Advanced Algebra Activity Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Optimization Project: Fence Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Optimization problems ask you to find the minimum or maximum value of a function with real-world applications. In this group project, you and your partners will be given a length of fencing and asked to make an enclosure with the fencing. You will discover the maximum area you can enclose, and explore the relationship between the area of an enclosed space and the perimeter of the fence.

You will present your discoveries as a poster.

https://www.dreamstime.com/stock-photos-horses-roaming-around-fenced-farm-image13013083

You will be assigned a length of fencing randomly. Record that length: \_\_\_\_\_\_\_

Design a rectangular enclosure that uses all your fencing. (Draw this below.) What is its length? Its width? Its area? How are these quantities related?

Design your poster. On your poster, you should have:

 In words, a statement of the three problems you solved for this project, specific to your length of fencing.

 In words, the answers to those three questions.

 A **graph** of the function from problem 1, carefully labeled (title, axis labels, equation given).

 A representation of the answers that worked for Problems 1 and 2 **on the graph**.

 A **summary** of what type of shape a farmer might use to maximize the area of an enclosure.

 A **visualization** of the arrangement of fencing that produces the maximum area.

**Problem 1:** Determine the **maximum** area that a rectangular enclosure made with all your fencing can occupy. You will need to write and graph the equation for the area of a rectangular enclosure that uses all your fencing as a function of the length of the enclosure. Use your poster for the graph!

**Problem 2:** Determine the **length** and **width** of an enclosure that uses all of your fencing and has an area three fiftieths of the square of the length of your fencing. You may wish to consult your graph, use the quadratic formula, or factor to solve this problem.

**Problem 3:** Determine whether a different shape of enclosure with the same amount of fencing has a greater **maximum** area.

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| --- | --- | --- |
| **Concerns***Areas that Need Work* | **Criteria***Standards for This Performance* | **Advanced***Evidence of Exceeding Standards* |
|  | **Statement of Problems**The three problems you answered are presented, in words, on the poster. |  |
|  | **Statement of Solutions**Correct solutions are given, in words, to each of the three problems presented. |  |
|  | **Graph**The function is graphed using the correct variables. Graph title and axes are clearly labeled. Solutions to Problems 1 and 2 are labeled. |  |
|  | **Summary**A summary of problem 3 is given. |  |
|  | **Visual Appeal**Text and graph are presented in visually appealing poster format. Consideration is given to readability and aesthetic appeal. |  |
|  | **Individual Contribution**You contribute to the project and consider your group mates' contributions. |  |
| **1-2 points each** | **3 points each** | **4 points each** |

Advanced Algebra Activity Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Optimization Project: Ball Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Optimization problems ask you to find the minimum or maximum value of a function with real-world applications. In this group project, you and your partners will be given a maximum throwing speed and asked to determine how high you could launch a ball at this speed from the top of a building that is 20 ft tall. You will discover the maximum height you could reach, and explore the relationship between the height reached and the gravity under which you throw the ball.

You will present your discoveries as a poster.

You will be assigned a throwing speed randomly. Record that speed: \_\_\_\_\_\_\_

The function that models the height of an object thrown straight up from the top of a building h feet tall with an initial velocity of v feet per second under an acceleration of gravity of 2g feet per second squared is:

http://www.mesacc.edu/~scotz47781/mat120/notes/projectile\_motion/projectile\_motion.html

h(t) = -gt2 + vt + h

where h(t) is the height of the object t seconds after it is thrown. On earth, g is 16. Rewrite this equation given the g, v, and h for your group:

Design your poster. On your poster, you should have:

 In words, a statement of the three problems you solved for this project, specific to your length of fencing.

 In words, the answers to those three questions.

 A **graph** of the function from problem 1, carefully labeled (title, axis labels, equation given).

 A representation of the answers that worked for Problems 1 and 2 **on the graph**.

 A **summary** of which planet, Earth or one with an acceleration of gravity of 24 ft/s2, will allow a greater maximum height.

 A **statement** of how you know which planet will have the greater maximum height.

**Problem 1:** Determine the **maximum** height that a ball thrown straight up from your building at your top speed will reach. You will need to write and graph the equation for the height of the ball as a function of time. Use your poster for the graph!

**Problem 2:** Determine the **time** it will take your ball to reach a height of 20 feet above the ground. You may wish to consult your graph, use the quadratic formula, or factor to solve this problem.

**Problem 3:** Determine whether a ball launched from the same height and with the same initial speed on a planet with an acceleration of gravity of 24 ft/s2 will reach a greater or a lesser **maximum** height than your ball did. How do you know?

|  |  |  |
| --- | --- | --- |
| **Concerns***Areas that Need Work* | **Criteria***Standards for This Performance* | **Advanced***Evidence of Exceeding Standards* |
|  | **Statement of Problems**The three problems you answered are presented, in words, on the poster. |  |
|  | **Statement of Solutions**Correct solutions are given, in words, to each of the three problems presented. |  |
|  | **Graph**The function is graphed using the correct variables. Graph title and axes are clearly labeled. Solutions to Problems 1 and 2 are labeled. |  |
|  | **Summary**A summary of problem 3 is given. |  |
|  | **Visual Appeal**Text and graph are presented in visually appealing poster format. Consideration is given to readability and aesthetic appeal. |  |
|  | **Individual Contribution**You contribute to the project and consider your group mates' contributions. |  |
| **1-2 points each** | **3 points each** | **4 points each** |