

1. Show that the function is one-to-one and find the inverse.

(a) $f(x) = \frac{1 + 3x}{5 - 2x}$

(b) $g(x) = \sqrt{2 + 5x}$

2. Find $g'(a)$, where g is the inverse function of the given function.

(a) $f(x) = x + x^2 + e^x$ at $a = 1$.

(b) $f(x) = 3 + x^2 + \tan\left(\frac{\pi x}{2}\right)$, $-1 < x < 1$ at $a = 3$.

3. Evaluate the following.

(a) $\log_3 3^{\sqrt{5}} + \log .0001 + \ln e^4$

(b) $2^{\log_2 3 + \log_2 5}$

4. Express the given quantity as a single logarithm.

(a) $\log_2 x + 5 \log_2(x + 1) + \frac{1}{2} \log_2(x - 1)$

(b) $\frac{1}{3} \ln x - 4 \ln(2x + 3)$

5. Find the domain of the function $f(x) = \sqrt{x} \ln(x^2 - 1)$.

6. Find the limit.

(a) $\lim_{x \rightarrow -2^+} \log_2 \left(\frac{x - 3}{x + 2} \right)$

(b) $\lim_{x \rightarrow \infty} \ln \frac{4}{x + 2}$

(c) $\lim_{x \rightarrow \infty} [\ln(x + 2) - \ln(1 + x)]$

7. Solve the equation for x .

(a) $2^{x-5} = 8$

(b) $3^{3x-4} = 2$

(c) $\log_2 x = 3$

(d) $\ln(x + 6) + \ln(x - 3) = \ln 5 + \ln 2$

(e) $2^{3^x} = 5$

8. Find the inverse function.

(a) $y = \ln(x + 3)$

(b) $y = 2^{10^x}$

(c) $y = \frac{1 + e^x}{1 - e^x}$

9. Find the derivative.

(a) $f(x) = \log(x^2 - x)$

(b) $f(x) = 3^{\sin x}$

- (c) $f(x) = x\sqrt{\ln x}$
- (d) $f(x) = \ln(\ln(3x + 1))$
- (e) $f(x) = \ln \left| \frac{x^2 - 4}{2x + 5} \right|$
- (f) $f(x) = (\cos x)^{\sin x}$
- (g) $f(x) = \frac{\sqrt{x+1} (2-x^4)^5}{(x+3)^7 (x^3-2x+1)^{10}}$

10. A bacteria culture starts with 1000 bacteria and the growth rate is proportional to the number of bacteria. After 2 h the population is 9000.
- (a) Find an expression for the number of bacteria after t hours.
 - (b) Find the number of bacteria after 3 h.
 - (c) In what period of time does the number of bacteria double?
11. An isotope of strontium, Sr^{90} , has a half-life of 25 years.
- (a) Find the mass of Sr^{90} that remains from a sample of 18 mg after t years.
 - (b) How long will it take for the mass to decay to 2 mg?
12. A cup of coffee has a temperature of 200°F and is in a room that has a temperature of 70°F . After 10 min the temperature of the coffee is 150°F .
- (a) What is the temperature of the coffee after 15 min?
 - (b) When will the coffee have cooled to 100°F ?