Integration by Substitution

The idea for **integration by substitution** is to make a substitution so that the integral is simpler.

Ex 1.

Find the integral:

$$\int (2x-3)^5 \, dx$$

Ex 2.

Find the following integrals:

$$\int \sqrt{4x-1} \, dx$$

$$\int 8x(4x^2 - 3)^5 \, dx$$

Ex 3.

Find the following integrals:

$$\int \frac{3x + 6}{\sqrt{2x^2 + 8x + 3}} \, dx$$

$$\int \frac{(\ln x)^2}{x}\,dx$$

$$\int e^{5x+2}\,dx$$

Ex 4.

Find the general solution of the differential equation $\frac{dy}{dx} = e^y\sqrt{x+1}$.

Practice

1. Find the following integrals:

a) $\int x^3 e^{x^4+2}\, dx$

b) $\int (x+1)(x^2+2x+3)^{12}\, dx$

c) $\int \frac{x}{x-1}\, dx$ (Hint: Let $u = x - 1$, so that $x = u + 1$, then divide before integrating.)

2. Solve the given separable differential equation (find the general solution).

$\frac{dy}{dx} = \frac{\ln x}{yx}$

Q: What goes up and down but doesn't move?