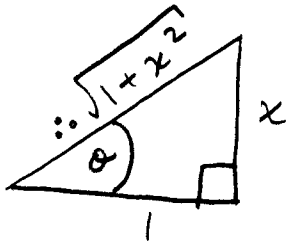
(1)[5 points] Simplify

$$\sin\left(\tan^{-1}(x)\right)$$

Your answer should not contain any trigonometric functions.

Let $\theta = \tan^{-1}(x)$,

$\therefore \tan\theta = \frac{x}{1}$

$\therefore$ 

$\therefore \sin(\tan^{-1}(x))$

$= \sin(\theta)$

$= \frac{x}{\sqrt{1+x^2}}$

(2)[5 points] Find the derivative of

$$y = \tan^{-1}\sqrt{x}$$

$y' = \frac{1}{1+(\sqrt{x})^2} \cdot \frac{d}{dx}(\sqrt{x})$

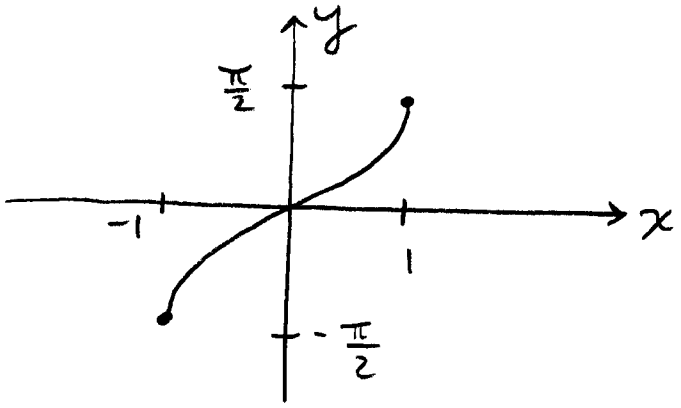
$= \frac{1}{1+x} \cdot \frac{1}{2} x^{-\frac{1}{2}}$

$= \frac{1}{2\sqrt{x}(1+x)}.$

(3)[5 points] Find

$$\lim_{x \to -1^+} \sin^{-1} x$$

Graph of $y = \sin^{-1} x$ is



$$\therefore \lim_{x \to -1^+} \sin^{-1}(x) = -\frac{\pi}{2}$$