Chain Rule (e^x and $\ln x$)

Starter

1. **(Review of last lesson)**
Find the equation of the normal to the curve $y = \sqrt[3]{(3x-7)}$ when $x = 5$.

2. Use the method "Let $u = \ldots$" and the chain rule to differentiate the following:
(a) $y = e^{4x+7}$ (b) $y = \ln(x^3 - 8x + 2)$
(c) $y = ke^{f(x)}$ (d) $y = k\ln[f(x)]$

Notes

In general:

$$y = ke^{f(x)} \quad \Rightarrow \quad \frac{dy}{dx} = kf'(x)e^{f(x)}$$

$$y = k\ln[f(x)] \quad \Rightarrow \quad \frac{dy}{dx} = \frac{kf'(x)}{f(x)}$$

E.g. 1 Differentiate: (a) $y = e^{x^2+3}$ (b) $y = 2\ln(3x^5 - 7)$

Working: (a) $\frac{dy}{dx} = 2x \times e^{x^2+3} = 2xe^{x^2+3}$
$f'(x) \quad e^{f(x)}$

E.g. 2 Find the $x-$coordinates of the stationary points of the curve $y = e^{x^3-3x-5}$.
Hint: A stationary point is where the gradient is…

Video: Chain rule (e^x)
Video: Chain rule (natural logs)

Solutions to Starter and E.g.s

Exercise

p201 10A Qu 1idf, 2ibcfg, 3id

Summary

Chain Rule: $\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}$

$y = k[f(x)]^n \quad \Rightarrow \quad \frac{dy}{dx} = knf'(x)[f(x)]^{n-1}$

$y = ke^{f(x)} \quad \Rightarrow \quad \frac{dy}{dx} = kf'(x)e^{f(x)}$

$y = k\ln[f(x)] \quad \Rightarrow \quad \frac{dy}{dx} = \frac{kf'(x)}{f(x)}$