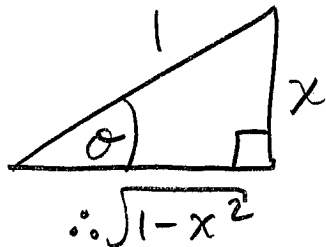


(1) [5] Simplify  $\tan(\sin^{-1} x)$ . (Your final simplified answer should not contain any trigonometric or inverse trigonometric functions.)

$$\text{Let } \theta = \sin^{-1} x \Rightarrow \sin \theta = \frac{x}{1}$$



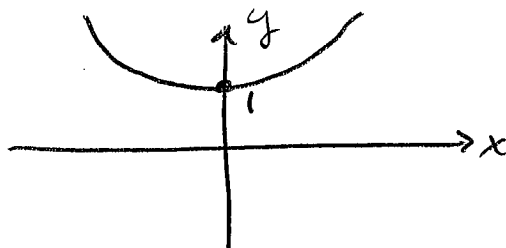
$$\therefore \tan(\sin^{-1} x) = \tan \theta = \boxed{\frac{x}{\sqrt{1-x^2}}}$$

(2) [5] Determine the derivative:  $f(x) = x \ln(\arctan(x))$ .

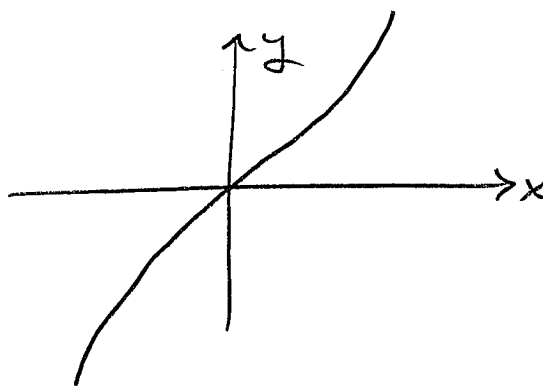
$$f'(x) = \boxed{1 \cdot \ln(\arctan(x)) + \frac{x}{\arctan(x)} \cdot \frac{1}{1+x^2}}$$

(3) [5] Determine  $\lim_{x \rightarrow 0^-} \coth(x)$ . (Recall that  $\coth(x) = 1/\tanh(x)$ .)

$$y = \cosh(x) :$$



$$y = \sinh(x) :$$



$$\lim_{x \rightarrow 0^-} \coth(x) = \lim_{x \rightarrow 0^-} \frac{\cosh(x)}{\sinh(x)} \left\{ \begin{array}{l} \rightarrow 1 \\ \rightarrow 0^- \end{array} \right.$$

$$= \boxed{-\infty} .$$