

Quadratic Functions in MATLAB

This lesson gives an introduction to solve quadratic functions in MATLAB. MATLAB was used to solve systems of equations for constants a, b and c for Quadratic functions with three known points. Students will also learn to graph quadratic functions with MATLAB and find the Maximum and Minimum values from the graph. The MATLAB command `linprog` was used to find the coefficients a, b, and c. `ezplot` was used to plot the quadratic functions. `Ezplot` usually plots the expression over the default domain $-2\pi < x < 2\pi$. Students will learn to change the default domain and range of the `ezplot` function.

Science Lesson Plan

Teacher: Megha Sunny

Period: Lesson Plan 6

Date(s): December 6 2012

SETTING THE STAGE	
<u>Essential Question</u>	How to solve problems in MATLAB? In this lesson we will introduce quadratic functions in MATLAB
<u>Content Objective(s)</u> (Student-friendly)	<ul style="list-style-type: none"> • Use MATLAB to solve systems of equations for constants a, b and c for Quadratic functions with three known points. • Graph Quadratic functions with MATLAB • Use MATLAB to find Maximum and Minimum values.
<u>Connection to previous or future lessons</u>	This is the sixth lesson in MATLAB. An introduction to basic MATLAB programming was provided in the first lesson.
<u>Critical Thinking Questions</u>	What is the purpose of learning MATLAB? How to solve quadratic functions? How find the maximum and minimum of a function using MATLAB easily?
<u>Key Vocabulary</u>	Quadratic functions, Maximum, Minimum
<u>Materials Needed/Safety</u>	Laptops, MATLAB, Pencil, Paper
ACTIVE INSTRUCTION	
<ul style="list-style-type: none"> • Launch (Engage) 	Students will turn on the laptops and open MATLAB in it. Working with laptops will grab the student's attention. They were given a Do now problem at the beginning of the class.
<ul style="list-style-type: none"> • Investigation (Explore) 	
TIME FOR REFLECTION	
<ul style="list-style-type: none"> • Summarization (Explain & Extend) 	Students will use MATLAB to solve the coefficients a, b and c for the systems of Quadratic equations and graph the quadratic function in MATLAB and find the maximum or the minimum values from the graph.

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<ul style="list-style-type: none">• Assessment (Evaluate)	Observation Listening Questions
<ul style="list-style-type: none">• Homework	None

*This template is available in electronic form.

Do Now

- What is the standard form of a quadratic equation?
- What do a , b , c , x , and y represents in the above equation?
- How do you find the maximum or minimum values?

Quadratic Functions

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Objective

- Use MATLAB to solve systems of equations for constants a , b and c for Quadratic functions with three known points.
- Graph Quadratic functions with MATLAB
- Use MATLAB to find Maximum and Minimum values.

Example 1

- Find the quadratic function to model the values in the table

X	Y
1	-2
2	-4
3	-4

Solution

- Substitute the values of x and y in the equation $y = ax^2 + bx + c$ to form the system of equations
- Solve the system of equations using MATLAB

Graphing Quadratic Functions

- `ezplot(eq)` plots the expression $eq(x)$ over the default domain $-2\pi < x < 2\pi$
 $eq = 'y = ax^2 + bx + c'$
`ezplot(eq)`
- The domain and range for `ezplot` can be set as follows
`ezplot((eq), [x min, x max, y min, y max])`
- Can you identify the maximum or minimum from the graph?

Quadratic functions in MATLAB

1. Find the quadratic function to model the values in the table

X	Y
1	-2
2	-4
3	-4

- a. Write down the system of equations
- b. Write down the MATLAB code to solve for a, b and c
- c. Write down the MATLAB code to graph a quadratic equation
- d. Identify the maximum or minimum from the graph.

Lesson 6

Fellow: Megha Sunny

Teacher: Patrick Morasse

6 December 2012

2. Shelly throws her keys up in the air releasing from a height of 1 ft. above the ground. Table shows the height of the key at different times.

Time (s)	Height (ft.)
0	1
1	5
2	1

- a. Find the quadratic model for this data.
- b. Graph the function using MATLAB and use the graph to estimate the height of the key after 1.5s.

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3. The fuel efficiency of a vehicle can be modeled with a quadratic function $y=ax^2+bx+c$ over a limited span of speeds. Suppose that a certain car has an efficiency of 20 miles per gallon at a speed of 14 miles per hour. At 42 miles per hour the efficiency is increased to 34 miles per gallon. The car reduces its efficiency to 20 miles per gallon when the speed is increased to 70 miles per hour.
- Find the value of the coefficients a , b , and c
 - Find a quadratic function that models the car's efficiency.
- c. Graph the function using ezplot and find the speed of the speed of car at its best efficiency.