

1. Differentiate the following functions.

(a)  $f(x) = e^{\sin(x)}$

(b)  $y = 4^{\cos(x)}$

2. Determine the inverse function  $g^{-1}(x)$  for  $g(x) = 3x + 7$ .

3. Determine the inverse function  $f^{-1}(x)$  for  $f(x) = x^3 - 2$ .

Problems.

1. For the function  $g(x) = 3x + 7$ , determine  $g'(g^{-1}(13))$  and  $(g^{-1})'(13)$ .

2. For the function  $f(x) = x^3 - 2$ , determine  $f'(f^{-1}(62))$  and  $(f^{-1})'(62)$ .

3. Based on the previous two problems, what is the relationship between  $f'(f^{-1}(x))$  and  $(f^{-1})'(x)$ ? Use the chain rule to verify that your theory is correct.

4. Use the chart below to answer the following questions.

$x$	$f(x)$	$f'(x)$
4	11	$\pi$
11	17	$e$
9	4	20

(a)  $(f^{-1})'(4)$

(b)  $\left. \frac{df^{-1}}{dx} \right|_{x=11}$

(c)  $(f^{-1})'(9)$

5. Use implicit differentiation and the differentiation rule for exponential functions to determine  $\frac{d}{dx}(\ln(x))$ .

6. Use implicit differentiation and the differentiation rule for exponential functions to determine  $\frac{d}{dx}(\log_a(x))$ .

Review. Solve the equation  $\ln(x + 3) + \ln(x + 5) - 2\ln(x) = \ln(4)$ .

1. Differentiate the following functions.

(a)  $y = \log_3(x)$

(b)  $f(x) = x + \ln(x)$

(c)  $y = x^3(\ln(x))^2$

(d)  $g(x) = \ln(\sin(x))$

(e)  $g(x) = \ln|x|$

(f)  $y = \ln\left(\left(\frac{x}{x+7}\right)^5\right)$

2. Use *logarithmic differentiation* to differentiate the following functions.

(a)  $y = x^{\cos(x)}$

(b)  $y = (2x + 1)^{x+3}$

(c)  $y = (x^2 + x)^{\sqrt{x}}$

(d)  $y = \frac{x^3 \sqrt[3]{x+5}}{(4x+1)(x-5)}$