

A. Lesson Context

BIG PICTURE of this UNIT:	<ul style="list-style-type: none"> • How & why do we build NEW knowledge in Mathematics? • What NEW IDEAS & NEW CONCEPTS can we now explore with specific references to POLYNOMIAL FUNCTIONS AND RATIONAL FUNCTIONS? • How can we extend our knowledge of FUNCTIONS, given our BASIC understanding of Functions and quadratic functions? 		
CONTEXT of this LESSON:	<p>Where we've been</p> <p>In Unit 3, you worked with quadratic functions in vertex, standard, and factored forms.</p>	<p>Where we are</p> <p>HOW do we apply the concepts of functions & algebra & quadratics to better understand higher order polynomials?</p>	<p>Where we are heading</p> <p>How do we extend our knowledge & skills of polynomials given what we know about quadratics & about functions?</p>

B. Lesson Objectives

- a. Introduce cubic functions through a modeling investigation – tracking hurricanes

C. Fast Five (Skills Review/Preview Focus) – Find each product

1(a). The formula for the volume of cylinder is $V = \pi r^2 h$. If the height of a cylinder is twice its radius and its radius is 5 cm, determine the volume of this cylinder.

2(a). Use DESMOS/TI-84 to graph and sketch:

$$y = x^3, y = x^3 - 2 \text{ and } y = (x - 2)^3.$$

2(b). Sketch a function that crosses the x-axis at $x = 6$.

2(c). Sketch a function with x-intercepts at $x = 6$ & $x = -1$

2(d). Sketch a function with zeroes at $x = -2, 3$ and 4 .

1(b). The formula for the volume of a sphere is $V = 4/3\pi r^3$. Determine the volume of a sphere if its radius is 4 cm.

3(a). Use DESMOS/TI-84 to graph and sketch the polynomial functions:

(i) $y = (x - 1)(x + 2)(x - 3)$ and

(ii) $y = -(x - 2)(x + 1)(x + 4)$.

1(c). Determine the radius of a sphere if its volume is 200 cm^3 .

3(b). Use WolframAlpha to factor $x^3 - x^2 - 14x + 24$. Sketch the graph as well.

D. Polynomial Modeling – Tracking Hurricanes

You are tracking a hurricane and must make a timely decision to evacuate the people living in a town that will get “hit” with a hurricane.

First, you will be provided with data regarding the locations of various towns that are POSSIBLY in the path of a hurricane.

Secondly, you will be provided with “timed” data about the location of the center of the hurricane. From this location data, you must develop a mathematical model that allows you to predict which town(s) are directly in the path of the hurricane and must therefore be evacuated.

Constraints: You can only evacuate a maximum of 2 towns (as evacuations are massively expensive and a major inconvenience!!!) Secondly, it will take 12 hours to successfully evacuate a town, so your final decision as to which town(s) to evacuate must be made 12 hours in advance of the hurricane reaching the town.

Here are the town locations: ***Below are some Cities along the Gulf Coast. Listed are their longitudes and latitudes.*** For the cities to be graphed, either the longitude or the latitude should be negative. Which should be negative and why? Explain.

City	Longitudes (x)	Latitudes (y)
New Orleans, Louisiana	90.0W	30.0N
Biloxi, Mississippi	89.0W	30.5N
Mobile, Alabama	88.0W	30.6N
Pensacola, Florida	87.1W	30.2N
Panama City, Florida	85.6W	30.2N
Baton Rouge, Louisiana	91.1W	30.5N
Houma, Louisiana	91.2W	29.6N
Lake Charles, Louisiana	93.13W	30.7N
Houston, Texas	95.21W	29.58N

Now enter the coordinates of the cities (Use the BOX symbol on TI-84 scatter plots to MARK these towns).

Here is the tracking data: HOWEVER, you only have access to the data once every day (as it becomes available only every 4 hours!!)

Lesson 2: Modeling with Polynomial Functions | Unit 4 – Polynomial & Rational Functions

DAY 1: You now have [access to the data on the Hurricane Data Page](#) for the last 24 hours of tracking the hurricane.

Graph your data on the TI-84 (Use the + symbol on the TI-84 to MARK these hurricane locations)

(& Take Photo using your phone & upload into your Daily Report – Google doc)

(a) Which models are you considering? Why?

(b) Your “final” model equation is: $L_{\text{day1}}(t) =$ _____.

(& Take photo(s) of scatterplot & model(s) & upload into your Daily Report – Google doc)

(c) Justify your choice of “final” model (explain why you chose the model you did)

(d) Use your model to PREDICT which town(s) you think need to be **evacuated**. Show/explain how you determined these towns

(e) Use your model to PREDICT at **what time & on what day** you think the hurricane will hit the town(s).

(f) Do you feel confident enough at this time to make the FINAL decision to evacuate your selected towns?

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