**Math 233 Unit 2 Individual Project**

**NAME (Required): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

A computer virus is a malicious program that can cause high levels of destruction to your computer or your mobile device. Even with an antivirus program installed, infections can still spread very rapidly as it is restricted to detecting infections, based on information on previous virus code. A team of experts wants to study a recently discovered computer virus by building a mathematical model that predicts the spread of infection, even with an antivirus installed, as a function of time.

**Be sure to show your work details for all calculations and explain in detail how the answers were determined for critical thinking questions**.

1. Set up a function that represents the spread of this new computer virus during the first 25 days by choosing a value for *A*,based on the first letter of your last name, from the table below. (*A* does not necessarily have to be a whole number). In your equation, *S*(*t*) is the number of machines projected to be infected and *t* is the time, in days.

|  |  |  |
| --- | --- | --- |
| **First letter of your last name** | **Mathematical Model** | **Possible values for A** |
| A–F | $$S\left(t\right)=-6t^{3}+At^{2}, 0\leq t\leq 25$$ | 161 – 180 |
| G–L | $S\left(t\right)=-8t^{3}+At^{2}$, $0\leq t\leq 25$ | 221 – 240 |
| M–R | $$S\left(t\right)=-10t^{3}+At^{2}, 0\leq t\leq 25$$ | 261 – 280 |
| S–Z | $$S\left(t\right)=-12t^{3}+At^{2}, 0\leq t\leq 25$$ | 321 – 340 |

**State your specific function here:** $S\left(t\right)= $

1. Using the function that you have created from #1, find the value of ***S*(15)**. Show your work details.
2. Find **S**$'(t)$, the derivative of ***S*(*t*)**. Show your work details and simplify your answer.
3. Find the value of $S'(15)$. Show your work details.
4. Interpret the meanings of $S(15)$and$S'(15)$ in the context of this virus scenario.
5. Generate a graph for ***S*(*t*).** (There are free downloadable programs like [Graph 4.4.2](http://www.padowan.dk/) or [Mathematics 4.0](http://microsoft-mathematics.en.uptodown.com/); or, there are also online utilities such as [this site](https://www.desmos.com/) and many others.) Insert both the function and the graph into your Word document that contains all of your work details and answers. Be sure to label and number the axes appropriately. (**Note:** Some graphing utilities require that the independent variable must be “x” instead of “t”.)
6. After how many days is the virus projected to infect the maximum number of machines? What is the maximum number of machines projected to be infected? Show your work details for both answers.
7. Functions are increasing on intervals where the derivative is positive and are decreasing on intervals where the derivative is negative. Over what intervals is your function increasing and decreasing? What do you think is the reason why the number of infected machines will start to decrease at some point in the domain?

**References**

*Desmos*. (n.d.). Retrieved from https://www.desmos.com/

*Graph 4.4.2*. (n.d.). Retrieved from the Graph Web site: http://www.padowan.dk/

*Mathematics 4.0*. (n.d.). Retrieved from the Microsoft Web site: http://microsoft-mathematics.en.uptodown.com/