

Math 111-002
Assignment # 3

1. Determine whether each function is one-to-one:

(a) $f(x) = 10 - 3x$;

(b) $f(x) = |x|$;

(c) $f(x) = 4 + \cos x$, $0 \leq x \leq \pi$.

2. If $f(x) = x + \cos x$, find $f^{-1}(1)$ and $(f^{-1})'(1)$.

3. Find the inverse function of $f(x) = \frac{4x-1}{2x+5}$. Calculate the derivative of f^{-1} explicitly. Use the Inverse Function Theorem to calculate $(f^{-1})'(-1/5)$ and compare its value with the one from the derivative you found.

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

(a) $f(x) = x^3 + 3 \sin x + 2 \cos x$, $a = 2$.

(b) $f(x) = \sqrt{x^3 + x^2 + x + 1}$, $a = 2$.

5. Suppose h^{-1} is the inverse function of a differentiable function h . If $h(2) = 3$, and $h'(2) = -5$, find $(h^{-1})'(3)$.

6. Differentiate the function:

(a) $H(t) = \ln \sqrt{\frac{3t^2 + 2}{t - 1}}$

(b) $f(t) = \sin(\ln t)$

(c) $h(z) = \frac{1 + \ln z}{1 - \ln z}$

(d) $f(x) = \frac{(x^5 + 3x)^4 \cos^2 x}{x^{1/5}}$

(e) $f(x) = \sqrt[4]{\frac{x^3 + 1}{x^3 - 1}}$

7. Evaluate the integral:

(a) $\int_e^{e^2} \frac{2}{x} dx$

(b) $\int_e^6 \frac{dx}{x \ln x}$

(c) $\int \frac{x^2 + 1}{x^3 + 3x + 1} dx$

(d) $\int \frac{\cos x}{1 + \sin x} dx$