

1. 10 pts. Find a formula for the inverse of the function

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

2. 10 pts. Find $(f^{-1})'(2)$ for the function $f(x) = x^3 + 3 \sin x + 2 \cos x$.

3. 10 pts. each Differentiate the function.

(a) $f(x) = \ln(\sin^2 x)$

(b) $g(x) = e^{x^2-x}$

(c) $h(t) = 3^{\cos 5t}$

(d) $u(x) = \log_2(4 - 6x)$

(e) $F(x) = x^{x/9}$

(f) $y = (\ln x)^{\cos x}$

(g) $y = \sin^{-1}(2/x + 1)$

(h) $f(x) = \tanh \sqrt{x}$

4. 15 pts. Find an equation of the tangent line to $y = \ln(x^3 - 7)$ at the point $(2, 0)$.

5. 10 pts. each Evaluate each integral.

(a) $\int_1^2 \frac{1}{8 - 3t} dt$

(b) $\int \frac{(1 + e^x)^2}{e^x} dx$

(c) $\int \frac{\log_{10} x}{x} dx$

(d) $\int 3^{\sin \theta} \cos \theta d\theta$

(e) $\int_0^{\sqrt{3}/4} \frac{dx}{1 + 16x^2}$

(f) $\int \frac{\cosh x}{\cosh^2 x - 1} dx$

6. 15 pts. Find y' if $x^y = y^x$.

7. 10 pts. each Evaluate the limit using L'Hôpital's Rule.

(a) $\lim_{x \rightarrow 0} \frac{\sin^{-1} x}{x}$

(b) $\lim_{x \rightarrow 0} \sin 3x \csc 8x$

(c) $\lim_{x \rightarrow 0^+} (9x + 1)^{\cot x}$

FORMULAS & DEFINITIONS

- $(\sin^{-1} x)' = \frac{1}{\sqrt{1-x^2}}$
- $(\tan^{-1} x)' = \frac{1}{1+x^2}$
- $(\sec^{-1} x)' = \frac{1}{|x|\sqrt{x^2-1}}$
- $\int \frac{1}{\sqrt{a^2-x^2}} dx = \sin^{-1}\left(\frac{x}{a}\right) + c$
- $\int \frac{1}{a^2+x^2} dx = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right) + c$
- $\int \frac{1}{x\sqrt{x^2-a^2}} dx = \frac{1}{a} \sec^{-1}\left|\frac{x}{a}\right| + c$
- $\int \sin^n x dx = -\frac{\sin^{n-1} x \cos x}{n} + \frac{n-1}{n} \int \sin^{n-2} x dx$
- $\int \cos^n x dx = \frac{\cos^{n-1} x \sin x}{n} + \frac{n-1}{n} \int \cos^{n-2} x dx$
- $\int \tan^n x dx = \frac{\tan^{n-1} x}{n-1} - \int \tan^{n-2} x dx$
- $\int \sec^n x dx = \frac{\sec^{n-2} x \tan x}{n-1} + \frac{n-2}{n-1} \int \sec^{n-2} x dx$
- $\int \tan x dx = \ln |\sec x| + c$
- $\int \cot x dx = \ln |\sin x| + c$
- $\int \sec x dx = \ln |\sec x + \tan x| + c$
- $\int \csc x dx = -\ln |\csc x + \cot x| + c$