

1. 10 pts. Given $f(x) = x^5 + 2x^3 + 8x - 12$, so that $f(-2) = -76$, find the value of $(f^{-1})'(-76)$ if it exists.
2. 10 pts. Find all the inverses associated with

$$f(x) = \frac{2}{x^2 + 2},$$

and state their domains.

3. 10 pts. each Find the derivative of each function.

(a) $f(x) = \ln(e^{-7x} + 1)$

(b) $g(x) = x^{\ln(x^5)}$

(c) $h(x) = (\sin x)^{\tan x}$

(d) $k(x) = 7 \log_3(4 - x^5)$

(e) $\ell(x) = \sec^{-1}(e^{-2x})$

(f) $p(x) = \cos^{-1}(\sqrt{x})$

4. 10 pts. each Determine each indefinite integral.

(a) $\int (3e^{-8x} - 8e^{11x}) dx$

(b) $\int \frac{9}{4 - 9y} dy$

(c) $\int x^3 10^{x^4} dx$

5. 10 pts. each Evaluate each definite integral.

(a) $\int_1^{3e} \frac{e^{\ln(x)}}{2x} dx$

(b) $\int_2^{2\sqrt{3}} \frac{5}{z^2 + 4} dz$

6. 10 pts. Evaluate the limit using L'Hôpital's Rule:

$$\lim_{x \rightarrow \infty} \left(\frac{2}{x} \right)^{5/x}$$

FORMULAS & DEFINITIONS

1. $\theta = \tan^{-1} x \Leftrightarrow x = \tan \theta$, for $\theta \in (-\pi/2, \pi/2)$
2. $\theta = \cot^{-1} x \Leftrightarrow x = \cot \theta$, for $\theta \in (0, \pi)$
3. $\theta = \sec^{-1} x \Leftrightarrow x = \sec \theta$, for $\theta \in [0, \pi/2) \cup (\pi/2, \pi]$
4. $\theta = \csc^{-1} x \Leftrightarrow x = \csc \theta$, for $\theta \in [-\pi/2, 0) \cup (0, \pi/2]$
5. $(b^x)' = b^x \ln b$, for $b \in (0, 1) \cup (1, \infty)$
6. $(\log_b |x|)' = \frac{1}{x \ln b}$, for $x \neq 0$
7. $(\sin^{-1} x)' = \frac{1}{\sqrt{1-x^2}}$, for $x \in (-1, 1)$
8. $(\tan^{-1} x)' = \frac{1}{1+x^2}$, for $x \in (-\infty, \infty)$
9. $(\sec^{-1} x)' = \frac{1}{|x|\sqrt{x^2-1}}$, for $x \in (-\infty, -1) \cup (1, \infty)$
10. $\int b^x dx = \frac{1}{\ln b} b^x + c$, for $b \in (0, 1) \cup (1, \infty)$
11. $\int \frac{1}{\sqrt{a^2-x^2}} dx = \sin^{-1} \left(\frac{x}{a} \right) + c$, for $a \in (0, \infty)$
12. $\int \frac{1}{a^2+x^2} dx = \frac{1}{a} \tan^{-1} \left(\frac{x}{a} \right) + c$, for $a \neq 0$
13. $\int \frac{1}{x\sqrt{x^2-a^2}} dx = \frac{1}{a} \sec^{-1} \left| \frac{x}{a} \right| + c$, for $a \in (0, \infty)$
14. $\int \sin^n x dx = -\frac{\sin^{n-1} x \cos x}{n} + \frac{n-1}{n} \int \sin^{n-2} x dx$
15. $\int \cos^n x dx = \frac{\cos^{n-1} x \sin x}{n} + \frac{n-1}{n} \int \cos^{n-2} x dx$
16. $\int \tan^n x dx = \frac{\tan^{n-1} x}{n-1} - \int \tan^{n-2} x dx$, $n \neq 1$
17. $\int \sec^n x dx = \frac{\sec^{n-2} x \tan x}{n-1} + \frac{n-2}{n-1} \int \sec^{n-2} x dx$, $n \neq 1$
18. $\int \tan x dx = -\ln |\cos x| + c = \ln |\sec x| + c$
19. $\int \cot x dx = \ln |\sin x| + c$
20. $\int \sec x dx = \ln |\sec x + \tan x| + c$
21. $\int \csc x dx = -\ln |\csc x + \cot x| + c$