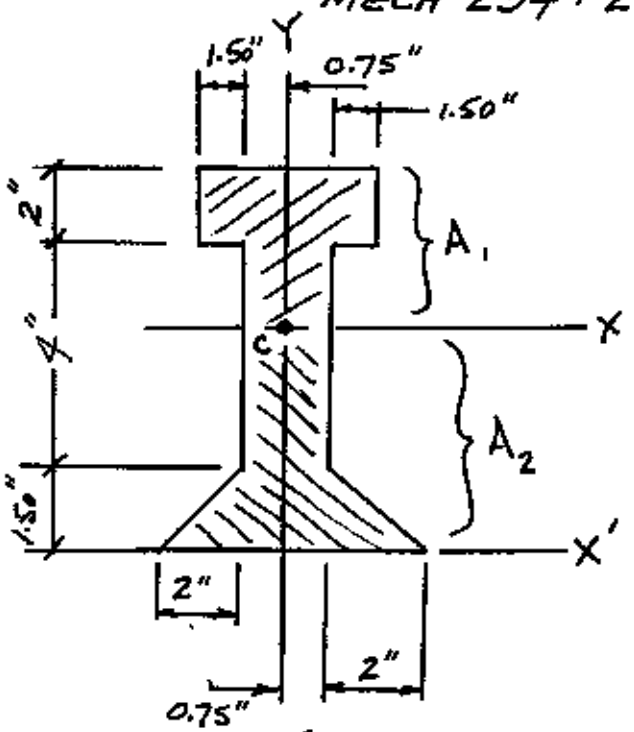
MECH 234 + 235

PROB. 5.25
p. 224



FIND FIRST MOMENT for AREA A_1 + A_2 with respect to X-axis

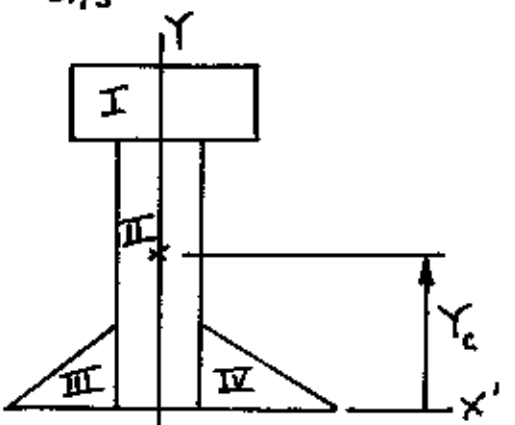
SYMMETRY ABOUT Y-AXIS !

① NEED TO DETERMINE LOCATION OF CENTROID, C.

② SELECT A NEW AXIS, X', TO USE AS REFERENCE

③ FIND CENTROID of ENTIRE GEOMETRY TO BE AT pt. C.

- DIVIDE THE COMPOSITE INTO SIMPLE SHAPES
- SET UP TABLE FOR AREAS & CENTROIDS
- COMPUTE THE DIST. FROM X' - AXIS TO CENTROID for COMPOSITE.



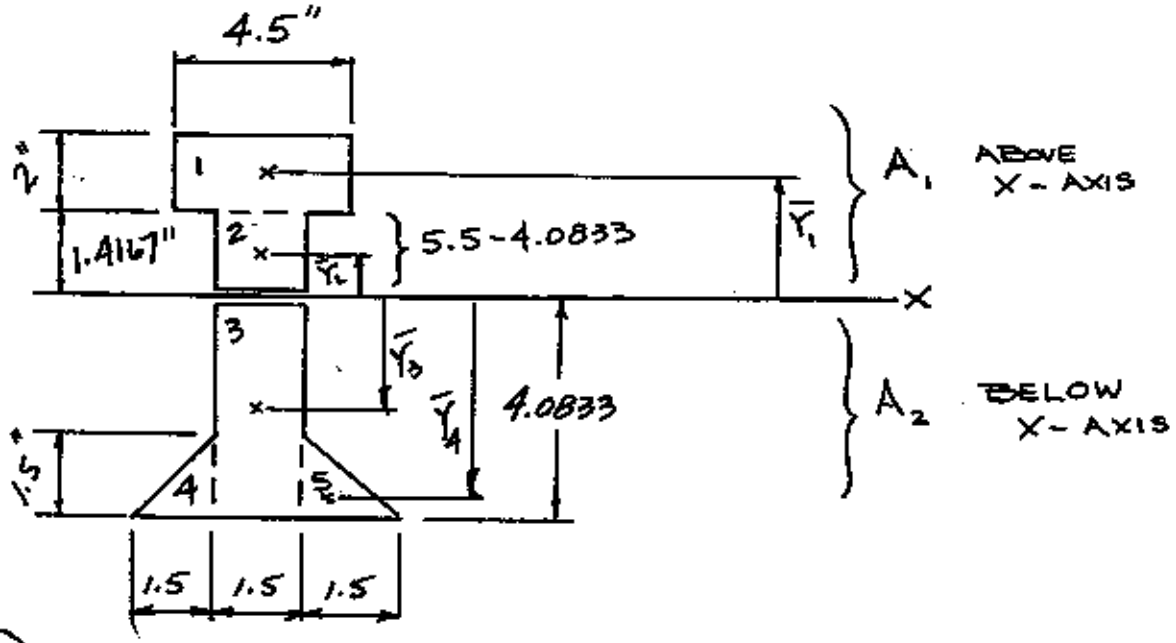
SECT.	AREA	$\bar{Y}$	$A\bar{Y}$
I	$(4.5")(2") = 9^{\square"}$	$1" + 4" + 1.5" = 6.5"$	$58.50\ in^3$
II	$(4.5")(5.5") = 8.25^{\square"}$	$\frac{1}{2}(4" + 1.5") = 2.75"$	$22.6875\ in^3$
III	$\frac{1}{2}(2")(1.5") = 1.5^{\square"}$	$\frac{1}{3}(1.5) = 0.5$	$0.75\ in^3$
IV	$\frac{1}{2}(2")(1.5") = 1.5^{\square"}$	$\frac{1}{3}(1.5) = 0.5$	$0.75\ in^3$
	$\Sigma A = 20.25^{\square"}$		$\Sigma = 82.6875\ in^3$

$$\bar{Y}_c = \frac{\Sigma A\bar{Y}}{\Sigma A} = \frac{82.6875\ in^3}{20.25\ in^2} = \boxed{4.0833\ in.\ above\ X'}$$

NOW REDO THE TABLE FOR A_1 ABOVE X-AXIS AND A_2 BELOW X-AXIS.

SINCE PT. C IS AT THE "CENTER of GRAVITY", YOU SHOULD EXPECT THE FIRST MOMENTS TO BE EQUAL, BUT OPPOSITE SIGNS, ∴ CANCEL. →

PROB. 5.25 cont'd.



(A1)

SECT.	AREA	$\bar{Y}$	$A\bar{Y}$
1	$(4.5")(2") = 9^{\square"}$	$1.4167" + 1" = 2.4167"$	$21.7503\ in^3$
2	$(1.5")(1.4167") = 2.125$	$\frac{1}{2}(1.4167") = 0.7084"$	$1.5052\ in^3$

FIRST MOMENT of A_1 $= \Sigma A\bar{Y} = 23.2555\ in^3$

(A2)

SECT.	AREA	$\bar{Y}$	$A\bar{Y}$
3	$(1.5")(4.0833") = 6.125^{\square"}$	$-[\frac{1}{2}(4.0833)] = -2.04165$	$-12.5051\ in^3$
4	$\frac{1}{2}(2")(1.5") = 1.5^{\square"}$	$-4.0833 + \frac{1}{3}(1.5) = -3.5833$	$-5.375\ in^3$
5	$\frac{1}{2}(2")(1.5") = 1.5^{\square"}$	$-4.0833 + \frac{1}{3}(1.5) = -3.5833$	$-5.375\ in^3$

FIRST MOMENT of A_2 $= \Sigma A\bar{Y} = -23.255\ in^3$