**DUE DATE: 25/5/12**

**Conditions**

* 2 weeks
* 1 lesson (exam conditions) TASK 1
* 1 lesson (work in pairs) to collect data for TASK 2

**Equipment:**

* LoggerPro & data loggers
* Graphics Calculator

**Instructions**

* Show all working or describe steps.
* Submit all graphs, tables, sketches and or photographs used to complete this task.
* Complete all sections of the task.
* This task will be marked according to the criteria given on page 2. Ensure you address the criteria

**Student Name:**

Teacher: Mrs Knuth

Mathematics B – Year 11



**Instrument 1.2: Extended Modelling and Problem Solving Task**

**Topic : Periodic Functions**

**Term 2- 2012**

|  |  |
| --- | --- |
| ***General Objective*** | ***Level gained*** |
| Knowledge & Procedures |  |
| Modelling & Problem Solving |  |
| Communication & Justification |  |

|  |
| --- |
| **Common Curriculum Elements:**   * Recognising letters,words and other symbols * Translating from one form to another * Graphing and tabulating * Substituting in formulae * Structuring/organizing a mathematical argument * Reaching a conclusion which is necessarily true provided a given set of assumptions * Justifying, Visualising, Analysing * Applying a progression of steps to achieve a required answer * Manipulating, operating and using equipment |

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| ***Criterion*** | **Standard *A*** | **Standard *B*** | **Standard *C*** | **Standard *D*** | **Standard *E*** | **NR** |
| --- | --- | --- | --- | --- | --- | --- |
| ***Knowledge and procedures*** | recall, access, selection of mathematical definitions, rules and procedures in routine and non-routine simple tasks through to routine complex tasks, in life-related and abstract situations | recall, access, selection of mathematical definitions, rules and procedures in routine and non-routine simple tasks through to routine complex tasks, in life-related and abstract situations | recall, access, selection of mathematical definitions, rules and procedures in routine, simple life-related or abstract situations | use of stated rules and procedures in simple situations | statements of relevant mathematical facts |  |
|  |  |  |  |  |  |
| application of mathematical definitions, rules and procedures in routine and non-routine simple tasks, through to routine complex tasks, in life-related and abstract situations | application of mathematical definitions, rules and procedures in routine or non-routine simple tasks, through to routine complex tasks, in either life-related or abstract situations | application of mathematical definitions, rules and procedures in routine, simple life-related or abstract situations |  |  |  |
|  |  |  |  |  |  |
| numerical calculations, spatial sense and algebraic facility in routine and non-routine simple tasks through to routine complex tasks, in life-related and abstract situations | numerical calculations, spatial sense and algebraic facility in routine or non-routine simple tasks, through to routine complex tasks, in either life-related or abstract situations | numerical calculations, spatial sense and algebraic facility in routine, simple life-related or abstract situations | numerical sense, spatial sense and/or algebraic facility in routine or simple tasks |  |  |
|  |  |  |  |  |  |
| appropriate selection and accurate use of technology | appropriate selection and accurate use of technology | selection and use of technology | use of technology | use of technology |  |
|  |  |  |  |  |  |
| ***Criterion*** | **Standard *A*** | **Standard *B*** | **Standard *C*** | **Standard *D*** | **Standard *E*** | **NR** |
| ***Modelling and problem solving*** | use of problem-solving strategies to interpret, clarify and analyse problems to develop responses from routine simple tasks through to non-routine complex tasks in life-related and abstract situations | use of problem-solving strategies to interpret, clarify and analyse problems to develop responses to routine and non-routine simple tasks through to routine complex tasks in life-related or abstract situations | use of problem-solving strategies to interpret, clarify and develop responses to routine, simple problems in life-related or abstract situations | evidence of simple problem-solving strategies in the context of problems | evidence of simple mathematical procedures |  |
|  |  |  |  |  |  |
| identification of assumptions and their associated effects, parameters and/or variables | identification of assumptions, parameters and/or variables |  |  |  |  |
|  |  |  |  |  |  |
| use of data to synthesise mathematical models and generation of data from mathematical models in simple through to complex situations | use of data to synthesise mathematical models in simple situations and generation of data from mathematical models in simple through to complex situations | use of mathematical models to represent routine, simple situations and generate data | use of given simple mathematical models to generate data |  |  |
|  |  |  |  |  |  |
| investigation and evaluation of the validity of mathematical arguments including the analysis of results in the context of problems; the strengths and limitations of models, both given and developed | interpretation of results in the context of simple through to complex problems and mathematical models | interpretation of results in the context of routine, simple problems |  |  |  |
|  |  |  |  |  |  |
| ***Criterion*** | **Standard *A*** | **Standard *B*** | **Standard *C*** | **Standard *D*** | **Standard *E*** | **NR** |
| ***Communication and justification*** | appropriate interpretation and use of mathematical terminology, symbols and conventions from simple through to complex and from routine through to non-routine, in life-related and abstract situations | appropriate interpretation and use of mathematical terminology, symbols and conventions in simple or complex and from routine through to non-routine, in life-related or abstract situations | appropriate interpretation and use of mathematical terminology, symbols and conventions in simple routine situations | use of mathematical terminology, symbols or conventions in simple or routine situations | use of mathematical terminology, symbols or conventions |  |
|  |  |  |  |  |  |
| organisation and presentation of information in a variety of representations | organisation and presentation of information in a variety of representations | organisation and presentation of information | presentation of information | presentation of information |  |
|  |  |  |  |  |  |
| analysis and translation of information from one representation to another in life-related and abstract situations from simple through to complex and from routine through to non-routine | analysis and translation of information from one representation to another in life-related or abstract situations, simple or complex, and from routine through to non-routine | translation of information from one representation to another in simple routine situations |  |  |  |
|  |  |  |  |  |  |
| use of mathematical reasoning to develop coherent, concise and logical sequences within a response from simple through to complex and in life-related and abstract situations using everyday and mathematical language | use of mathematical reasoning to develop coherent and logical sequences within a response in simple or complex and in life-related or abstract situations using everyday and/or mathematical language | use of mathematical reasoning to develop sequences within a response in simple routine situations using everyday or mathematical language |  |  |  |
|  |  |  |  |  |  |
| coherent, concise and logical justification of procedures, decisions and results | coherent and logical justification of procedures, decisions and results | justification of procedures, decisions or results |  |  |  |
|  |  |  |  |  |  |
| justification of the reasonableness of results |  |  |  |  |  |
|  |  |  |  |  |  |

**Authorship of Assessment**

I certify that this assignment is my own work, based on my personal study and /or research and that I have acknowledged all materials and sources used in its preparation, whether they be books, articles, class notes or any other kind of document, hard copy or electronic and that I have not copied in part or whole or otherwise the work of other students or persons.

Name: Date:

Signature:

This assignment has been shown to me and I have seen the results given.

Student Signature: Date:

**For Task 2**

|  |  |
| --- | --- |
| Partner |  |
| Periodic Data Modelled |  |
| Equipment used | Motion sensor  Temperature sensor  Microphone |

**What goes up… must come down!**

**Task 1 ( To be completed during class time under exam conditions)**

Amelia measured the depth of water at the end of the Townsville jetty at various times on Friday, 16 January 2001. The table below provides her results.

|  |  |
| --- | --- |
| ***Time*** | ***Depth ( m)*** |
| *6 a.m.* | *1.5* |
| *7* | *1.8* |
| *8* | *2.3* |
| *9* | *2.6* |
| *10* | *2.5* |
| *11* | *2.2* |
| *12* | *1.8* |
| *1 p.m.* | *1.2* |
| *2* | *0.8* |
| *3* | *0.5* |
| *4* | *0.6* |
| *5* | *1.0* |
| *6* | *1.3* |
| *7* | *1.8* |
| *8* | *2.2* |
| *9* | *2.5* |
| *10* | *2.5* |
| *11* | *2.3* |



**Knowledge and Procedure***{ time is measured in hours* ***after*** *6 a.m }*

**Question 1.**

1. Plot an accurate graph of ***depth*** *vs* ***time*** [where time = hours after 6.00am]

1. Find the period and the amplitude of your graph. Hence find an equation which relates depth (D) and time (t). (Remember: time is the number of hours after 6 a.m.)
2. Outline the steps needed to find a Sine Regression equation using your Graphics Calculator.
3. Now use the Sine Regression capability of your Graphics Calculator to find a mathematical model for the depth.
4. Compare your equations from questions (b) and (d), and comment on any differences.

**Modelling and Problem Solving**

**Question 2.**

Amelia’s mother can moor her yacht when the depth is above 1.7 m.

Your task is to determine what time periods could she moor the yacht at the end of the Townsville Jetty on Monday, 19 January, 2001?

a. Use your equation from question 1.(b) to determine the time periods.

b. Explain how to check with your graph from question 1., the answer you determined in part a. [a rough sketch should be included].

c. Use your regression equation from question 1.(d) to also determine the time periods for the yacht to be moored on Monday 19 January.

d. Comment on any **assumptions** made and their **effects.**

e. Discuss the **strengths and limitations** of the model.

**TASK 2 (TWO WEEKS)**

**Knowledge and Procedures**

**Question 3.**

You are to collect some data of your own which is periodic.

* + You are to generate the data in pairs. You will be utilising LoggerPro so suggested data is a pendulum swinging, a spring bouncing, room temperatures, sound waves, or another as approved by teacher. You will have **one lesson** to generate the data and produce a graph. Ensure you save the data and graph for insertion into your assignment. If more time is required, you will need to organise it outside of class-time.
  + Describe your method of data collection and what modifications were necessary to ensure reliable data was collected. Draw a diagram of your setup.
  + [](http://images.google.com.au/imgres?imgurl=http://www.wwu.edu/depts/tutorialcenter/calculator.gif&imgrefurl=http://www.wwu.edu/depts/tutorialcenter/calculators.htm&h=392&w=404&sz=78&hl=en&start=3&um=1&tbnid=49pVLOf2y3ibeM:&tbnh=120&tbnw=124&prev=/images?q=calculator&um=1&hl=en)Display the data in a table with appropriate headings. You must include enough points to include at least 2 periods.

**Question 4.**

a. Use LoggerPro to graph the data, including labels.

* + - Find the period and amplitude.
    - Use the ‘Curve Fit’ capability of LoggerPro to find an equation to model the data.
    - Save the graph for insertion into your assignment.

b. Use the sine regression capability of your calculator to also find an equation to model the data.

**Modelling and Problem Solving**

**Question 5.**

a. Compare the equations that model your data (LoggerPro & calculator versions) in Question (2). **Analyse the data that can be generated** from each model and comment on the **strength of the model** for interpolated values.

b. Use both equations from Question (2) to predict a value of the dependent variable, using a value for the independent variable, which is outside of the range of the data you found **(i.e. you will need to extrapolate).** Explain clearly what you are trying to predict.

c. Comment on any **limitations** in the model you have used and on the reliability of your prediction.

d. **Identify any assumptions** made and discuss their effect on the predictions you made.