

MA161 SEMESTER 1, CALCULUS: PROBLEM SHEET 10

1. Evaluate the following limits. Use l'Hôpital's Rule where appropriate. If there is a more elementary method, consider using it. If l'Hôpital's Rule does not apply, explain why.

(a) $\lim_{x \rightarrow -1} \frac{x^3 + 1}{x + 1}$

(b) $\lim_{x \rightarrow 2} \frac{2x^2 - 1}{x - 1}$

(c) $\lim_{x \rightarrow \pi/2} \frac{\cos x}{x - \pi/2}$

(d) $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 - x}$

(e) $\lim_{x \rightarrow 0} \frac{e^{4x} - 1}{x}$

(f) $\lim_{x \rightarrow 0} \frac{5^x - 3^x}{x}$

2. Consider the function

$$f(x) = 2 + 3x - x^3$$

- (i) Find the first and second derivative of f .
- (ii) Find all critical points of f .
- (iii) Find the intervals where f is increasing and where it is decreasing.
- (iv) For each critical point, determine if it corresponds to a local minimum, or to a local maximum of f .
- (v) Use the information obtained so far to sketch the graph of f .