

MATH 147 Discussion

Quiz 1

January 22, 2021

Directions: Write your solutions to each question on a separate sheet of paper. Once you are finished with the quiz, take pictures of your solutions to each solution **separately**, and submit your quiz solutions on Crowdmark, separated by question (Q1, Q2, Q3). Please note that you must submit your quiz by 1:10 p.m. deadline, or I will not accept your quiz submission.

(5pts) 1. Tell me a bit about yourself. (This is the only non-math question of this quiz.)

(1pt) (a) What is your full name (first and last)?

(1pt) (b) What is your current major?

(1pt) (c) What year of study are you in? (e.g. junior, senior, graduate, etc.)

(1pt) (d) What is your favorite application of Fourier analysis?

(1pt) (e) Draw a really quick portrait sketch of French mathematician and physicist Joseph Fourier. You may use [this image](#) for reference.

(5pts) 2. Let f be the function defined on $[0, 2\pi]$ by

$$f(x) = x \sin(x).$$

Show that the n^{th} Fourier coefficient is

$$\hat{f}(n) = \begin{cases} \frac{1}{n^2-1} & \text{if } n \neq \pm 1, \\ -\frac{1}{4} + \frac{\pi}{2}i, & \text{if } n = -1, \\ -\frac{1}{4} - \frac{\pi}{2}i & \text{if } n = 1 \end{cases}$$

for all integers n .

Suggestion: Use $\sin(x) = \frac{e^{ix} - e^{-ix}}{2i}$.

(5pts) 3. Express $f(x) = x \sin(x)$ as a Fourier series in exponential form. Then convert the series into its sine-cosine form.