

# Welcome Back to MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
<b>Monday</b> Date: <u>3/20</u> Topic: <u>Nothing due - Quiz 6.1 was Friday</u>	0 1 2	
<b>Tuesday</b> Date: <u>3/20</u> Topic: <u>Solving with Quadratic Formula</u>	0 1 2	
<b>Wednesday</b> Date: _____ Topic: _____	0 1 2	
<b>Thursday</b> Date: _____ Topic: _____	0 1 2	
<b>Friday</b> Date: _____ Topic: _____	0 1 2	

## Class Plan:

1. Warm-up -  
Introduction to optimization
2. Application:  
Quadratic Optimization
3. Practice - choose partners!

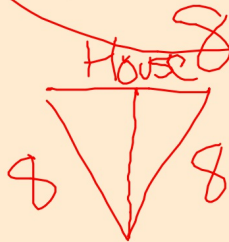
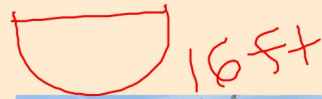
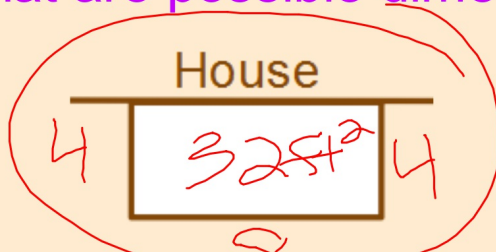


## Warm-up: Optimizing Space to Play!

(Ms. Berg is nannying this summer)

She bought 16 feet of fencing for a play pen (genius!). A wall will be one side of the pen.

What are possible dimensions for the pen?

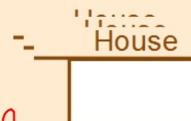
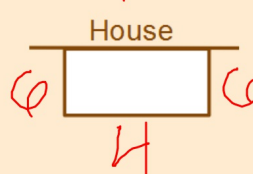
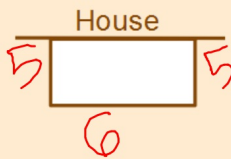
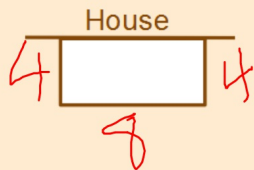
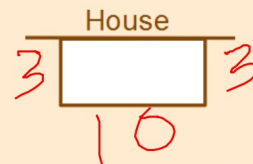
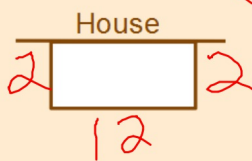
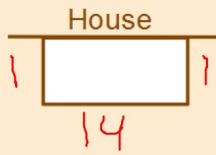


### Let's list possibilities!

16 feet of plastic fencing to create a rectangle space with three sides.

What is the largest area these kiddos can get?!

Width (ft)	1	2	3	4	5	6
Area (ft <sup>2</sup> )	14	24	30	32	30	24



### **Steps to solve:**

Diagram     $\text{Area}(\text{rectangle}) = (\text{length})(\text{width})$

Area and perimeter equations

Create one quadratic equation for Area.

Solve for the roots/x-intercepts

Solve for the vertex (maximum)

Calculate the maximum area.

Let's use an Area Equation.  
16 feet of plastic fencing to create a rectangle space with three sides.

What is the largest area these kiddos can get?!

Diagram

House



Area and perimeter equations  
Create one quadratic equation for Area.

$$\begin{array}{l} A = l \cdot w \\ P = 16 \end{array} \quad \begin{array}{l} 16 = 2w + l \\ l = 16 - 2w \end{array} \quad \boxed{A = w(16 - 2w)}$$

Let's use an Area Equation.

16 feet of plastic fencing to create a rectangle space with three sides.

What is the largest area these kiddos can get?!

Solve for the roots/x-intercepts ( $A=0$ )

$$0 = w(16 - 2w) \quad \left[ \begin{array}{l} \text{Solve from factored} \\ \text{form} \end{array} \right]$$

$$w = 0, \quad 0 = 16 - 2w$$

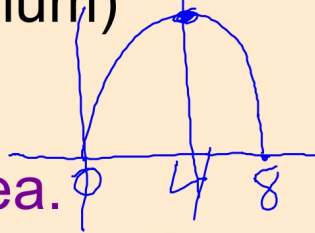
$$\boxed{w = 0 \text{ ft}} \quad \begin{array}{l} 2w = 16 \\ \boxed{w = 8 \text{ ft}} \end{array}$$

Let's use an Area Equation.

16 feet of plastic fencing to create a rectangle space with three sides.

What is the largest area these kiddos can get?  
Solve for the vertex (maximum)

$$\frac{0+8}{2} = 4$$



Calculate the maximum area.

$$A = w(16 - 2w)$$

$$A = 4(8)$$

$$\boxed{w=4}$$

$$A = 4(16 - 2(4))$$

$$\boxed{A = 32 \text{ ft}^2}$$



### Let's use an Area Equation.

16 feet of plastic fencing to create a rectangle space with three sides.

What is the largest area these kiddos can get?!

Solve for the vertex (maximum)

Using roots!  $w = \frac{0+8}{2} = 4\text{ft}$

Calculate the maximum area.

$$A = w(16 - 2w) \quad A = 4(16 - 8)$$

$$A = 4(16 - 2(4)) \quad A = 4(8)$$

$$A = 32\text{ft}^2$$

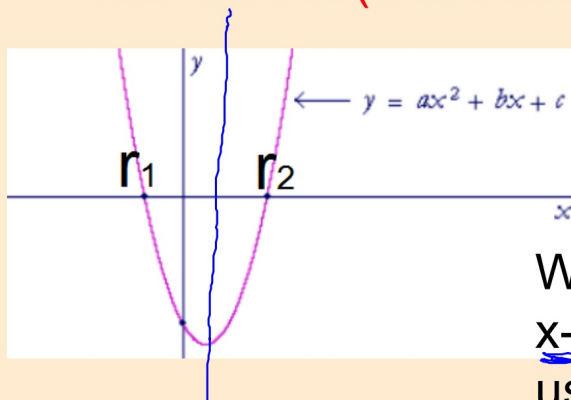
$$32\text{ft}^2$$

Largest possible area for Bo & Lawson

Optimization: To **maximize** or **minimize** a specific characteristic.  
(Get the most out of limited resources)

What will we be solving for...?

The vertex (maximum/minimum)



$$h = \frac{r_1 + r_2}{2}$$

Write a formula for the x-value of the vertex, using the roots.

### Area of the Farmer's Pen

A farmer has 2400 feet of fencing and wants to fence off a rectangular pen that borders a straight river. They need no fencing along the river.

**What are the dimensions of the pen that has the largest area? Reflect on the realism of your method and solution.**



### **Steps to solve:**

Diagram

Area and perimeter equations

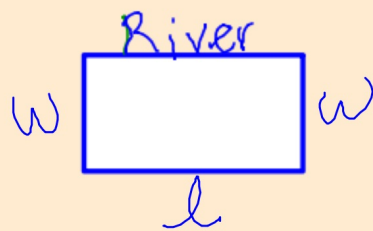
Create one quadratic equation for Area.

Solve for the roots/x-intercepts (factor first)

Solve for the vertex (maximum)

Calculate the maximum area.

Diagram



$$P = 2400 \text{ ft}$$

Area and perimeter equations

$$\begin{array}{l|l} 2400 = 2w + l & A = lw \\ l = 2400 - 2w & A = w(2400 - 2w) \end{array}$$

Create one quadratic equation for Area.

Solve for the roots/x-intercepts (factored form)

$$A = w(2400 - 2w)$$

$$0 = w(2400 - 2w)$$

$$\boxed{w = 0 \text{ ft}}$$

$$2400 - 2w = 0$$

$$2400 = 2w$$

$$\boxed{w = 1200 \text{ ft}}$$

Solve for the vertex (maximum)

$$X = \frac{0 + 1200}{2}$$

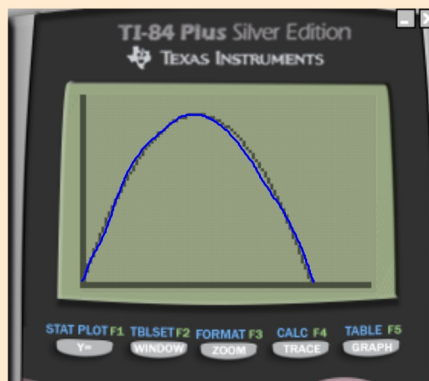
$$X = 600 \text{ ft}$$

$$y = 2400 - 2(600)$$

$$y = 1200 \text{ ft}$$

Calculate the maximum area.

This gives a maximum area of  $2400(600) - 2(600)^2$   
 $600 \times 1200 \Rightarrow = 720,000 \text{ ft.}^2$



At  $x = 600$  ft, the  
Area is 720,000 sq feet

Reflect on the realism of your method and solution.

Is it an animal pen?!

How big should a pig pen be? **Cows...  $12 \times 24 = 288$  sqft**

Pigs require very little space. While textbooks say pigs can get by with a minimum of **20 square feet** per pig in an outdoor area, they need more room to roam. Plan for a minimum of **50 square feet** per pig, preferably a little more. When designing your pig pen, keep a few things in mind. Apr 20, 2016

[Raising Small Groups of Pigs – Start Farming – Penn State Extension](https://extension.psu.edu/business/start-farming/livestock/pigs/raising-small-groups-of-pigs)  
[extension.psu.edu/business/start-farming/livestock/pigs/raising-small-groups-of-pigs](https://extension.psu.edu/business/start-farming/livestock/pigs/raising-small-groups-of-pigs)

Search for: [How big should a pig pen be?](#)

[About this result](#) • [Feedback](#)

The 720,000 square feet will perfectly fit my bunch of 14,400 pigs...! or 2500 cows!



Reflect on the realism of your method and solution.

Could you pen plants?!

A screenshot of a unit conversion tool. At the top, there is a dropdown menu labeled "Area". Below it, a text input field contains the number "1". To the right of this input is an equals sign, followed by another text input field containing the number "43,560". Below the "1" input is a dropdown menu labeled "Acre". Below the "43,560" input is a dropdown menu labeled "Square foot". At the bottom left of the tool is a link labeled "More info" and at the bottom right is a link labeled "Feedback".

16.5 Acres is approximately 720,000 square ft

## Exercises...

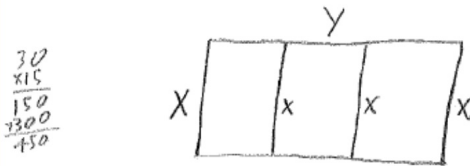
### Optimization Practice

1. Three adjacent holding pens are being built with a total of 120 meters of fencing. What overall dimensions will maximize the area? What is the maximum overall area?

2. Two adjacent fenced in areas are being placed against a long building. Write a function to model the area of the total enclosure in terms of its wide if 150 meters of fencing is used.

## Solution

1. Three adjacent holding pens are being built with a total of 120 meters of fencing. What overall dimensions will maximize the area? What is the maximum overall area?



$$\text{Fencing: } 4x + 2y = 120$$

$$\text{Area: } A = x \cdot y$$

$$\begin{array}{r} 30 \\ \times 15 \\ \hline 150 \\ 450 \\ \hline 450 \end{array}$$

$$15(60 - 2(15)) \\ = 15(30) = 450$$

$$\frac{2y}{2} = \frac{120 - 4x}{2} \Rightarrow y = 60 - 2x$$

$$A = x(60 - 2x)$$

$$\text{Vertex at } x = \frac{30 - 0}{2} \Rightarrow x = 15 \text{ meters}$$

$$y = 60 - 2(15) = 60 - 30 = 30 \Rightarrow y = 30 \text{ meters}$$

$$x = 0$$

$$60 - 2x = 0 \Rightarrow 60 = 2x \\ \Rightarrow x = 30$$

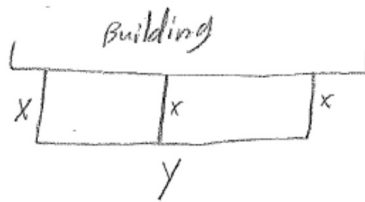
15 meters by 30 meters

$$\text{Area} = 450 \text{ m}^2$$

2. Two adjacent fenced in areas are being placed against a long building. Write a function to

## Solution

2. Two adjacent fenced in areas are being placed against a long building. Write a function to model the area of the total enclosure in terms of its wide if 150 meters of fencing is used.



$$x+x+x+y = 150$$

$$\therefore 3x+y = 150$$

$$\begin{array}{r} -3x \\ \hline y = 150 - 3x \end{array}$$

$$A = x(150 - 3x)$$