**MATH233 Unit 3 Individual Project**

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

This assignment features an exponential function that is closely related to Moore’s Law, which states that the numbers of transistors per square inch in Central Processing Unit (CPU) chips will double every two years. This law was named after Dr. Gordon Moore.

Table 1 below shows selected CPUs from this [leading processor company](http://www.intel.com/content/www/us/en/company-overview/company-overview.html) introduced between the years 1982 and 2008 in relation to their corresponding processor speeds of Million Instructions per Second (MIPS).

Table 1: Selected CPUs with corresponding speed ratings in MIPS.

|  |  |  |  |
| --- | --- | --- | --- |
| Processor | Year | *t* Years After 1982 When Introduced | Million Instructions per Second (MIPS) |
| 4 | 1982 | 0 | 1.28 |
| 5 | 1985 | 3 | 2.15 |
| 6 | 1989 | 7 | 8.7 |
| 7 | 1992 | 10 | 25.6 |
| 8 | 1994 | 12 | 188 |
| 9 | 1996 | 14 | 541 |
| 10 | 1999 | 17 | 2,064 |
| 11 | 2003 | 21 | 9,726 |
| 12 | 2006 | 24 | 27,079 |
| 13 | 2008 | 26 | 59,455 |

(Instructions per second, n.d.)

This information can be mathematically modeled by the exponential function:

NOTE: This function is created as a “best fit” function for a table of empirical data and, therefore, does not exactly match many (or any) of the data values in the table above. Rather, the total cumulative differences from all of the data points are at a minimum for this function.

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

1. Generate a graph of this function, ***MIPS(t) = (0.112)(1.405^(1.14t+9.12))***, years after 1982, using Excel or another graphing utility. (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”.)
2. Find the derivative of with respect to . Show your work details.
3. Choose a -value between 10 and 26. Calculate the value of Show your work details.
4. Interpret the meaning of the derivative value that you just calculated from part 3 in terms of the function and this scenario.
5. If the function is reasonably accurate, for what value of will the rate of increase in MIPS per year reach 6,000,000 ? Approximately which year does that correspond to? Show your work details.
6. For the -value you chose in part 3 above, find the equation of the tangent line to the graph of at that value of . What information about the function can be obtained from the tangent line? Show your work details.
7. Using Web or Library resources research to find the years of introduction and the processor speeds for both [CPU A](http://www.techradar.com/us/reviews/pc-mac/pc-components/processors/intel-core-i5-2500k-917570/review) and [CPU B](http://www.techradar.com/us/reviews/pc-mac/pc-components/processors/intel-core-i7-4770k-1156062/review). Be sure to cite your creditable resources for these answers. Convert the years introduced to correct values of by subtracting 1982 from each year. Then, determine how well the function predicts the CPUs’ processor speeds by comparing the calculated values with the actual MIPS ratings of these two CPUs. Show your work details.

**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/

*Instructions per second*. (n.d.). Wikipedia. Retrieved from http://en.wikipedia.org/wiki/Instructions\_per\_second

Intel. (2008). *Mircoprocessor quick reference guide*. Retrieved from http://www.intel.com/pressroom/kits/quickrefyr.htm

Laird, J. (2011, January 3). Intel Core i5-2500K review. *Techradar*. Retrieved from http://www.techradar.com/us/reviews/pc-mac/pc-components/processors/intel-core-i5-2500k-917570/review

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