name: _____

1. Consider the function $f(x) = \dfrac{x-7}{x+5}$. *(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.
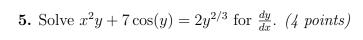
(c) Graph the function of f. Label all asymptotes and extrema.

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

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

(b) $f(x) = \arcsin(\ln(x^2))$

3. Without finding the inverse, evaluate the derivative of the inverse of the function $f(x) = 2e^{3x}$ at the point $(2, 0)$. *(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
$$f(x) = x^2 + 3x + 5; \ [2, 4]$$
find the points guaranteed to exist by the Mean Value Theorem *(4 points)*

5. Solve $x^2 y + 7\cos(y) = 2y^{2/3}$ for $\frac{dy}{dx}$. *(4 points)*

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