Review of Chapter 3: Differentiation

Keywords: derivative

1. Formulas

1.1 Differentiation rules:
- Derivative of a constant: \( \frac{d}{dx}(c) = 0 \)
- Power rule: \( \frac{d}{dx}(x^n) = nx^{n-1} \)
- Constant multiple rule: \( \frac{d}{dx}(cf) = c \frac{d}{dx}(f) \)
- Sum rule: \( \frac{d}{dx}(f \pm g) = \frac{d}{dx}(f) \pm \frac{d}{dx}(g) \)
- Product rule: \( \frac{d}{dx}(fg) = \frac{d}{dx}(f)g + f \frac{d}{dx}(g) \)
- Quotient rule: \( \frac{d}{dx}\left(\frac{f}{g}\right) = \frac{\frac{dg}{dx}f - \frac{df}{dx}g}{g^2} \)
- Chain rule: \( \frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx} \)
- General power rule: \( \frac{d}{dx}(u^n) = nu^{n-1} \frac{du}{dx} \)

1.2 Functions in economics:
- Cost function: \( C(x) \)
- Average cost function: \( \bar{C}(x) = \frac{C(x)}{x} \)
- Revenue function: \( R(x) = xp = xp(x) \)
- Profit function: \( P(x) = R(x) - C(x) \)
- Elasticity of demand: \( E(p) = -\frac{pf'(p)}{f(p)} \)

1.3 Increments and differentials:
- Increment in \( x \): \( \Delta x = x_2 - x_1 \)
- Increment in \( y \): \( \Delta y = f(x + \Delta x) - f(x) \)
- Differential: \( dy = f'(x)dx \)

2. Concepts, theorems, and techniques

2.1 Application to economics:

- Marginal functions and its physical meanings: marginal cost, marginal average cost, marginal revenue, marginal profit
- Elastic, unitary, and inelastic demands
2.2 Differentiation:

- Second and higher order derivatives
- Implicit differentiation
- Related rates