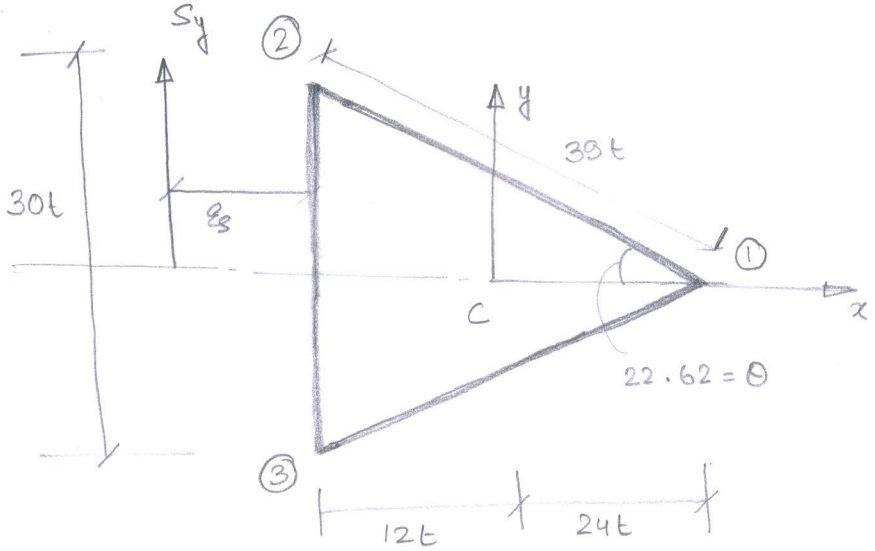

Find the shear center for the given isosceles triangle.

$$I_{xx} = \frac{1}{12}(30t)^3 t + 2\int y^2 dA = 2250t^4 + 2\int_0^{39t} s^2 \sin^2\theta \, ds\,t$$

$$= 2250t^4 + \frac{2}{3}t^2 \sin^2\theta \, s^3\Big|_0^{39t} = 2250t^4 + \frac{2}{3}\sin^2\theta (39t)^3 t$$

$$= 8100t^4$$

Since $I_{xy} = 0$ and $S_x = 0$

$$q - q_0 = \frac{-S_y}{I_{xx}} \int_0^s t y \, ds$$

Assuming $q = q_0$ at ①, we get,

For portion 12

$$q_{12} - q_0 = \frac{-S_y t}{I_{xx}} \int y \, ds$$

$$= \frac{-S_y t}{I_{xx}} \int_0^s s \sin\theta \, ds = \frac{-S_y t \sin\theta \, s^2}{2 I_{xx}}$$

$$\Rightarrow \quad q_{12} = \frac{-S_y t s^2 \sin\theta}{2 I_{xx}} + q_0 = \frac{-S_y t s^2}{2 I_{xx}} \left(\frac{15}{39}\right) + q_0$$

$$q_2 = \frac{-S_y t (39t)^2}{2 I_{xx}} \left(\frac{15}{39}\right) + q_0 = \frac{-S_y t^3}{I_{xx}} \frac{\cancel{11407.5}}{292.5} + q_0$$

For portion 23

$$q_{23} - q_2 = \frac{-S_y}{I_{xx}} t \int_{=0} (15t - s)\, ds + \frac{S_y t^3}{I_{xx}} \cdot \frac{292.5}{\cancel{11407.5}} + q_0$$

$$q_3 = \frac{-S_y}{I_{xx}} t \left(15ts - \frac{s^2}{2}\right)\Big|_0^{30t} - 292.5 \frac{S_y t^3}{I_{xx}} + q_0$$

$$q_3 = -292.5 \frac{S_y t^3}{I_{xx}} + q_0$$

For portion 31

$$q_{31} - q_3 = -\frac{S_y}{I_{xx}} \int ty\,ds = -\frac{S_y t}{I_{xx}} \int_0^s \left(\frac{15s}{39} - 15t\right) ds$$

$$= -\frac{S_y t}{I_{xx}} \left[\frac{15s^2}{2\times 39} - 15ts\right]$$

$$q_{31} = -\frac{S_y t}{I_{xx}} \left[\frac{5}{26}s^2 - 15ts\right] - \frac{292.5\,S_y t^3}{I_{xx}} + q_0$$

$$q_1 = -\frac{S_y t}{I_{xx}} \left[-292.5t^2\right] - \frac{292.5\,S_y t^3}{I_{xx}} + q_0 = q_0$$

Assuming that S_y is acting through the shear center,

$$\int q\,ds = 0$$

$$\Rightarrow q_0(2\times 39t + 30t) - \frac{S_y t}{2I_{xx}} \cdot \frac{5}{13} \int_0^{39t} s^2 ds - \frac{S_y t^3}{I_{xx}} 292.5 \int_0^{30t} ds$$

$$- \frac{S_y t}{I_{xx}} \int_0^{30t} \left(15ts - \frac{s^2}{2}\right) ds - \frac{292.5\,S_y t^3}{I_{xx}} \int_0^{39t} ds - \frac{S_y t}{I_{xx}} \int_0^{39t} \left(\frac{5}{26}s^2 - 15ts\right) ds = 0$$

$$\Rightarrow 108\,t q_0 - \frac{S_y t}{I_{xx}} \cdot \frac{5}{6\times 13} s^3 \Big|_0^{39t} - 292.5\times 30t\,\frac{S_y t^3}{I_{xx}} - \frac{S_y t}{I_{xx}} \left(\frac{15ts^2}{2} - \frac{s^3}{6}\right)\Big|_0^{30t}$$

$$- \frac{292.5\,S_y t^3}{I_{xx}} 39t - \frac{S_y t}{I_{xx}} \left(\frac{5s^3}{3\times 26} - \frac{15ts^2}{2}\right)_0^{39t} = 0$$

$$\Rightarrow 108\,t q_0 - \frac{S_y t^4}{I_{xx}} \left[3802.5 + 8775 + 6750 - 4500 + 114075 + 3802.5 - 11407.5\right] = 0$$

$$\Rightarrow 108\,t q_0 = \frac{18630}{8100} S_y \Rightarrow \boxed{q_0 = 0.0213 \frac{S_y}{t}}$$

Shear Center Taking moment about (1)

$$S_y(\xi_g + 36t) = \frac{S_y t}{I_{xx}} \int_0^{30t} \left(15ts - \frac{s^2}{2}\right) 36t\, ds + \frac{292.5\, S_y t^3}{I_{xx}} \int_0^{30t} 36t\, ds - q_0 \int_0^{30t} 36t\, ds$$

$$= \frac{S_y t}{I_{xx}} 36t \left(\frac{15ts^2}{2} - \frac{s^3}{6}\right)_0^{30t} + \frac{292.5\, S_y t^3}{I_{xx}} 36t \times 30t - q_0 36t \cdot 30t$$

$$= 25.996\, S_y t$$

$$\Rightarrow \boxed{\xi_g = -10t}$$