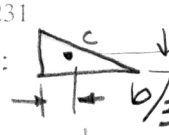
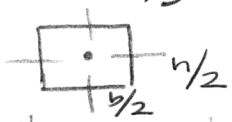
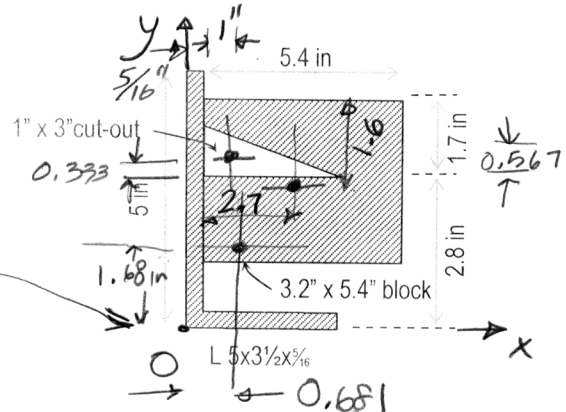
Shapes:  $I_x = \frac{bh^3}{36}$ $I_y = \frac{b^3h}{36}$ $A = \frac{bh}{2}$

 $I_x = bh^3/12$ $I_y = b^3h/12$ $A = bh$

ENDS 231: Practice Quiz 5

Clearly show your work and answer.

A steel section needs to be built-up for a special application. It consists of an unequal leg angle L5 x 3 ½ x 5/16 *(tall leg vertical)*, and a 3.2" x 5.4" steel block with a 1" tall by 3" wide wedge-shaped cut-out. For the composite shape find:

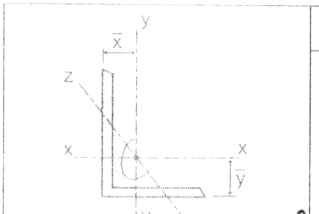


a) the location of the centroid with respect to the bottom left corner of the angle,

b) the moment of inertia about the x *or possibly* the moment of inertia about the y axis

c) *[some short question from the text material]*

Properties for the standard steel shape:



L5 x 3 ½ x 5/16
$A = 2.40$ in^2
$\bar{x} = 0.681$ in
$\bar{y} = 1.68$ in
$I_x = 6.26$ in^4
$I_y = 1.75$ in^4

Is this rotated 90°? then switch x & y's

steps: find origin, put dot at centroid of each shape, note which shapes are holes, [negative area method] fill in chart, measure $\hat{x}$, $\hat{y}$ from O (add up dimensions – or subtract)

	A in^2	x	Ax	y	Ay	I_x	$(\hat{y}-y)$ d_y	Ad_y^2	I_y	$(\hat{x}-x)$ d_x	$A(dx)^2$
L (+)	2.40	0.681	1.634	1.68	4.032	6.26	1.04	2.5896	1.75	2.159	11.19
□ (+)	17.28	3.0125	52.056	2.90	50.112	14.746	0.18	0.560	41.99	0.1725	0.514
◣ (-)	-1.5	1.3125	-1.969	3.133	-4.70	-0.083	0.413	-0.256	-0.75	1.5275	-3.5
Σ	18.18		51.72		49.44	20.922		2.9	42.99		8.204

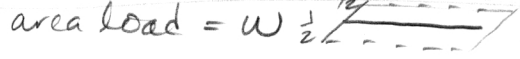
$\hat{x} = 51.72/18.18 = 2.84$" dr

$\hat{y} = 49.44/18.18 = 2.72$" dr

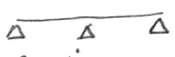
$I_x = 23.83$ in^4 (+ or $I_x = 20.922 + 2.9$)

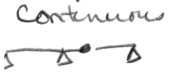
$I_y = 51.19$ in^4 ($I_y = 42.99 + 8.204$)

concepts: tributary width x area load = w

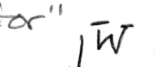


½ way each side to next "collector"

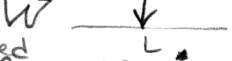




$L \cdot w = W$

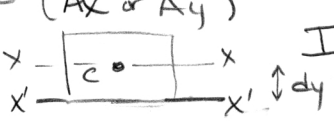


← equivalent force systems



Q = 1st moment area ($A\bar{x}$ or $A\bar{y}$)

Parallel axis theorem $I_{x'} = I_x + Ad_y^2$



Answers: $r = \sqrt{\frac{I}{A}}$

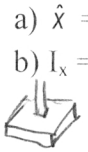
a) $\hat{x} = 2.84$ in, $\hat{y} = 2.72$ in

b) $I_x = 23.82$ in^4, $I_y = 51.19$ in^4

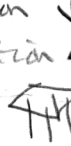
w: self-weight, snow, wind

action ↓ on.. reaction & result

"level" framing: girders; support beams or joists



or wall footing (shallow)



piles (deep)