Handout for Lecture 20

Calculus Review and Functional Forms

ECON 340: Economic Research Methods — Instructor: Div Bhagia

For a function $y = f(x)$, the derivative denoted by dy/dx or $f'(x)$ captures how the value of the function changes due to a small change in x.

Rules of differentiation:

(a) $y = a \rightarrow \frac{dy}{dx} = 0$

(b) $y = ax \rightarrow \frac{dy}{dx} = a$

(c) $y = ax^b \rightarrow \frac{dy}{dx} = abx^{b-1}$

(d) $y = f(x) \pm g(x) \rightarrow \frac{dy}{dx} = f'(x) \pm g'(x)$

(e) Derivative of a log function:

$$y = log(x) \rightarrow \frac{dy}{dx} = \frac{1}{x}$$

(f) Chain rule:

$$z = f(y),\ y = g(x) \rightarrow \frac{dz}{dx} = \frac{dz}{dy} \cdot \frac{dy}{dx}$$

Find the derivative for the following functions:

1. $y = 10 \rightarrow \frac{dy}{dx} =$
2. $y = 5x \rightarrow \frac{dy}{dx} =$
3. $y = 8x^3 \rightarrow \frac{dy}{dx} =$
4. $y = 3x^2 + 4 \rightarrow \frac{dy}{dx} =$
5. $y = 2 + 3 \cdot log(x) \rightarrow \frac{dy}{dx} =$
6. $y = log(z),\ z = x^2 \rightarrow \frac{dy}{dx} =$
7. $y = log(x^2) \rightarrow \frac{dy}{dx} =$
8. $y = log(f(x)) \rightarrow \frac{dy}{dx} =$

Find $\frac{dY}{dX}$ for the following model:

$$Y = \beta_0 + \beta_1 X + \beta_2 X^2 + u$$

What is the interpretation of β_1 and β_2?

Consider the following model:

$$\log(Y) = \beta_0 + \beta_1 \log(X) + u$$

Differentiate both sides of the above equation and show that β_1 represents the elasticity of Y with respect to X.