School of Mathematics and Physics, UQ

MATH1071 Advanced Calculus & Linear Algebra I
Semester 1 2025
Problem Set 3

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Tutorial Group #8
Due 5pm Monday 14 March 2025

Question 1: 5 marks

Use limit laws, determine the limit

$$\lim_{x\to 0} \frac{\sin x + 3x^2}{x - 8x^4 + 2\sin x}$$

Solution:

Question 2: 15 marks

Use the definition of limits, prove the following statement:
Suppose that $f(x), g(x)$ are functions with $\lim_{x\to a} f(x) = b$ and $\lim_{u\to b} g(u) = L$. Suppose $f(x) \neq b$ for all x. Show that if $h = g \circ f$, i.e. if $h(x) = g(f(x))$, then $\lim_{x\to a} h(x) = L$.

Solution:

Question 3: 10 marks

Prove the following statement: Suppose $f(x)$, $g(x)$ are two functions continuous at $x = a$. Suppose $h(x)$ is a new function with $h(x) = f(x)g(x)$. Prove that $h(x)$ is also continuous at $x = a$.

Solution:

Question 4: 10 marks

Let $f(x) = \frac{1}{x^2}$. Using the definition of the derivative, compute $f'(a)$ for $a \neq 0$.

Solution:

Question 5: 10 marks

Solution: