$f(x) = -\frac{2}{x} - \frac{x^3}{6} + \frac{13}{6}$.

E.g. Find $f(x)$ given

$f''(x) = 2e^x + 3\sin x$;

$\boxed{f(0) = 0;\ f(\pi) = 0}$

$f'(x) = \int (2e^x + 3\sin x)\,dx = \boxed{2e^x - 3\cos x + C_1}$

$f(x) = \int (2e^x - 3\cos x + C_1)\,dx = 2e^x - 3\sin x + C_2 x + C_2$

Find C_1 and C_2

Since $f(0) = 0$; $2e^0 - 3\sin(0) + C_1 \cdot 0 + C_2 = 0$

$2 + C_2 = 0$; $\boxed{C_2 = -2}$

Nov 9-4:55 PM

Since $f(\pi) = 0$; $2e^\pi - 3\sin(\pi) + C_1\pi + C_2 = 0$

$2e^\pi - 3\sin(\pi) + C_1\pi - 2 = 0$

$2e^\pi + C_1\pi - 2 = 0$

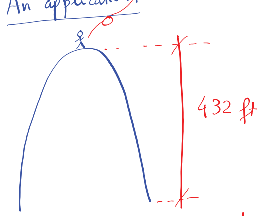
$C_1\pi = 2 - 2e^\pi$

$C_1 = \frac{2 - 2e^\pi}{\pi}$.

$\boxed{f(x) = 2e^x - 3\sin(x) + \frac{2 - 2e^\pi}{\pi} x - 2.}$

Nov 9-4:58 PM

An application: ball



A ball is thrown upward with an initial speed of 48 ft/s from the edge of a cliff 432 ft above ground.

Find the height function in t.

Constant acceleration due to gravity $= -32\ ft/s^2$

$a(t) = -32\ ft/s^2$

$h(t)$? $v(t) = h'(t)$; $a(t) = v'(t) = h''(t)$

$\boxed{h''(t) = -32;\ v(0) = h'(0) = 48;\ h(0) = 432}$

Nov 9-5:00 PM

$h''(t) = -32$

$h'(t) = \int -32\,dt = -32t + C_1$

$h'(0) = 48$; $C_1 = 48$

$h'(t) = -32t + 48$

$h(t) = \int (-32t + 48)\,dt = -16t^2 + 48t + C_2$

$h(0) = 432$; $C_2 = 432$.

$\boxed{h(t) = -16t^2 + 48t + 432}$

Nov 9-5:05 PM