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MATH 102

Using Technology

(https://unco.instructure.com/http

Assignment

As you do these activities, please keep a list of useful links or other resources that you find. You may want to refer back to them someday.

Three of the following four activities (spreadsheets / LaTeX / GeoGebra / SymPy) is enough for a passing grade if they are done completely, but I strongly suggest you do all four if possible.

It's okay for this assignment to share bits and pieces with classmates, but please make sure you understand how to recreate everything yourself. For the "discover interesting things" part, please discover your own. Everyone should turn in their own files in the end; do not submit a copy of a classmate's file.

Spreadsheets (Excel / Google Sheets / LibreOffice / ??)

1. Create a column with all the numbers between 3 and 7, incrementing by 0.05. (Don't type them all; use the Autofill feature or appropriate formulas.)
2. Create a second column in which you calculate the function $f(x) = \frac{e^{\cos(\sqrt{x})}}{\ln x}$ of the numbers in the first column.
3. Create a third column with the **slopes** or **rates of change** of the function $f(x)$ between successive points. So, for example, your first entry would be the value of $\frac{f(3.05)-f(3.0)}{3.05-3.0}$.
4. Create a second **worksheet** within the same file and choose a good name for it. Figure out how to use references (not copy/paste) to make Column A of your second sheet contain the numbers from Column B of your first sheet. If done properly, you should be

able to change the numbers on the first sheet, and see the second sheet update automatically.
5. In a third worksheet, look up how to use random number generating functions to generate a column of 500 random integers between 1 and 6 inclusive. Calculate their average, and count how many of them are 5s.
6. Generate a column of 500 random **real numbers** (not just integers) between 0 and 15, following the uniform distribution (intuitively, with no bias or weighting toward or against any numbers in the range). Calculate their average, and count how many are between 2.4 and 5.4 (the *countif* function may be what you want).
7. Discover two more interesting things you can do with Excel. Add them to your file, together with a brief explanation.

Submit a .xlsx file or a link to your Google Sheet.

The LaTeX document processor

You might find the following guide helpful: **https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes (https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes)**

1. Set up one of the following options for running LaTeX:
   - For browsers: **https://www.overleaf.com/project (https://www.overleaf.com/project)** (freemium)
   - A LaTeX distribution for Windows: **https://miktex.org/ (https://miktex.org/)** (free)
   - For Mac: **https://pages.uoregon.edu/koch/texshop/ (https://pages.uoregon.edu/koch/texshop/)** (free)
   - For Linux: check your OS package manager. texlive is one possibility. (free)
2. Check that you are able to compile a sample LaTeX file, such as **hw-template.tex (https://unco.instructure.com/courses/77552/files/7041021/download?download_frd=1)**, and produce a PDF. (If you're unable to download .tex files, here is the same file as .txt: **hw-template.txt (https://unco.instructure.com/courses/77552/files/7041023/download?download_frd=1))**
3. Choose a random paragraph from some math textbook (make sure the paragraph contains a decent amount of math symbols or equations) and rewrite it in LaTeX.
4. Take a homework problem you recently solved in a math class, and write its solution in LaTeX, explaining all the steps and making the formatting look as nice as you can.
5. Discover two more interesting things you can do with LaTeX, and add them to your file with a brief explanation.

Submit your .tex and .pdf files, or else your Overleaf link if using that.

GeoGebra online graphing calculator

https://www.geogebra.org/ (https://www.geogebra.org/)

1. Figure out how to graph a basic function such as $\sin(x)$.
2. Graph the function $f(x) = \frac{e^{\cos(\sqrt{x})}}{\ln x}$ from before. Arrange your graph to show the interval $3 \leq x \leq 7$
3. Figure out how to save your graph as a permalink or image. (You may have to make an account or link an existing one of yours.)
4. Start a new graph. Graph the two functions $f(x) = x^6 - 2x^5 + x^3$ and $g(x) = x^2 - 1$. (Make sure you get the exponents right so that you are not graphing x^(2-1) instead.)
5. From the dropdown by the function, try out the Special Points feature showing the zeros and critical points of your functions. Save a permalink or image of this.
6. Discover at least three more interesting features of GeoGebra, and submit images or links with a brief explanation. (There are more tools in the "nine dots" menu in the upper right. The CAS Calculator may be especially interesting; it can calculate derivatives.)

Submit your links and/or images.

SymPy

This is Python's toolkit for algebra, calculus, number theory, and lots of other math. You can run it on any computer with Python installed, but for casual computations the online version at **https://live.sympy.org/ (https://live.sympy.org/)** is convenient.

1. To make sure Python is working, calculate 1+1 and make sure you get 2.
2. Find out how to calculate derivatives in SymPy, and use it to find the derivative of $f(x) = \frac{e^{\cos(\sqrt{x})}}{\ln x}$.
3. The answer may not be simplified very nicely, so apply the simplify() function to your previous command to get a simpler form.
4. The formatting on live.sympy.org doesn't always work perfectly. Try right-clicking on the equation you just computed, and select "Show Math As: TeX Commands". If you're also doing the LaTeX project, try copying this into a LaTeX file and see how nice it looks.
5. SymPy is good at dealing with big numbers. Use it to find the factorial of 100 (you'll want to look up the appropriate command).
6. Try using the factorint command to find the prime factorization of the number $156316938322835350955382840$. Figure out what the output means.
7. Discover three more interesting things you can do with SymPy and include them, along with a brief explanation.

Use the pushpin button to make a URL with your history (you can copy it from the address bar after doing Make URL, it will be very long) and submit it.

Points 30

Submitting a text entry box or a file upload

Due	For	Available from	Until
Oct 21 at 9:30am	Everyone	-	-

Some Rubric

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings		Pts
Spreadsheets	**10 pts** **Full Marks**	**0 pts** **No Marks**	10 pts
LaTeX	**10 pts** **Full Marks**	**0 pts** **No Marks**	10 pts
GeoGebra	**10 pts** **Full Marks**	**0 pts** **No Marks**	10 pts
SymPy	**10 pts** **Full Marks**	**0 pts** **No Marks**	10 pts
			Total Points: 40