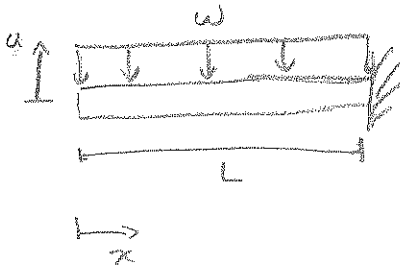
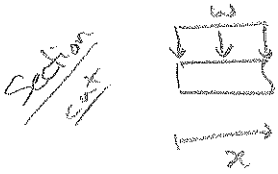
15.4 /



a) Eqn. of elastic curve ($u(x) = ?$)



$$\Sigma M_{cut} = M + \int_0^x w x \, dx = 0$$

$$M = -\frac{w x^2}{2}$$

$$u'' = \frac{d^2 u}{dx^2} = \frac{M(x)}{EI} = -\frac{w x^2}{2EI}$$

$$u' = -\frac{w x^3}{6EI} + C_1$$

$$u = -\frac{w x^4}{24EI} + C_1 x + C_2$$

$$u'(L) = -\frac{wL^3}{6EI} + C_1 = 0 \quad \leftarrow \text{Slope at wall is zero}$$

$$C_1 = \frac{wL^3}{6EI}$$

$$u(L) = -\frac{wL^4}{24EI} + \frac{wL^4}{6EI} + C_2 = 0 \quad \leftarrow \text{Deflection at wall is zero}$$

$$C_2 = -\frac{wL^4}{8EI}$$

a) cont'd ($u(x) = ?$)

$$\boxed{u(x) = -\frac{w}{24EI}\left(x^4 - 4L^3 x + 3L^4\right)}$$

b) Deflection at free end ($u(0) = ?$)

$$\boxed{u(0) = -\frac{wL^4}{8EI}}$$

c) Slope at free end ($u'(0) = ?$)

$$u'(x) = -\frac{w}{6EI}\left(x^3 - L^3\right)$$

$$\boxed{u'(0) = \frac{wL^3}{6EI}}$$