Name: _____ Mark: _____

Mini-math Div 3/4: Friday, February 8, 2023 (20 minutes)

Calculator active

1. (4 points) At time $t \geq 0$, a particle moving in the xy-plane has velocity vector given by $v(t) = \langle \sin(t^2), 2^{\sqrt{t}} \rangle$. If the particle is at point $(-3, 1)$ at time $t = 0$, how far is the particle from the origin at time $t = 3$?

2. (4 points) Where does the graph $r = 1 - \sin\theta$, $0 \leq \theta \leq 2\pi$, have a vertical tangent?

3. (4 points) Find the area of the inner loop of $r = 4\sqrt{3} - 8\cos\theta$

4. (4 points) Find the area of the region common to $r = 1 - \sin\theta$ and $r = 2\sin\theta$.