

Name: _____

Student Number: _____

1. For each pair of $f(x)$ and $g(x)$ listed below, calculate the composition $f \circ g(x)$ and do simplification if possible.

a) $f(x) = 4x + 2, g(x) = 3x^2 + 2x + 1$

b) $f(x) = x^2 + 1, g(x) = \cos(2x + 1)$

c) $f(x) = \ln x, g(x) = 2^x$

2. For the following $f(x)$, find the inverse function $f^{-1}(x)$. If there's no inverse, brief the reason. (For extra credit, find an interval in which $f^{-1}(x)$ exists).

a) $f(x) = \sin x$

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

c) $f(x) = \sqrt{x^2 - 3}$

3. Calculate the value of following limits. Please notice some of them are one-sided.

a) $\lim_{x \rightarrow 2} (x^3 + 5x - 6)$

b) $\lim_{x \rightarrow 3} \sqrt{x^2 + 7}$

c) $\lim_{x \rightarrow \infty} \frac{3x - 5}{x}$

d) $\lim_{x \rightarrow \infty} \frac{\sqrt{x^2 + 5x} - x}{x - 1}$

e) $\lim_{x \rightarrow +2} \frac{x^2 + 4}{x - 2}$ (One sided)

4. Find a value of c that makes $f(x)$ continuous on $(-\infty, \infty)$.

$$f(x) = \begin{cases} cx^2 + 4x & : x < 3 \\ x^3 - 5c & : x \geq 3 \end{cases}$$