Introduction to Integration By Substitution
Class 13: Wednesday February 26

The Chain Rule:
Suppose $h(x) = f(g(x))$. Then

$$\frac{dh}{dx} = h'(x) = f'(g(x)) \cdot g'(x).$$

The derivative of a composite function $h(x)$ is the product of the derivatives of the outside and inside functions. The derivative of the outside function mus t be evaluated at the inside function.

Example
Try this more complicated chain rule: Suppose $k(x) = f(g(h(x)))$. Find

$$\frac{dk}{dx} = k'(x) =$$

Consider these following functions and compute their derivatives. Which ones do you have to use the chain rule on?

1. $f(x) = \sin(x^2)$, $\qquad f'(x) = \frac{df}{dx} =$ ____________________

2. $g(x) = e^{\sin(x)}$, $\qquad g'(x) = \frac{dg}{dx} =$ ____________________

3. $h(x) = \pi^x$, $\qquad h'(x) = \frac{dh}{dx} =$ ____________________

Remember, how **antidifferentiation** is related to differentiation. With this in mind, try and compute these antiderivatives:

1. $\int f'(x)\ dx =$

2. $\int [f(g(x))]'\ dx =$

3. $\int f'(g(x))g'(x)\ dx =$

4. $\int \cos(x)e^{\sin(x)}\ dx =$

5. $\int (e^{\sin(x)})'\ dx =$

6. $\int e^{\sin(x)}\ dx =$