U-substitutions: An Alternate Approach

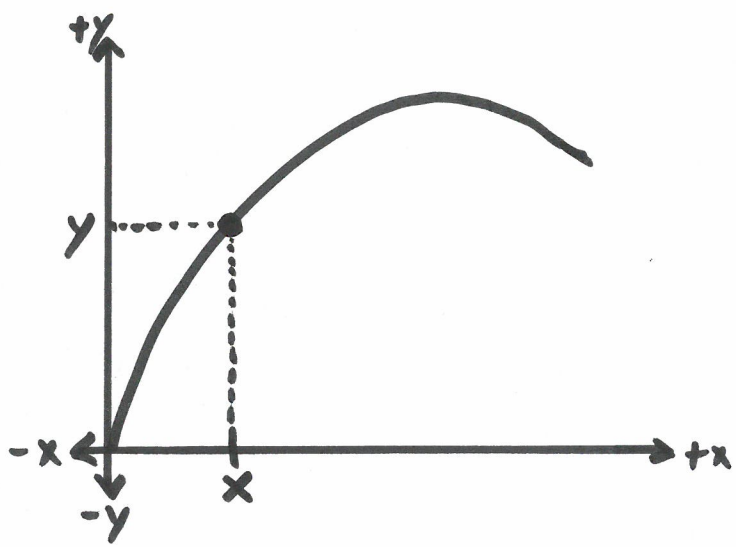
- Remember from derivatives
  if f is a function of x then the derivative of f can be written as

$$f'(x) \quad \text{or} \quad D_x f \quad \text{or} \quad \frac{df}{dx}$$

The most detailed form

- derivative = slope of the tangent

$$= \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \frac{dy}{dx}$$



Use the fraction form of the derivative in u-substitutions

1. identify u
2. take $\frac{du}{dx}$, and use algebra to get $dx = \ldots$
3. substitute u and dx into integral

Integral Properties

$$\int c\, f(x)\,dx = c\int f(x)\,dx$$

$$\int [f(x)+g(x)]\,dx = \int f(x)\,dx + \int g(x)\,dx$$

Integral Identities

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C \qquad n \neq -1$$

$$\int \frac{1}{x}\,dx = \ln|x| + C$$

$$\int e^x\,dx = e^x + C$$

$$\int \sin(x)\,dx = -\cos(x) + C$$

$$\int \cos(x)\,dx = \sin(x) + C$$

① $\int x^2 e^{3x^3} dx$

② $\int \frac{3e^x}{e^x+2} dx$

③ $a(t) = -75\cos(5t)$

Find $v(t)$ if $v(0)=0$

④ $\int \frac{3x}{x^2+4}\,dx$