MATH 202, Spring 2024 **Name:** _____
In class work 25 **Row and Seat:** _____

"Finding Nirvana is like locating silence." JACK KEROUAC

In class work **25** has questions **1** through **3** with a total of **6** points. Turn in your work at the end of class *on paper*. This assignment is due at *Tuesday 30 April 13:20*.

Define a curve $\mathscr{C} = \begin{cases} x = \text{sign}(t)\sqrt{|t|}\cos(|t|) \\ y = \text{sign}(t)\sqrt{|t|}\sin(|t|) \end{cases}$ $t \in [-3\pi, 3\pi]$. The function sign is defined as $\text{sign}(x) = \begin{cases} -1 & x < 0 \\ 0 & x = 0 \\ 1 & x > 0 \end{cases}$. Wikipedia tells me that this curve has been used for an "efficient layout for the mirrors of concentrated solar power plants."

You might like to use the Taylor series for the component functions centered at $\pi/2$; they are

$$x(t) = \left(\frac{\sqrt{2}\sqrt{\pi}\left(t - \frac{\pi}{2}\right)}{2}\right) - \frac{\sqrt{2}\sqrt{\pi}\left(t - \frac{\pi}{2}\right)^2}{2\pi} + \frac{\left(\sqrt{2}\pi^2 + 3\sqrt{2}\right)\left(t - \frac{\pi}{2}\right)^3}{12\sqrt{\pi}\pi} + \cdots,$$

$$y(t) = \frac{\sqrt{2}\sqrt{\pi}}{2} + \frac{\sqrt{2}\sqrt{\pi}\left(t - \frac{\pi}{2}\right)}{2\pi} - \frac{\left(\sqrt{2}\pi^2 + \sqrt{2}\right)\left(t - \frac{\pi}{2}\right)^2}{4\sqrt{\pi}\pi} - \frac{\left(\sqrt{2}\pi^2 - \sqrt{2}\right)\left(t - \frac{\pi}{2}\right)^3}{4\sqrt{\pi}\pi^2} + \cdots.$$

2 1. Ask Desmos to draw $\mathscr{C}$. As best you can, reproduce the curve here.

2 2. Find $\left.\dfrac{\mathrm{d}y}{\mathrm{d}x}\right|_{t=\pi/2}$

2 3. Find $\left.\dfrac{\mathrm{d}^2 y}{\mathrm{d}x^2}\right|_{t=\pi/2}$