Solve: $y'' + 4 = 0$, $y(0) = -2$, $y'(0) = 0$

$r^2 + 4 = 0$ implies $r^2 = -4$. Thus $r = \pm 2i$.

Since $r = 0 \pm 2i$, $y = c_1 cos(2t) + c_2 sin(2t)$.

Then $y' = -2c_1 sin(2t) + 2c_2 cos(2t)$

$y(0) = -2$: $-2 = c_1 cos(0) + c_2 sin(0)$ implies $-2 = c_1$

$y'(0) = 0$: $0 = -2c_1 sin(0) + 2c_2 cos(0)$ implies $0 = c_2$

Thus IVP solution: $y = -2cos(2t)$

Section 8-3 : Periodic Functions & Orthogonal Functions

This is going to be a short section. We just need to have a brief discussion about a couple of ideas that we'll be dealing with on occasion as we move into the next topic of this chapter.

Periodic Function The first topic we need to discuss is that of a periodic function. A function is said to be **periodic** with **period** T if the following is true,

$$f(x + T) = f(x) \qquad \text{for all } x$$