1) Problem 3.3.7

2) Equator problem: Prove there are two points on the equator that are directly opposite each other which have the same temperature. (Assume that the temperature varies continuously on the equator, so theorems of section 3.3 apply.)

3) Problem 3.4.7

4) Provide a definition of \( \lim_{x \to \infty} f(x) = -\infty \).

5) Let \( f(x) = x^n + g(x) \), where \( n \geq 1 \) and there exists \( M > 0 \) for which \( |g(x)| \leq M|x|^{n-1} \) for all \( x \in \mathbb{R} \).
   (a) Prove that \( \lim_{x \to \infty} f(x) = \infty \).
   (b) E.C. Prove (use induction) that if \( g \) is an \( n \)-th degree polynomial then there exists \( M > 0 \) for which \( |g(x)| \leq M|x|^n \).
   (c) Prove that if \( f \) is Lipschitz and differentiable on the real line then the derivative of \( f \) is bounded.
   (d) Prove polynomials of degree 2 or more are not Lipschitz on the real line \( \mathbb{R} \).

6) Let \( f \) and \( g \) be differentiable. Prove the product rule: \( (fg)' = f'g + gf' \).