

First Homework of Mathematics II

Deadline 01/06/2018

1. Given $f(x) = \frac{x-1}{3x+5}$, determine $f\left(\frac{1}{x}\right)$.
2. Given $f(x) = \ln x$ and $g(x) = x^3$, determine $(f \circ g)(2)$, $(f \circ g)(a)$ and $(g \circ f)(a)$.
3. Find the domain of the following functions
 - a). $f(x) = \sqrt{3+x} + \sqrt[4]{7-x}$
 - b). $y = \ln(x^2 - 3x + 2) + \sqrt{-x^2 + 4x + 5}$
4. If $f(x) = \frac{x-1}{x+1}$, show that $f\left(\frac{1}{x}\right) = -f(x)$ and $f\left(-\frac{1}{x}\right) = -\frac{1}{f(x)}$
5. If $f = \frac{1}{x}$, show that $f(a) - f(b) = f\left(\frac{ab}{b-a}\right)$
6. Prove that
 - a). $\cosh^{-1} x = \ln\left(x + \sqrt{x^2 - 1}\right)$, $x \geq 1$
 - b). $\tanh^{-1} x = \frac{1}{2} \ln\left(\frac{1+x}{1-x}\right)$, $(-1 < x < 1)$
7. Prove that
 - a). $\sin(\cos^{-1} x) = \sqrt{1-x^2}$
 - b). $\cos(\sin^{-1} x) = \sqrt{1-x^2}$
 - c). $\tan(\sin^{-1} x) = \frac{x}{\sqrt{1-x^2}}$
 - d). $\sin(\tan^{-1} x) = \frac{x}{\sqrt{1+x^2}}$
8. Determine if the following function is continuous at $x = 0$.

$$f(x) = \begin{cases} \frac{x-6}{x-3}, & x < 0 \\ 2, & x = 0 \\ \sqrt{4+x^2}, & x > 0 \end{cases}$$



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