

READ ME: Merely finding the answer to a problem is not enough to receive full credit; you must show how you arrived at that answer.

1) Consider the ellipse with equation

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

where $a > b$.

a) (6 points) Find a formula for the curvature of the ellipse. *Hint:* the ellipse is not a function, you will need to find a parameterization. Use the formula

$$\kappa(t) = \frac{\|f'(t) \times f''(t)\|}{\|f'(t)\|^3}$$

once you have cleverly parameterized the curve in 3 dimensions.

b) (3 points) For a given point on the ellipse, how many other points are there with the same curvature? Use the formula you obtained in a) to justify your answer.

2) (3 points) Compute

$$\lim_{(x,y) \rightarrow (1,-1)} \arctan\left(\frac{1}{xy - x + y - 1}\right) \sin(xy + 1).$$

3) (5 points) Show that

$$\lim_{(x,y) \rightarrow (3,4)} \frac{(x-3)^2(y-4)^3}{(x-3)^3 + (y-4)^9}$$

does not exist