February 16, 2021 **MAC 2311**
Quiz 5 - Keeran & York

Remember to show all of your work.

Problem 1. Find the derivative of each of the following functions (no need to simplify your answer)

- $f(x) = \dfrac{x^4 + 3x^2 - x + 16}{3e^x}$

Sample Solution Here, we'll use the quotient rule.

$$f'(x) = \frac{3e^x * \frac{d}{dx}(x^4 + 3x^2 - x + 16) - \frac{d}{dx}(3e^x) * (x^4 + 3x^2 - x + 16)}{(3e^x)^2}$$

$$f'(x) = \frac{(3e^x)(4x^3 + 6x - 1) - (3e^x)(x^4 + 3x^2 - x + 16)}{9e^{2x}}$$

- $f(x) = \cos(x)\cot(x)$

Sample Solution Here, we'll use the product rule.

$$f'(x) = \frac{d}{dx}(\cos(x)) * \cot(x) + \cos(x) * \frac{d}{dx}(\cot(x))$$

$$f'(x) = -\sin(x)\cot(x) - \cos(x)\csc^2(x)$$

Problem 2. Find the equation of the tangent line of the function $f = 2\sqrt{x}$ at $x = 9$

There's two steps here: find the point, and find the slope.
We already have the x value for the point, so we just need to find the y value:

$$f(9) = 2\sqrt{9} = 2 * 3 = 6$$

Therefore, the point is $(9, 6)$.

Now we have to find the slope of the tangent line: this comes from finding the derivative and plugging in the x value.

$$\begin{aligned} f(x) &= 2x^{1/2} \\ f'(x) &= 2 * (1/2)x^{-1/2} \\ f'(x) &= \frac{1}{\sqrt{x}} \\ f'(9) &= \frac{1}{\sqrt{9}} = \frac{1}{3} \end{aligned}$$

so the slope is $m = \frac{1}{3}$. Thus,

$$y - 6 = \tfrac{1}{3}(x - 9)$$
$$y = \tfrac{1}{3}x + 3$$