score	possible	problem
	20	1
	30	2
	30	3
	10	4
	10	5
	100	

Name: _____
Name: _____
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Work in groups of 3 or 4. Show your work. Aknowledge any help on these specific problems.

/10 1. (a) Prove that $\frac{d}{dx}\left(\cot^{-1}(x)\right) = -\frac{1}{1+x^2}$.

/10 (b) State L'Hôpital's Rule. Identify what are its assumptions (hypotheses) and what are its conclusions.

2. Compute the following limits:

/10 (a) $\lim_{t\to 0} \dfrac{e^{2t}-1}{\sin(t)} =$

/10 (b) $\lim_{x\to\infty} x^3 e^{-x^2} =$

/10 (c) $\lim_{x\to 0^+} x^{\sqrt{x}} =$

3. Compute the following derivatives:

/10 (a) $\dfrac{d}{dx}\sqrt{\arctan(3x)} =$

/10 (b) $\dfrac{d}{dx}\cos(\cosh(\cos^{-1}(x))) =$

/10 (c) $\dfrac{d}{dx}\dfrac{\cot^{-1}(1+x^2)}{\operatorname{sech}(5x)} =$

/10 4. If an electrostatic field E acts on a liquid polar dielectric, the net dipole moment P per unit volume is

$$P(E) = \frac{\cosh(E)}{\sinh(E)} - \frac{1}{E}\,.$$

Show that $\lim_{E \to 0^+} P(E) = 0$.

/10 5. Show that $\cosh^2(x) - \sinh^2(x) = 1$.