Lecture Study Guideline

You need to follow three steps to study

Step 1: Watch the topic related video uploaded on LMS.

Step 2: Read the lecture notes attached.

Step 3: Read the topic from course book and do practice of questions mention below.

Topic: Chain Rule

Step 1

Watch the topic related video uploaded on LMS.

Step 2

3.6 The chain Rule:

If $y = f(u)$ & $u = g(x)$.

Then $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

Example Find dy/dx if $y = \cos(x^3)$.

sol: let $u = x^3 \Rightarrow y = \cos u$

$\Rightarrow \frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx} = -\sin u \cdot 3x^2$

$$\boxed{\frac{dy}{dx} = -3\sin(x^3)x^2.}$$

Generalized Derivative Formulas

$$\frac{d}{dx}[f(u)] = f'(u) \cdot \frac{du}{dx}$$

Ex. 3.6.

Q3. let $f(x) = x^5$ & $g(x) = 2x-3$

find $(f \circ g)(x)$ & $(f \circ g)'(x)$.

sol: $(f \circ g)(x) = f(2x-3) = (2x-3)^5$

$\therefore (f \circ g)'(x) = \frac{d}{dx}(2x-3)^5$

let $v = 2x-3$.

$\Rightarrow (f \circ g)'(x) = \frac{d}{dx} v^5 = \frac{dv^5}{dv} \cdot \frac{dv}{dx}$

$= 5v^4 \cdot 2$.

$= 10v^4 = 10(2x-3)^4$

Q 11 $y = f(x) = \frac{4}{(3x^2-2x+1)^3}$

let $v = 3x^2-2x+1$

$\Rightarrow$ ~~f(x)~~ $y = \frac{4}{v^3} = 4v^{-3}$

$\therefore \frac{dy}{dx} = \frac{dy}{dv} \cdot \frac{dv}{dx} = -3 \cdot 4v^{-4} \cdot \frac{d}{dx}(3x^2-2x+$

$= -12(3x^2-2x+1)^{-4}(6x-2)$

23. $f(x) = \sqrt{\cos(\sin x)}$ let $v = 5x$

$\Rightarrow y = (\cos v)^{1/2} \therefore \frac{dy}{du} = \frac{dy}{dv} \cdot \frac{dv}{dx}$

$\Rightarrow dy/du = 1/2 \cos v^{-1/2} \cdot (-\sin v) \cdot 5$

33. $y = \cos^3(\sin 2x)$

let $v = \sin 2x \Rightarrow y = \cos^3 v$.

$$\frac{dy}{dx} = \frac{dy}{dv}\cdot\frac{dv}{dx} = 3\cos^2 v \cdot (-\sin v) \cdot 2\cos 2x.$$

30. $y = \dfrac{\sin x}{\sec(3x+1)} = \sin x \cdot \cos(3x+1)$

Q 61 if $y = A\cos\omega t$

a) show that $\dfrac{d^2y}{dt^2} = -\omega^2 y$

b) show that $T = 2\pi/\omega$ (Time req. to complete one oscillation)

c) Find f in terms of T.

Sol:

a) $\dfrac{dy}{dt} = -A\omega\sin\omega t$

$$\frac{d^2y}{dt^2} = -A\omega^2\cos\omega t = -\omega^2 y.$$

b) As period of cos is 2π

$\therefore \omega T = 2\pi \Rightarrow T = 2\pi/\omega$

c) $f = 1/T$

Step 3: Read topic 3.6 from text book (Calculus by Howard Anton 8th edition)

Practice exercise 3.6 (Q.3, Q.4, Q.7 to Q.40, Q.51 to Q.54)