

Q5

a) $f(x) = \ln \ln x$

$$\frac{d}{dx} \ln \ln x$$

chain rule

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

$$\frac{d}{dx} \ln \ln x = \frac{1}{\ln(x)} \frac{d}{dx} \ln(x)$$

$$\frac{d}{dx} \ln(x) = \frac{1}{x}$$

$$= \frac{1}{\ln x} \times \frac{1}{x} = \frac{1}{x \ln x}$$

$$= \frac{1}{x \ln x}$$

b) $f(\theta) = \cos(\theta^2)$

$$= \frac{d}{d\theta} \cos(\theta^2) = \frac{d}{d\theta} \cos \theta^2 \frac{d}{d\theta} \theta^2, \frac{d}{d\theta} \cos \theta = -\sin \theta$$

Apply chain rule

$$= -\sin(\theta^2) \frac{d}{d\theta} (\theta^2)$$

$$\frac{d}{d\theta} (\theta^2) = 2\theta$$

$$= -\sin(\theta^2) \cdot 2\theta$$

$$= -2\theta \sin \theta^2$$

$$(c) f(t) = \frac{1}{(2t+1)^2} = (2t+1)^{-2}$$

$$\text{let } 2t+1 = u$$

$$= \frac{d}{du} u^{-2} \quad \cdot \text{Apply chain rule } \frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

$$= -2u^{-3} \cdot \frac{d}{dt}(u) \quad , \quad \frac{d}{dt} u = \frac{d}{dt}(2t+1) = 2$$

$$= -2(2t+1)^{-3} \cdot 2 = \frac{-4}{(2t+1)^3}$$

$$= \frac{-4}{(2t+1)^3}$$

$$(d) f(t) = 2t^3$$

$$= \frac{d}{dt} (2t^3) = 2 \frac{d}{dt} t^3$$

$$= 2 \cdot (3t^{3-1}) = 2(3t^2) = 6t^2$$

$$= 6t^2$$