

1. Find the value

(a) $e^{3 \ln 2}$ (b) $\ln e^{-0.3}$ (c) $\log_{10} \left(\frac{1}{100} \right)$ (d) $\log_{100} \left(\frac{1}{10} \right)$
 (e) $\sin^{-1} \left(\sin \left(-\frac{\pi}{5} \right) \right)$ (f) $\cos^{-1} \left(\cos \left(-\frac{\pi}{5} \right) \right)$ (g) $\sin (\sin^{-1}(-.6))$ (h) $\cos (\sin^{-1}(-.6))$

2. Find $\frac{dy}{dx}$

(a) $y = e^{3x^2-7}$ (b) $y = \ln(7x^3 + 2)$ (c) $y = \tan^{-1}(2x + 5)$ (d) $y = \pi^x + x^\pi$
 (e) $y = \log_2 x$ (f) $y = \frac{(x^2 + 7)^3 e^{7x}}{x^{4/3}(3x + 1)}$ (g) $y = (x^2 + 1)^{2x+7}$ (h) $y = x \sin^{-1}(e^{2x})$

3. Evaluate

(a) $\int x e^{3x^2} dx$ (b) $\int \frac{x^2}{2 - 7x^3} dx$ (c) $\int_5^8 \frac{dx}{3 - x}$ (d) $\int \frac{1}{4 + x^2} dx$
 (e) $\int_e^{e^4} \frac{1}{x \sqrt{\ln x}} dx$ (f) $\int \frac{\ln x}{x} dx$ (g) $\int 2^x dx$ (h) $\int \frac{x}{\sqrt{4 - x^2}} dx$
 (i) $\int \frac{x^3}{\sqrt{4 - x^2}} dx$ (j) $\int \sin^2 x \cos^2 x dx$ (k) $\int x \tan^{-1} x dx$ (l) $\int x^2 \sinh x dx$
 (m) $\int \sin 4x \sin 5x dx$ (n) $\int (\ln x)^2 dx$ (o) $\int \frac{x^3}{9 + x^2} dx$

4. Determine whether the function $f(x)$ is one-to-one. If it is, give a formula for $f^{-1}(x)$. If it isn't, find specific values $x_1 \neq x_2$ for which $f(x_1) = f(x_2)$.

(a) $f(x) = \frac{x + 2}{x - 2}$ (b) $f(x) = x^4 - 7$ (c) $f(x) = \frac{e^x + 2}{e^x}$

5. For what values of x is $f(x)$ increasing?

(a) $f(x) = x e^{3x-1}$ (b) $f(x) = x \ln x$

6. Let $f(x) = e^{6x} + e^x - 1$. Show that $f(x)$ is one-to-one. Let $g(x)$ be the inverse function of $f(x)$. Determine $g'(1)$.

7. Bacteria in a culture grow at a rate proportional to its size. The count in the culture was 400 after 2 hours and 25,600 after 6 hours.

(a) What was the initial population of the culture?

- (b) Find an expression for the population after t hours.
(c) How long does it take for the population to double?

8. Find the local extrema of $f(x) = \sinh x - (x - 1) \cosh x$.

9. Evaluate the following limits:

- (a) $\lim_{x \rightarrow 0} \frac{e^x - 1 - x}{x^2}$ (b) $\lim_{x \rightarrow 2^-} \frac{\ln x}{\sqrt{2 - x}}$ (c) $\lim_{x \rightarrow -\infty} \tanh 3x$
(d) $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^3}$ (e) $\lim_{x \rightarrow 1} (x - 1) \tan\left(\frac{\pi x}{2}\right)$ (f) $\lim_{x \rightarrow 0} (\csc x - \cot x)$
(g) $\lim_{x \rightarrow \infty} \frac{\ln(1 + e^x)}{5x}$ (h) $\lim_{x \rightarrow \infty} \left(\frac{x}{x + 1}\right)^x$ (i) $\lim_{x \rightarrow \infty} (x^3 + x)^{\frac{1}{x}}$

10. Problem 65, page 412.

11. Problem 21, page 404.