Math Honors 2: Portfolio Task 2 (due at 7:30 a.m. May 31 - Block A OR at 8:30 a.m. June 1 - Blocks C & D)

TIDE MODELLING

Description

The Bay of Fundy in Nova Scotia, Canada is deemed to have the greatest average change in tide height in the world. In the table below data is presented from December 27 2010 using Atlantic Standard Time (AST). The heights were taken at Grindstone Island.

Time (AST)	00.00	01.00	02.00	03.00	04.00	05.00	06.00	07.00	08.00	09.00	10.00	11.00
Height (m)	7.5	10.2	11.8	12.0	10.9	8.9	6.3	3.6	1.6	0.9	1.8	4.0

Time (AST)	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00
Height (m)	6.9	9.7	11.6	12.3	11.6	9.9	7.3	4.5	2.1	0.7	0.8	2.4

In this task you will develop a model function for the relationship between the time of day and the height of the tide. Consider carefully the expectations of a modeling task as you complete your work by referring to the assessment rubric.

Method

1. Using a GDC or graphing software, plot the graph of time against height. Describe the result.

2. Use your knowledge of functions to develop two functions that model the behavior noted in the graph. Describe any variables, parameters, and/or constraints for the model. You should:

    (a) develop a polynomial function, by solving a system of equations using matrices

    (b) develop a trigonometric function, by analyzing key characteristics of the graph

    (c) discuss why exponential and logarithmic functions are inappropriate choices to model the height of the tide

3. Draw a graph of each function on the same set of axes as the graph in Step 1. How well does each function fit the data?

4. Modify each of your functions to create a better fit. Describe the issues you had to consider.

5. Good sailors will launch their boats on an outgoing tide (that is when the tide is going out). Use each of your modified functions to determine the times between which a good sailor would have launched a boat on December 27 2010.

6. Use the regression feature of your GDC or software to develop best-fit polynomial and trigonometric functions for this data. Compare these functions with the ones you developed analytically.

7. From the various analytic and regression polynomial and trigonometric functions developed so far in this task, select the function that you think is the most appropriate model and describe the reasons for your choice.

8. The table below lists the tide heights for December 28 2010. Does your selected model fit this data? What modifications are needed? Confirm that your modified model fits this data.

Time (AST)	00.00	01.00	02.00	03.00	04.00	05.00	06.00	07.00	08.00	09.00	10.00	11.00
Height (m)	5.0	7.9	10.2	11.6	11.6	10.5	8.5	6.0	3.5	1.7	1.2	2.2

Time (AST)	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00
Height (m)	4.4	7.2	9.7	11.3	11.8	11.1	9.4	7.0	4.4	2.2	1.0	1.3

9. Bad sailors don't check the tide schedules and launch their boats once every day whenever they feel like it. A boat can only be launched safely in water that is at least 4.5 meters deep. Use your modified model from Step 8 to find the probabilities of the following events:

   (a) a bad sailor launching his boat safely on December 28 2010.

   (b) in a group of six bad sailors, at least two of them launching their boats safely on December 28 2010.