

Directions: Show all work on a separate sheet of paper for full credit.

1. Differentiate the function

(a)  $g(x) = (\tan^{-1}(x))^2$

$$\frac{2 \tan^{-1} x}{1 + x^2}$$

(b)  $h(x) = \cos^{-1}(\sin^{-1}(x))$

$$-\frac{1}{\sqrt{1 - (\sin^{-1} t)^2}} \cdot \frac{1}{\sqrt{1 - t^2}}$$

(c)  $f(x) = \sin^{-1}(1/x)$

$$\frac{1}{\sqrt{1 - (1/x)^2}} \cdot \frac{-1}{x^2}$$

2. Evaluate the integral.

(a)  $\int_0^{1/2} \frac{\sin^{-1}(x)}{\sqrt{1 - x^2}} dx$

$$\frac{\pi^2}{72}$$

(b)  $\int \frac{e^{2x}}{\sqrt{1 - e^{4x}}} dx$

Let  $u = e^{2x}$  Answer:  $\frac{1}{2} \sin^{-1}(e^{2x}) + C$

(c)  $\int_0^{\pi/2} \frac{\sin(x)}{1 + \cos^2(x)} dx$

Let  $u = \cos(x)$ . Answer:  $\pi/4$

3. Find the exact value of the expression.

(a)  $\tan(\sin^{-1}(2/3))$

$$\frac{2}{\sqrt{5}}$$

(b)  $\csc(\arccos(3/5))$

$$\frac{5}{4}$$

4. Simplify  $\tan(\sin^{-1}(x))$

$$\frac{x}{\sqrt{1 - x^2}}$$