# Math 1300 Extra Credit

Due August 4, 2023 at the beginning of class

Collaboration and use of external sources are permitted, but must be fully acknowledged and cited. You will get most out of the problems if you tackle them on your own. All writing must be done individually. Each of these questions is worth 4 points (compared to a usual homework problem, which is worth 2 points).

1. A sector with arc length s and radius r is illustrated below with chord length represented as x.
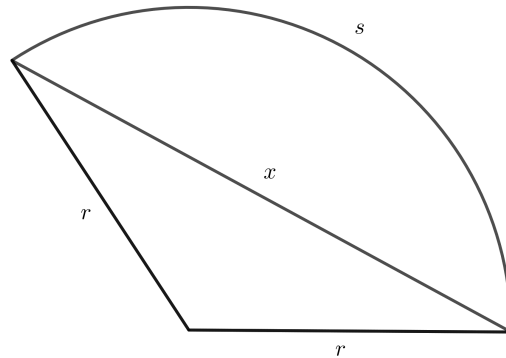
   Suppose the radius is 6 and the arc length is increasing at a rate of 2. How fast is the chord length x growing after 2π minutes, assuming $s, x = 0$ when $t = 0$? (Hint: You will need to use some facts from geometry.)

2. Find the point or points on the curve $x^2 - y^2 = 3$ for $x > 0$ that are closest to the point $(8, 0)$.

3. Recall that we can integrate $\frac{1}{1+x^2}$ with $\arctan(x)$. However, if we change the function slightly, then this no longer works. Find the antiderivative of $\frac{1}{x^2-1}$. (Hint: We know how to integrate $\frac{1}{x+1}$, $\frac{1}{x-1}$. Can you relate these functions to the given one?)