

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) $\cos (\sin^{-1}(-.6))$
 (i) $\sinh(\ln 2)$ (j) $5^{1/\ln 5}$

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) $\int \frac{x^2 dx}{1 + x^6}$
 (i) $\int \frac{\ln(\ln x)}{x \ln x} dx$ (j) $\int \tanh x dx$ (k) $\int \frac{e^{3/x}}{x^2} dx$

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. A salt in solution decomposes into another substance at a rate proportional to the amount still present. If 10 kg of salt reduces to 5 kg in $\frac{1}{2}$ hour, how much is left after 6 hours?

10. Find the limits:

(a) $\lim_{x \rightarrow 0} (1 + 2x)^{-1/x}$

(b) $\lim_{x \rightarrow -\infty} \tanh x$

11. Problem 65, page 412.

12. Problem 21, page 404.