Approximation and Limits
Modules: A4, B1

1. Consider the following Fermi estimation problem.

   "If in 2014, you had downloaded all the data on the entire internet, burned the data onto CDs, and stacked the CDs on top of each other, how tall would the stack be?"

   Find upper and lower bounds for what the height of the stack might be. State any assumptions about data you use in your calculations.

$$\underbrace{\rule{3cm}{0.4pt}}_{\text{lower bound}} \leq \underbrace{???}_{\text{actual value}} \leq \underbrace{\rule{3cm}{0.4pt}}_{\text{upper bound}}$$

2. Find the following limit, fully justifying your reasoning using mathematical principles we have covered. Remember to use complete sentences as part of your response.

$$\lim_{x \to 2} \left(\frac{x - 2}{x^2 + \sin\left(\frac{1}{x-2}\right)} \right)$$

3. In three sentences or less, reflect on the similarities and differences in the the math used to solve these problems.

	Clarity and conciseness of written exposition; consideration of audience	Good movement between English & Mathematics	Mathematical Thinking
Below expectations (0)	Writing is confusing, or shows signs of carelessness through high level of error; does not demonstrate application of engineering communication; only understandable to the writer.	Math is presented without context; it is difficult to reconstruct the meaning of equations.	No demonstration of any significant level of mathematical analysis at an appropriate level. No serious attempt to apply mathematics.
Shows potential (1)	Writing requires some effort to understand, or has some errors rarely affecting understanding; some evidence of communication principles but may be awkward or simplistic; offers sufficient information and demonstrates mostly logical development of ideas; generally directed to the instructor or TA.	While the writing is clear, the math is kept completely separate from it; requires some effort to understand how the math and writing are connected.	A serious attempt is made to apply appropriate math and explain mathematical reasoning, regardless of completeness or correctness.
Meets expectations (2)	Writing shows appropriate selection and balance of text and image (if necessary); demonstrates clarity at the paragraph, sentence, and word choice levels, with minimal error; writing applies principles in ways that enhance the reading experience; generally directed towards a fellow student who understands the math but not this particular instance.	The interaction of the text with the math is adequate; any transitions between math and text are appropriately placed and make sense; any equations and variables are introduced and explained in an organized manner; any solutions are interpreted in a real-world context where appropriate; no guesswork is needed by the reader.	The response shows a good ability to analyze a situation using math; relevant topics are applied with proper notation; any solutions are critically analyzed for sensibility; any obviously incorrect solutions are remarked upon and followed up with a sketch of an alternative idea or plan.
Above expectations; bonus (3)	The writing demonstrates professional polish through word choice, sentence structure choices, clarity, concision, proofreading, etc. This solution is presentable as a textbook example or exposition.	The math is merged very well with the writing; any equations and variables are embedded, clear, and concise; any transitions between text and mathematics aid understanding; any solutions are contextualized and explained in a professional manner.	The analysis is excellent, creating a large amount of insight into the prompt and demonstrates mastery of the topic at or above the course level.