1. Consider the function $f(x) = \dfrac{x+3}{x-4}$. *(4 points each)*

(a) Describe the intervals where f in increasing, where f is decreasing, and list the local extrema.

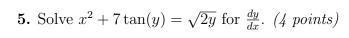(b) Describe the intervals where f is concave up and those where f is concave down.

(c) Graph the function of f. Label all asymptotes and extrema.

2. Compute the derivatives for the following functions: *(4 points each)*

(a) $f(x) = \dfrac{2e^x - 1}{2\cos(x) + 1}$

(b) $f(x) = \arcsin(\ln(3x))$

3. Without finding the inverse, evaluate the derivative of the inverse of the function $f(x) = 3e^{7x}$ at the point $(3, 0)$. *(4 points)*

4. Which of the following are required to be true of a function f for the Mean Value Theorem to hold on an interval $[a, b]$: (fill in all that apply) *(2 points)*

○ f in continuous on (a, b) ○ f is differentiable on $[a, b]$
○ f has an inverse on (a, b) ○ $f(a) = f(b)$

For the function and interval
$$f(x) = x^2 + 2x + 4; \ [0, 2]$$
find the points guaranteed to exist by the Mean Value Theorem *(4 points)*

5. Solve $x^2 + 7\tan(y) = \sqrt{2y}$ for $\frac{dy}{dx}$. *(4 points)*

6. The sides of a cube decreases in length at a rate of 3 meters per second. At what rate is the volume of the cube changing when the sides are 2 meters long? *(4 points)*