

1. 10 pts. Find the derivative of the inverse of the function $f(x) = x^2 - 2x - 3$, $x \leq 1$, at the point $(12, -3)$ on the graph of f^{-1} . Do not find f^{-1} .

2. 10 pts. each Find the derivative.

(a) $\frac{d}{dx}(\ln |\sin x|)$

(b) $\frac{d}{dx}(\cot e^x)$

(c) $\frac{d}{dx}(3^{x^2-x})$

(d) $\frac{d}{dx}(1+x^2)^{\sin x}$

(e) $\frac{d}{dx}(\log_8 |\tan x|)$

(f) $\frac{d}{dx}(\sin^{-1}(\ln x))$

(g) $\frac{d}{dt}(\csc^{-1}(\tan e^t))$

(h) $\frac{d}{dz}(\sqrt{\operatorname{sech} 8z})$

3. 15 pts. Find an equation of the tangent line to $y = 2^{\sin x}$ at $x = \pi$.

4. 10 pts. each Evaluate each integral.

(a) $\int_{-2}^3 \frac{12}{18-5t} dt$

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

(c) $\int \frac{(\ln \ln y)^4}{y \ln y} dy$

(d) $\int_{-1}^1 10^x dx$

(e) $\int \frac{3}{64x^2+100} dx$

(f) $\int \operatorname{sech}^2 w \tanh w dw$

5. 10 pts. Find the length of the curve $y = \ln(x - \sqrt{x^2 - 1})$, for $1 \leq x \leq \sqrt{2}$.

6. 10 pts. each Evaluate the limit, using L'Hôpital's Rule when applicable.

(a) $\lim_{x \rightarrow \infty} \left(3 + \frac{2}{x}\right)^{\ln x}$

(b) $\lim_{x \rightarrow 1^-} \tan\left(\frac{\pi x}{2}\right) \ln x$

(c) $\lim_{x \rightarrow 0} (1 + a^x)^{b/x}$, for $a, b > 0$

FORMULAS & DEFINITIONS

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