

Lesson 11

Read 3.4

Chain rule

Composition

A composite function is of the form $y = f(g(x))$

Examples

Functions of the following forms are composite :

e^{\exp} , $\sqrt{\exp}$, $(\exp)^n$, $\ln(\exp)$, $\sin(\exp)$, $\cos(\exp)$

The chain rule

$$(f(g(x)))' = f'(g(x))g'(x)$$

or

$$\text{If } y = f(g(x)) \text{ and } u = g(x) \text{ then } \frac{dy}{dx} = \frac{df}{du}(u) \frac{du}{dx}(x)$$

Calculate the derivatives of the following functions :

▶ e^{2x}

▶ $\sin(x^2)$

▶ $(\sin x)^2$

▶ $\sqrt{\frac{\sin x}{x}}$

▶ $\left(\frac{x^2+1}{x-5}\right)^7$

Find the 100th derivative of $f(x) = e^{3x}$

Calculate $(2^x)'$

General formula

$$(a^x)' = \ln(a) a^x$$

Air is being pumped into a spherical weather balloon. At any time t , the volume of the balloon is $V(t)$ and the radius is $r(t)$. What do $\frac{dV}{dt}$ and $\frac{dr}{dt}$ represent? Express $\frac{dV}{dt}$ in terms of $\frac{dr}{dt}$