

1. **(8 points)**  $3x^2 + 2xy + 6y^2 - 5x + 2y = 20$  is the equation of an ellipse.

(a) **(6 points)** On this curve, find  $\frac{dy}{dx}$  as an expression in  $x$  and  $y$ .

(b) **(2 points)** Identify conditions on  $x$  and  $y$  under which the tangent lines to this curve are horizontal and vertical (label which is which!).

2. **(16 points)** Find the following derivatives:

(a) **(4 points)**  $f'(\theta)$  when  $f(\theta) = \cos \ln \theta$ .

(b) **(4 points)**  $\frac{d}{dt} \frac{\tan t}{e^t - \arcsin t}$ .

(c) (4 points)  $\frac{d}{dx} \sqrt[3]{1 + \sec x}$ .

(d) (4 points)  $\frac{d^2}{dw^2} \arctan 2w$  (note that this is a second derivative).

3. (2 point bonus) Calculate  $\frac{d^{11}}{dx^{11}} (x^2 e^x)$ .