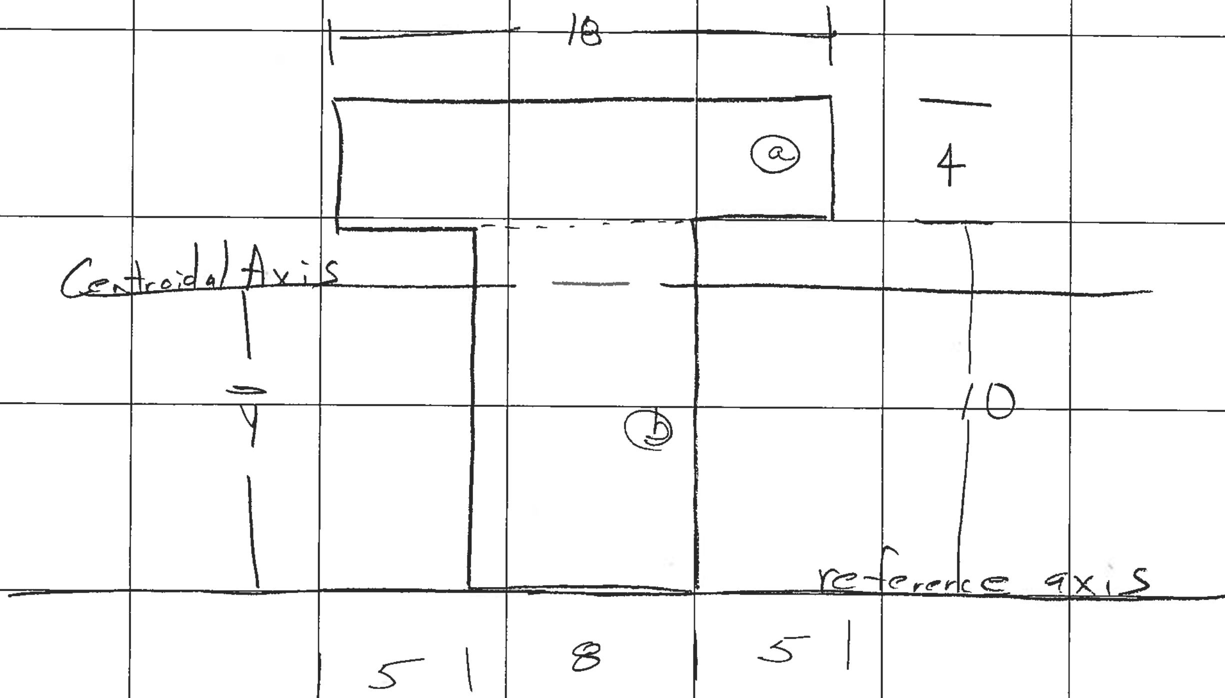
Locate the horizontal centroidal axis of the beam cross-section shown and calculate the area moment of inertia with respect to this axis



First we have to establish a reference axis. In this case the reference axis will be at the bottom of the cross-section as shown.

Then divide the cross-section into pieces with known centroids. In this case rectangle a and rectangle b.

Then calculate $\bar{y}$ using the following formula for composite areas

$$\bar{y} = \frac{\sum A_i y_i}{\sum A_i}$$

distance from centroid of the i^{th} part to the reference axis

area of the i^{th} part

$$\bar{y} = \frac{(18)(4)(12) + (8)(10)(5)}{(18)(4) + 8(10)}$$

$$\underline{\bar{y} = 8.316}$$

Then calculate the area moment of inertia of the composite area as follows with the parallel axis theorem

$$\bar{I}_z = \sum \left[\bar{I}_i + A_i d_i^2 \right]$$

Total moment of inertia

area of the i^{th} part

moment of inertia about parallel centroidal axis of the i^{th} part

distance between centroidal axis of the i^{th} part and the total centroid of the cross-section.

$$I = \left[\frac{1}{12}(18)(4)^3 + (18)(4)(12-8.316)^2\right]$$

$$+ \left[\frac{1}{12}(8)(10)^3 + (8)(10)(5-8.316)^2\right]$$

$$I = 96 + 977.2 + 666.7 + 879.7$$

$$\underline{I = 2619.6} \text{ in}^4 \text{ or mm}^4 \text{ or m}^4$$