Math 16B
Vogler

Gravity and Rules for Anti-Derivatives

Defn Let $s(t)$ measure distance at time t

1) $s'(t)$ is instantaneous velocity at time t, usually denoted $v(t) = s'(t)$ with units $\frac{\text{distance}}{\text{time}}$

2) $s''(t)$ is instataneous acceleration at time t, usually denoted $a(t) = s''(t)$ with units $\frac{\text{distance}}{\text{time}^2}$

For free-falling and projectiles on earth, assuming acceleration is only due to gravity ($g = -32\ ft/sec^2$), we can derive the following formulas using the anti derivative:

1) $a(t) = s''(t) = -32\ ft/sec^2$

2) $v(t) = s'(t) = -32t + v_0$ ← initial velocity (i.e. $v_0 = v(0)$)

3) $s(t) = -16t^2 + v_0 t + s_0$ ← initial position (i.e. $s_0 = s(0)$)

Rules for Anti-Derivatives

Let $f(x)$ and $g(x)$ be functions and k & n be numbers.

1) $\int k f(x)\,dx = k \int f(x)\,dx$

2) $\int f(x) \pm g(x)\,dx = \int f(x)\,dx \pm \int g(x)\,dx$

3) $\int k\,dx = kx + C$

4) $\int x^n\,dx = \frac{1}{n+1} x^{n+1} + C \quad (\text{for } n \neq -1)$

Notes: 1) C is the constant of integration that represents ANY number

2) Compare these rules with the derivative rules in Section 2.2.