

Please show all work and box your final answers. If you need more room, you may use the backs of the pages. Calculators are not allowed. Good luck!

1. (a) (4 points) Show that if  $y = \sin^{-1}(x)$  then  $y' = \frac{1}{\sqrt{1-x^2}}$ .

(b) (4 points) Show that if  $y = \sinh^{-1}(x)$  then  $y' = \frac{1}{\sqrt{1+x^2}}$ .

2. (4 points) Find  $\frac{dy}{dx}$  when  $y = \arctan\left(\frac{x}{a}\right) + \ln\sqrt{\frac{x-a}{x+a}}$ .

3. (4 points) Show that the following identity is true for all real numbers  $n$ .

$$(\cosh(x) + \sinh(x))^n = \cosh(nx) + \sinh(nx)$$

*Hint: use the definition of cosh and sinh to show that both the left and right hand side simplify to the same (simple) expression.*

4. Evaluate the limit. If the limit is of indeterminate form, be sure to indicate which type it is.

(a) (4 points)  $\lim_{x \rightarrow \infty} \frac{x}{\ln(1 + 2^x)}$

(b) (4 points)  $\lim_{x \rightarrow 0} (1 - x)^{1/x}$