** **MathematicS methods**

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**Investigation 1**

**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Assessment conditions: Students will get 1 period in class, but the work must be completed at home, using any technology students fell is relevant to the investigation process.**

**Part 1 and 2 should be included as appendices and the main report should be on part 3 only. Your report should be no more than four pages.**

**Surge and Logistic Models**

**Part 1: The Surge Function**

A surge function is in the form where *A* and *b* are positive constants.

* On the same axes, graph and for the case where and

* Determine the coordinates of the stationary point and point of inflection and label these on the graph.
* Repeat the investigation for three different values of while maintaining .
* Include your graphs in the report and summarise the findings in a suitable table.
* State the effect of changing the value of on the graph of .
* Using a similar process investigate the effect of changing the value of on the graph of .
* Make a conjecture on how the value of b effects the x-coordinates of the stationary point and the point of inflection of the graph of .
* Prove your conjecture.
* Comment on the suitability of the surge function in modelling medicinal doses by relating the features of the graph to the effect that a medicinal dose has on the body.

Discuss any limitations of the model.

*At least four key points should be made.*

**Part 2: The Logistic Function**

A logistic function is in the form where and are constants and the independent variable t is usually time; .

This model is useful in limited growth problems, that is, when the growth cannot go beyond a particular value for some reason.

* Investigate the effect that the values of and have on the graph of the logistics function.
* Discuss your findings on the logistic model.
* Relate the specific features of the logistic graph to a limited growth model.

*At least three key points should be made.*

**Part 3: Modelling using Surge and Logistic Functions**

Using either a surge or a logistic function (or both) develop a model to investigate one of the following scenarios.

* Movements of students into the school building at the end of lunch.
* A crowd leaving a sports venue.
* The limited growth of a population.
* pH levels in a titration.
* Repeat doses of a medicine.
* The spread of information in a group of people.
* Traffic density during peak hour.
* The acceleration of a car.
* A suitable alternative of your choosing.

**For this section write your response as a report which includes an introduction, a main body and a conclusion.**

**Introduction:**

- What is the question/problem you are investigating?

- How do you plan to approach this question/problem?

**Research:**

- What mathematical processes will you need to use?

- What is the mathematics behind this investigation?

**Conduct:**

- Carry out the mathematics

- Show all working out, including any tables/graphs.

- Provide descriptions of the steps you took.

**Communicate:**

- Any findings are clearly communicated.

- Was the result what you expected?

- Could there have been a better way of conducting the investigation.

- What is your conclusion?

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**Declaration of Authenticity**

I declare that this assignment is my own work and that I have correctly acknowledged the work of others.  This assignment is in accordance with School guidance on good academic conduct.

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_