SP09 MAE 105 Quiz #1 Solution 4/9/09

Prob. 1

$$\frac{du}{dx} = 5x^4 \Rightarrow u(x) = \int 5x^4\,dx = \boxed{x^5 + C}$$

where C is a constant.

$$u(0) = C = 3 \qquad \boxed{\therefore\ u(x) = x^5 + 3}$$

Prob. 2

$$\frac{d^2u}{dx^2} = \sin x \Rightarrow \frac{du}{dx} = \int \sin x\,dx = -\cos x + C_1$$

$$\Rightarrow u(x) = \int [-\cos x + C_1]\,dx = \boxed{-\sin x + C_1 x + C_2}$$

where C_1, C_2 are constants.

$$u(0) = C_2 = 2, \quad \frac{du(\pi)}{dx} = -\cos\pi + C_1 = 1 + C_1 = 3$$

$$\boxed{\therefore\ u(x) = -\sin x + 2x + 2}$$

Prob. 3

$$\frac{dG(t)}{dt} - 2G(t) = 0 \Rightarrow \frac{1}{G(t)}\frac{dG(t)}{dt} = 2$$

$$\Rightarrow \int \frac{1}{G(t)}\,dG(t) = \int 2\,dt \Rightarrow \ln[G(t)] = 2t + C$$

$$\Rightarrow G(t) = e^{2t+C} = \underbrace{e^C}_{\text{constant}} e^{2t} \qquad \boxed{\therefore\ G(t) = G_0 e^{2t}}$$

where G_0 is a constant

Extra credit.

$$\frac{du}{dx} = x\sin x \Rightarrow u = \int x\sin x\,dx = -x\cos x - \int(-\cos x)\,dx$$

$$= -x\cos x + \sin x + C$$

$$u(0) = C = 0 \qquad \boxed{\therefore\ u(x) = -x\cos x + \sin x}$$