Section 26.1: Applications of the Indefinite Integral

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11:02 AM

note: we will be omitting the electrical circuit applications (voltage, current, etc) in this class

kinematics:

$$a = \frac{dv}{dt}$$

a = acceleration
v = velocity
t = time

$$v = \int \frac{dv}{dt}\, dt$$

$$\boxed{v = \int a\, dt}$$

Similarly

$$\boxed{s = \int v\, dt}$$

s = position

note: if s = displacement, then there is an additional constraint that at $t=0$, $s=0$

example:

What is the displacement at time t for an object moving in a straight line with constant acceleration a, starting from initial velocity v_0?

$v = \int a\,dt$ where a is a constant

$v = at + C$

but at $t = 0$, $v = v_0$

$v_0 = a \cdot 0 + C$ $\therefore$ $C = v_0$

$$\boxed{v = at + v_0}$$

displacement $s = \int v\,dt$

$= \int (at + v_0)\,dt$

$= \frac{1}{2}at^2 + v_0 t + C_1$

at $t = 0$, $s = 0$

$0 = 0 + 0 + C_1$ so $C_1 = 0$

$$\boxed{s = \tfrac{1}{2}at^2 + v_0 t}$$