Calc AB

Lesson 37

9/15/15

Agenda: 9/15/15

HW leader :

Period 3	Period 4
Lauren H.	Ethan H.

lesson 37

Chain Rule

★ Test 2 on Friday

Chain Rule (or Differentiation by u substitution)

[Derivative for the composition of functions]

Idea: f and g are two differentiable functions

$$y = f(g(x))$$

let $u = g(x)$ then $y = f(u)$

so $dy = f'(u)\,du$

Hence $\frac{dy}{dx} = f'(u)\frac{du}{dx}$

Chain Rule: $\boxed{\frac{dy}{dx} = f'(g(x)) \cdot g'(x)}$

Ex. 37.1 If $f(x) = (x^2 + 2x)^{10}$ find $f'(x)$.

$u = x^2 + 2x \quad \frac{du}{dx} = 2x + 2$

$f'(x) = f'(u) \cdot \frac{du}{dx} = \boxed{10(x^2 + 2x)^9 \cdot (2x + 2)}$

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Ex 37.5 Find $\frac{dy}{dx}$ where $y = \sin^3 x = (\sin x)^3$

$$\frac{dy}{dx} = 3\sin^2 x \cdot \frac{d}{dx}(\sin(x))$$

$$= \boxed{3\sin^2(x) \cdot \cos(x)}$$

Ex 37.8 Find $\frac{dy}{dx}$ where $y = \ln|\cos x|$

$$\frac{dy}{dx} = \frac{1}{\cos(x)} \cdot \frac{d}{dx}(\cos(x)) = \frac{-\sin(x)}{\cos(x)} = \boxed{-\tan(x)}$$

1. Find $\frac{dw}{dz}$ where $w = \cos(e^{10z})$

$$\frac{dw}{dz} = -\sin(e^{10z}) \cdot \frac{d}{dz}(e^{10z})$$

$$= -\sin(e^{10z}) \cdot e^{10z} \cdot \frac{d}{dz}(10z)$$

$$= \boxed{-10e^{10z}\sin(e^{10z})}$$