the units clearly shown to be the same for each animal;
- In Question 2, a clear and complete explanation of why the student chose the animals for the 3 exhibits, with complete details about the theme, planned surroundings, and grouping of the animals;
- A clear and correct explanation or work that shows how each line and linear equation are calculated to represent the speed for each animal;
- Correct graphs that represent each animal's speed; graphs are clearly labeled and have appropriate scales;
- In Question 4, a correct equation that represents the fastest human's speed; a graph of the equation correctly drawn and labeled on each of the 3 graphs;
- A clear and complete explanation of how the graphs can be used to determine the comparison of the fastest human with the animal's speed, with correct comparisons.

Sample Responses for Part A

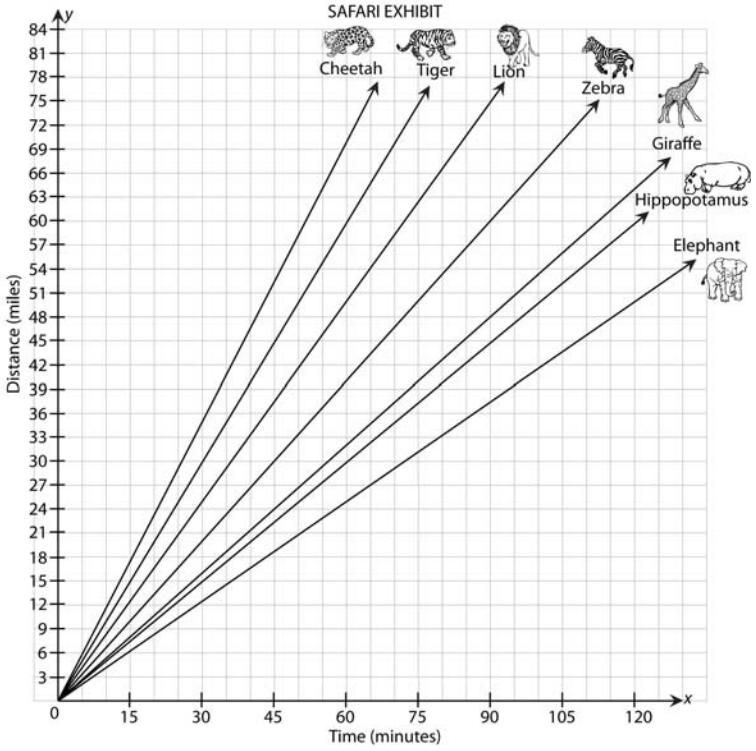
Question 1: (Note that speeds given and used throughout these sample responses were found using the links listed on page 7 of this document; actual student responses will vary depending on sources used.)

Fastest Speeds for Animals

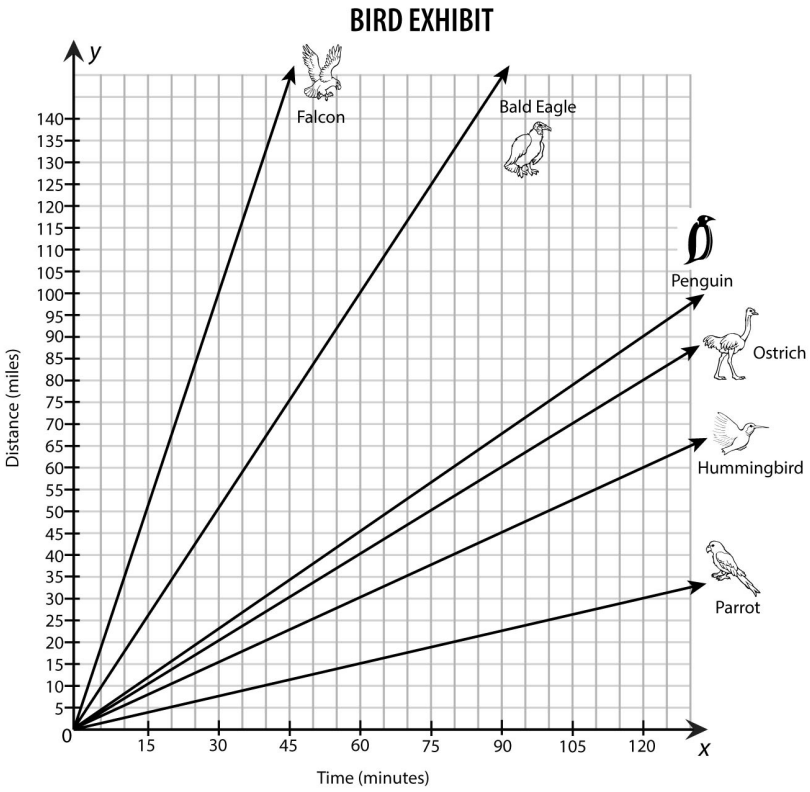
Animal	Fastest Speed	Animal	Fastest Speed
Elephant	25 mph (40 km/h)	Deer	43 mph (70 km/h)
Giraffe	32 mph (52 km/h)	Rhinoceros	30 mph (42 km/h)
Lion	50 mph (80 km/h)	Hippopotamus	30 mph (45 km/h)
Cheetah	70 mph (120 km/h)	Coyote	43 mph (138 km/h)
Tiger	60 mph (96 km/h)	Leopard	30 mph (45 km/h)
Grizzly Bear	30 mph (56 km/h)	Panda Bear	20 mph (32 km/h)
Ostrich	40 mph (70 km/h)	Tortoise	0.17 mph (0.3 km/h)
Wolf	45 mph (75 km/h)	Falcon	200 mph (322 km/h)
Bald Eagle	100 mph (160 km/h)	Parrot	15 mph (24 km/h)
Hummingbird	30 mph (48 km/h)	Jaguar	50 mph (80 km/h)
Fox	42 mph (67.6 km/h)	Penguin	45 mph (72 km/h)
Panther	71 mph (114 km/h)	Zebra	40 mph (64 km/h)
Hyena	40 mph (64 km/h)	Gorilla	25 mph (40 km/h)

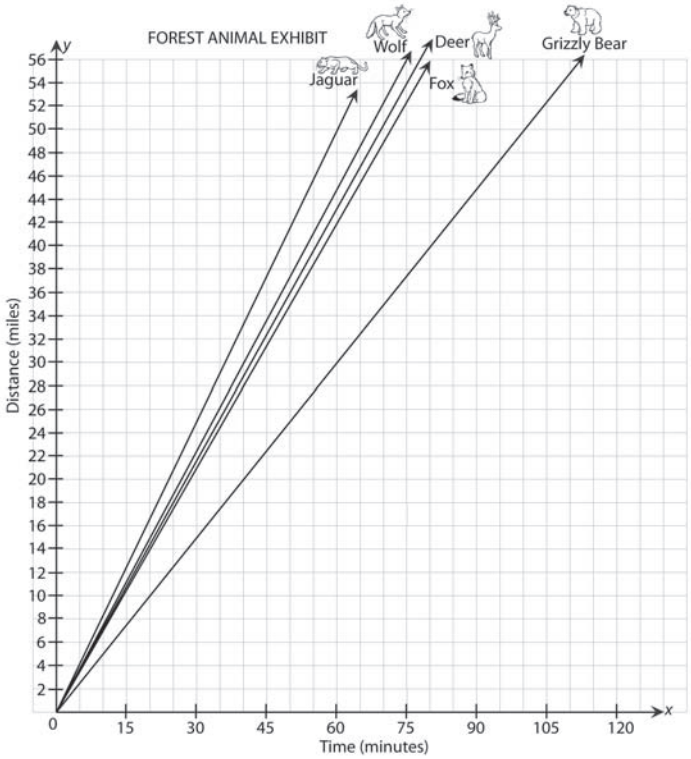
Question 2:
There are 25 animals at the zoo. My plan will have 3 exhibits that have a safari, bird, and forest theme. In the Safari Exhibit, I included the elephant, giraffe, lion, cheetah, tiger, zebra, and hippopotamus. This exhibit will be set up so that it is like entering a safari adventure. A small Jeep-looking vehicle that is attached to 3 others (like a train) and can hold six people each will be driven around a dirt road. Each animal will be placed in a large fenced-in area (cage-like but small wiring so that it is open and easy for the visitors to see and it feels open even though the fence is high and is electric). At the entrance where the visitors load onto the Jeep train will be the lighted display board. The second exhibit is the Bird Exhibit. This exhibit will have the ostrich, hummingbird, bald eagle, falcon, parrot, and penguin. This exhibit will be an indoor exhibit where the visitors will walk in and see the bald eagle and falcon in their own large, 20-foot high bird cage. There will be trees that fill their bird cages. The penguin will have rocks to run around on and water to play in. The hummingbirds' smaller area will be filled with lots of colorful flowers, and there will be areas in front of the glass cage that will have large magnifying glasses so that visitors can get a close-up view of this very small bird. The ostrich cage will be more of an outdoor theme with low bushes and a couple of trees for shade. The parrot will be placed at the end of the exhibit. There will be lots of trees for the parrot to sit in. A microphone and speaker will be set up for the visitors to talk in and see if they can get the parrot to mimic them. Before walking out of the exhibit, children can color a paper parrot hat to take with them (and wear). There will be a zoo employee that will be nearby to monitor this activity so that it is not abused. The display board for this exhibit will be located at the entrance of the bird exhibit. The third exhibit will include all of the forest animals: grizzly bear, wolf, fox, deer, and jaguar. The Forest Animal Exhibit will be like an enchanted forest with lots of colorful flowers and green trees. There will be caves for the bears and wolves to live in. A creek will run throughout each of the cages. The lighted board will be located at the beginning of the exhibit. It will be placed in the trunk of a fake, animated tree that will welcome the visitors to the exhibit. (It will have eyes that open and close and a mouth that moves as it talks.)

Question 3:



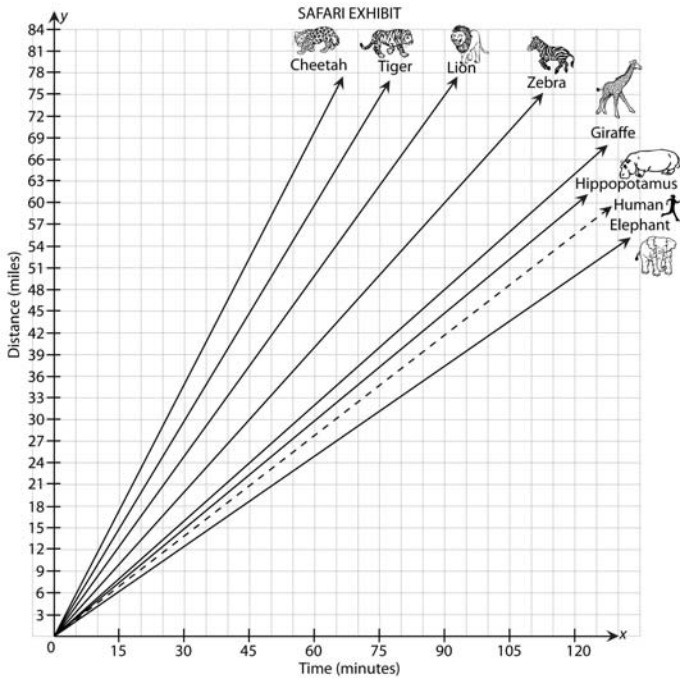
Algebra I: Extended Performance Task: Designing Zoo Exhibits

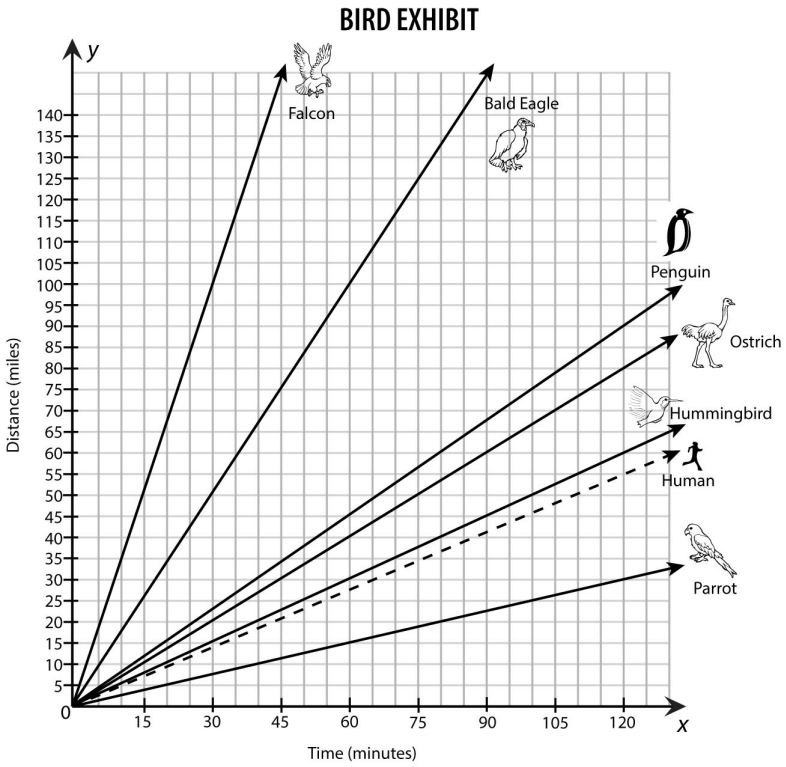


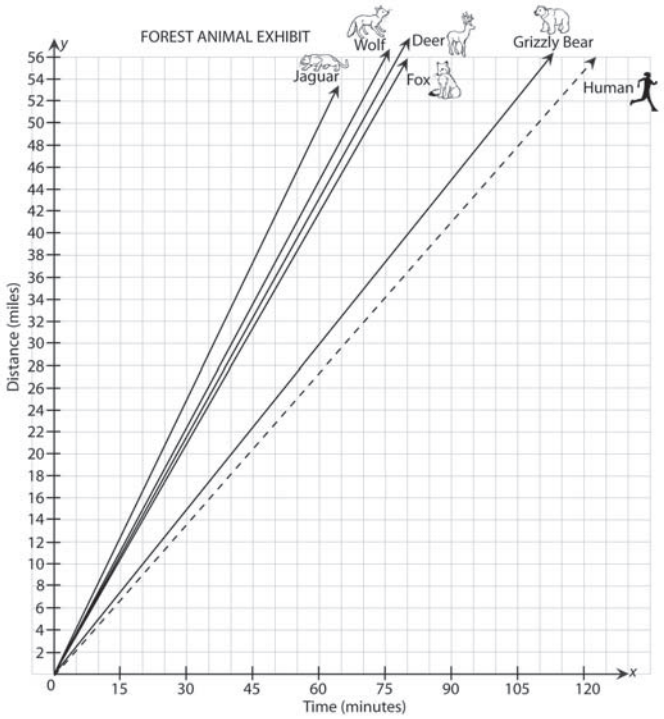


Question 4:
I found that Usain Bolt is the fastest human to date. He ran a 9.68-second 100-meter race, which would represent 23 miles per hour. 100 meters in 9.68 seconds is 1 meter every 0.0968 seconds. There are 1,609.3 meters in a mile and 3,600 seconds in an hour, so 1 meter/0.0968 sec × 1 mile/1609.3 meters × 3600 sec/1 hour = 23.11 mph. However, he dashed from the 60 m to the 80 m mark in 1.61 seconds, which is approximately 27.79 mph. So, I used 27.79 mph as the fastest speed; 20 meters/1.61 seconds × 1 mile/1609.3 meters × 3600 seconds/1 hours = 27.788788 mph. I found this information here: http://bleacherreport.com/articles/1283999-usain-bolt-mph-breaking-down-amazing-speed-from-olympic-sprinter

Question 5:
The linear equation that represents the fastest human's speed is $y = 27.79x$.







Question 6:
The visitors will be able to look at the graphs and determine which animals are faster or slower than the fastest human by position of the lines. The lines above the fastest human's line have a steeper slope, which means their speeds (miles per hour) are faster. The lines below the fastest human's line are animals with slower speeds since their slope (miles per hour) are not as steep. As shown in the

graphs, most of the animals' speeds are faster than a human's. The only animals in my exhibits that are slower are the elephant and parrot.

3 Point Response:

The response demonstrates a strong understanding, but the work is incomplete or contains minor errors.

A level 3 response is characterized by:

- The table that shows each animal and its speed, correctly filled in with the units clearly shown to be the same for each animal, but a minor calculation error is made;
- In Question 2, an explanation showing a strong understanding of why the student chose the animals for the 3 exhibits, with complete details about the theme, planned surroundings, and grouping of the animals;
- A strong understanding of how to write and graph each linear equation and its line to represent each animal's speed, but a minor calculation or graphing error is made; the graphs are labeled and have appropriate scales;
- In Question 4, a strong understanding of how to write and graph the equation that represents the fastest human's speed, but one minor calculation or graphing error is made;
- A strong understanding of how the graphs can be used to determine the comparison of the fastest human with the animal's speed, but a minor error is made due to an incorrect calculation in a previous question.

2 Point Response:

The response demonstrates a basic but incomplete understanding.

A level 2 response is characterized by:

- The table that shows each animal and its speed, but 2–3 of the speeds have incorrect calculations or units;
- In Question 2, an explanation showing a basic understanding of why the student chose the animals for the 3 exhibits, with most of the details about the theme, planned surroundings, and grouping of the animals given;
- A basic understanding of how to write and graph each linear equation and its line to represent each animal's speed, but two or more minor calculation or graphing errors are made; the graphs are labeled, but they may have inappropriate scales;
- In Question 4, a basic understanding of how to write and graph the equation that represents the fastest human's speed, but two or more minor calculations or graphing errors are made;
- A basic understanding of how the graphs can be used to determine the comparison of the fastest human with the animal's speed, but two or more minor errors are made due to incorrect calculations in a previous question.

1 Point Response:

The response demonstrates a minimal understanding.

A level 1 response is characterized by:

- The table that shows each animal and its speed, but 4–6 of the speeds have incorrect calculations or units;
- In Question 2, an explanation showing a weak understanding of why the student chose the animals for the 3 exhibits, with some (but not all) of the details about the theme, planned surroundings, and grouping of the animals;

- A weak understanding of how to write and graph each linear equation and its line to represent each animal's speed, but a major calculation and graphing error are made; the graphs are labeled, but they may have inappropriate scales;
- In Question 4, a weak understanding of how to write and graph the equation that represents the fastest human's speed, but a major calculation and graphing error are made;
- A weak understanding of how the graphs can be used to determine the comparison of the fastest human with the animal's speed, but 1–2 major errors are made due to incorrect calculations in a previous question.

0 Point Response:

There is no response, or the response is off topic.

Part B

4 Point Response:

The response demonstrates a high level of understanding.

The response demonstrates:

- A strong ability to make sense of a real-world problem and develop a solution that meets given requirements;
- A strong ability to calculate accurately with an appropriate degree of precision;
- A strong ability to check work and communicate reasoning in a clear and precise way;
- A strong understanding of how to solve real-world and mathematical problems leading to writing and graphing linear equations with two variables;
- A strong understanding of how to compare two or more different functions that are shown verbally or graphically and state their differences.

A level 4 response includes:

- A clear and complete description of nine facts (3 for each exhibit) that compare at least two speeds/lines shown on the graph;
- Correct and complete work that supports each fact and a clear and correct explanation of how all nine facts are found.

Sample Response for Part B
Question 7:
Student's answers will vary depending on their exhibits. A sample fact is given below.

Safari Exhibit:
Fact #1:
The fastest human and a giraffe are in a 5-mile race, and the human is given a half-mile head start. If the fastest human and a giraffe could run their fastest speed during the entire 5-mile race, the giraffe would pass the human right before the 4-mile mark (3.8 miles to be exact). It would take them almost 10 minutes to run the 5-mile race with the giraffe winning by about 20 seconds.

I found this fact by using the equations $y = 32x$ (giraffe) and $y = 27.79x + 0.5$ (human). The human was given a 1/2-mile head start, so his starting position is 0.5 instead of 0. I set the equations equal to each other to determine when they would meet during the race. Since x is in hours, I converted the time into minutes and then seconds;

$32x = 27.79x + 0.5$

$4.21x = 0.5$

$x = 0.1187648456$

This is the hour that they met up, but it is difficult to understand, so I multiplied by 60 to change to minutes (7.126). I then substituted this into both equations to get that 3.8 miles is where they will be at the same place. To find how long it will take both of them to reach the finish line, I set each of the equations equal to 5 and solved for x to give a time (in hours).
Giraffe:

$5 = 32x$

$x = 0.15625$ hour

Again, this number is difficult to conceptualize in hours, so I multiplied the number by 60 to get minutes (9.375) and then again by 60 to get seconds (562.50).
Human:

$5 = 27.79x + 0.5$

$4.5 = 27.79x$

$x = 0.16$ hours

When I multiply this by 60 to change to minutes I get 9.7 and then multiply again by 60 to get 582.94 seconds. When you subtract the time in seconds, the giraffe beat the fastest human by about 20 seconds.

I wanted to check my answers, so I typed the two equations into my calculator. I used the table feature in the calculator and set the *x* increment to 1/60 to show the distances for every minute. All of my answers were in the ranges shown in the table.

3 Point Response:

The response demonstrates a strong understanding, but the work is incomplete or contains minor errors.

A level 3 response is characterized by:

- A clear and complete description of eight out of the nine facts that compare at least two speeds/lines shown on the graph;
- A strong understanding of how to use the graphs to write the facts that are supported mathematically, but one minor calculation or concept error is made.

2 Point Response:

The response demonstrates a basic but incomplete understanding.

A level 2 response is characterized by:

- A clear and complete description of at least six out of the nine facts that compare at least two speeds/lines shown on the graph;
- A basic understanding of how to use the graphs to write the facts that are supported mathematically, but two or more minor calculation or concept errors are made or one major error is made.

1 Point Response:

The response demonstrates minimal understanding.

A level 1 response is characterized by:

- A clear and complete description of at least half of the nine facts that compare at least two speeds/lines shown on the graph;
- A weak understanding of how to use the graphs to write the facts that are supported mathematically, but two or more major calculation or concept errors are made.

0 Point response:

There is no response, or the response is off topic.

Part C

4 Point Response:

The response demonstrates a high level of understanding.

The response demonstrates:

- A strong ability to make sense of a real-world problem and develop a solution that meets given requirements;
- A strong ability to check work and communicate reasoning in a clear and precise way;
- A strong ability to justify the solution and communicate this to others;
- A strong ability to calculate accurately with an appropriate degree of precision;
- A strong understanding of how to solve real-world and mathematical problems leading to writing and graphing linear equations with two variables;
- A strong understanding of how to compare two or more different functions that are shown verbally or graphically and state their differences.

A level 4 response should include:

- An outline of a plan that clearly explains which animals were chosen for each exhibit and why, what information is on the graphs and how the graphs were derived, where the information was found, what the vision of the exhibits is, and how the boards are going to be displayed;
- The graphs that will be included on the display boards; the graphs are clear and complete.

3 Point Response:

The response demonstrates a strong understanding, but the work is incomplete or contains minor errors.

A level 3 response is characterized by:

- An outline of a plan that demonstrates a strong understanding of which animals were chosen for each exhibit and why, what information is on the graphs and how the graphs were derived, where the information was found, what the vision of the exhibits is, and how the boards are going to be displayed; the plan may contain one minor error or may have an incomplete or missing specific;
- The graphs that will be included on the display boards, which clear and complete but may contain a minor error in the graphing due to incorrect calculations.

2 Point Response:

The response demonstrates a basic but incomplete understanding.

A level 2 response is characterized by:

- An outline of a plan that demonstrates a basic understanding of which animals were chosen for each exhibit and why, what information is on the graphs and how the graphs were derived, where the information was found, what the vision of the exhibits is, and how the boards are going to be displayed; the plan may contain two or more minor errors or one major error or may have two to three incomplete or missing specifics;
- The graphs for the display boards which may contain two or more minor errors in the graphing due to incorrect calculations.

1 Point Response:

The response demonstrates minimal understanding.

A level 1 response is characterized by:

- An outline of a plan that demonstrates a minimal understanding of which animals were chosen for each exhibit and why, what information is on the graphs and how the graphs were derived, where the information was found, what the vision of the exhibits is, and how the boards are going to be displayed; the plan may contain two or more major errors or may have four or more incomplete specifics or three to four missing specifics;
- The graphs for the display boards which may contain two or more major errors in the graphing due to incorrect calculations.

0 Point response:

There is no response, or the response is off topic.

Part D

4 Point Response:

The response demonstrates a high level of understanding.

The response demonstrates:

- A strong ability to make sense of a real-world problem and develop a solution that meets given requirements;
- A strong ability to check work and communicate reasoning in a clear and precise way;
- A strong ability to justify the solution and communicate this to others;
- A strong ability to calculate accurately with an appropriate degree of precision;
- A strong understanding of how to solve real-world and mathematical problems leading to writing and graphing linear equations with two variables;
- A strong understanding of how to compare two or more different functions that are shown verbally or graphically and state their differences.

A level 4 response should include:

- A plan that clearly explains which animals will be included in each of the exhibits, including an explanation behind the student's decision and strategy; the titles of each exhibit; the final graphs that will be used on each of the display boards for the three exhibits; the information found on the graphs, including an overview of the facts the student put on the boards and how each graph was derived; the resources used to collect the data during research for the exhibits; the vision of the final exhibits, including the display boards; a summary of how the exhibits will succeed in achieving the educational and entertaining goals for the zoo's visitors; all supporting documents that provide the background information and work, including calculations performed, for all of the parts of the written plan;
- A plan that contains the reasoning behind the choices made by the student; the choices are strongly supported with at least 10 sentences that clearly demonstrate a strong understanding of the thought process involved in making these decisions.

3 Point Response:

The response demonstrates a strong understanding, but the work is incomplete or contains minor errors.

A level 3 response is characterized by:

- A plan that demonstrates a strong understanding of how the exhibits will be planned out; how the graphs for the display boards were created and includes the correct calculations for everything involved in the making of the graphs; specifics that should be detailed in the plan: which animals are included in the exhibits, the name and theme for each exhibit, where all your information was found, the vision of the final exhibits including the educational and entertaining aspects; the plan may contain 1–2 minor errors or may have 1–2 incomplete specifics;
- A plan that contains the reasoning behind the choices made by the student; the choices are supported with at least 9 sentences that demonstrate a strong understanding of the thought process involved in making these decisions, but 1–2 ideas are incomplete or incorrect due to minor errors made in the calculations.

2 Point Response:

The response demonstrates a basic but incomplete understanding.

A level 2 response is characterized by:

- A plan that demonstrates a basic understanding of how the exhibits will be planned out; how the graphs for the display boards were created and includes some of the calculations for the things involved in the making of the graphs; specifics that should be detailed in the plan: which animals are included in the exhibits, the name and theme for each exhibit, where all your information was found, the vision of the final exhibits including the educational and entertaining aspects; the plan may contain more than 2 minor errors or 1 major error or may have 3 incomplete specifics or 1–2 missing specifics;
- A plan that contains the reasoning behind the choices made by the student; the choices are supported with at least 7–8 sentences that demonstrate a basic understanding of the thought process involved in making these decisions with 3 ideas being incomplete or incorrect due to minor errors made in the calculations.

1 Point Response:

The response demonstrates minimal understanding.

A level 1 response is characterized by:

- A plan that demonstrates a minimal understanding of how the exhibits will be planned out; how the graphs for the display boards were created and includes some of the calculations for the things involved in the making of the graphs; the plan may contain 2 major errors or may have 4 or more incomplete specifics or 3–4 missing specifics;
- A plan that contains the reasoning behind the choices made by the student; the choices are supported with 5 sentences that demonstrate a minimal understanding of the thought process involved in making these decisions with 4 or more ideas being incomplete or incorrect due to minor errors made in the calculations.

0 Point response:

There is no response, or the response is off topic.