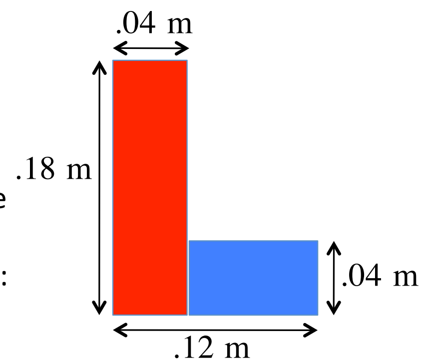
Problem 12.3

Determine the *center of gravity* of the object shown to the right.



As *center of gravity* and *center of mass* are essentially the same in most cases, so I'm not sure why we are doing this problem. In any case, the trick is to do the problem in pieces. By inspection:

center of mass of red section:

$$x_{red} = .02 \text{ m}, \quad y_{red} = .09 \text{ m}$$

area of mass of red section:

$$A_{red} = (.04 \text{ m})(.18 \text{ m})$$
$$= 7.2\text{x}10^{-3} \text{ m}^2$$

center of mass of blue section:

$$x_{blue} = .08 \text{ m}, \quad y_{blue} = .02 \text{ m}$$

area of mass of red section:

$$A_{blue} = (.08 \text{ m})(.04 \text{ m})$$
$$= 3.2\text{x}10^{-3} \text{ m}^2$$

Noting that the mass is simply the *area of a section* times the *mass per unit area* function σ, we can write:

$$x_{cg} = \frac{\sum m_i x_i}{\sum m_i}$$
$$= \frac{\left[\left(7.20\text{x}10^{-3} \text{ m}^2\right)\cancel{\sigma}\right](.02 \text{ m}) + \left[\left(3.20\text{x}10^{-3} \text{ m}^2\right)\cancel{\sigma}\right](.08 \text{ m})}{\left[\left(7.20\text{x}10^{-3} \text{ m}^2\right)\cancel{\sigma}\right] + \left[\left(3.20\text{x}10^{-3} \text{ m}^2\right)\cancel{\sigma}\right]}$$
$$= 3.85\text{x}10^{-2} \text{ m}$$

$$y_{cg} = \frac{\sum m_i y_i}{\sum m_i}$$
$$= \frac{\left[\left(7.20\text{x}10^{-3} \text{ m}^2\right)\cancel{\sigma}\right](.09 \text{ m}) + \left[\left(3.20\text{x}10^{-3} \text{ m}^2\right)\cancel{\sigma}\right](.02 \text{ m})}{\left[\left(7.20\text{x}10^{-3} \text{ m}^2\right)\cancel{\sigma}\right] + \left[\left(3.20\text{x}10^{-3} \text{ m}^2\right)\cancel{\sigma}\right]}$$
$$= 6.85\text{x}10^{-2} \text{ m}$$