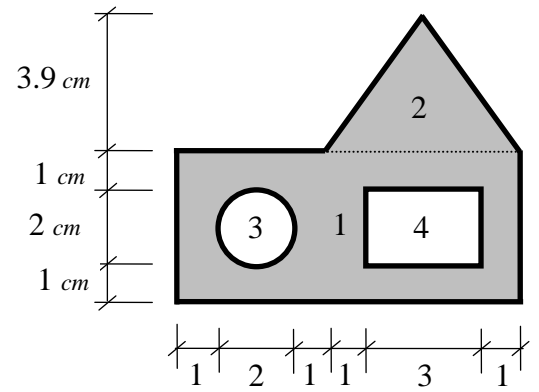


Question (1): (10 Marks)

For the shown cross-section, determine the following:

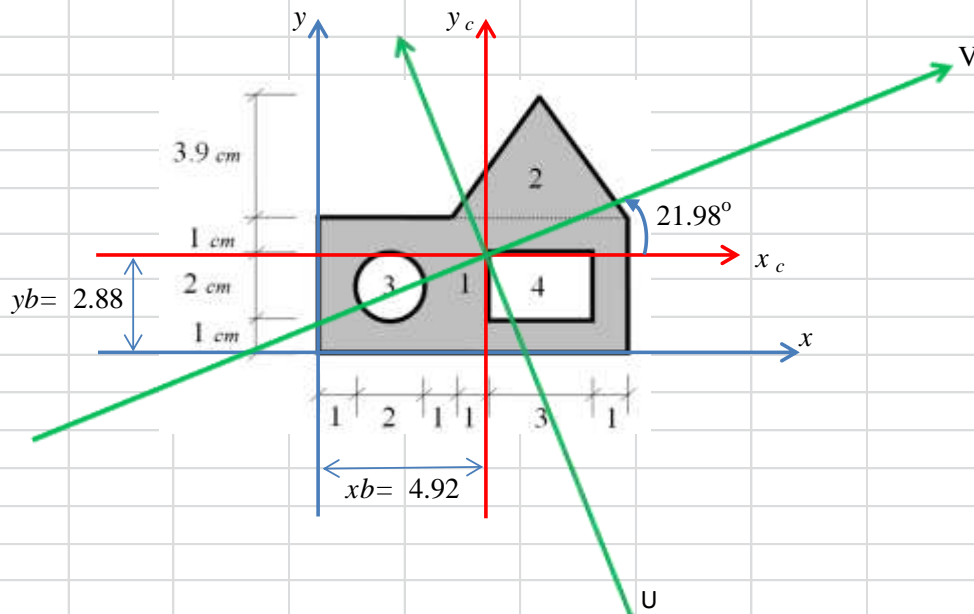
- (a) The location of the centroid.
- (b) The moments of inertia about the centroidal axes.
- (c) The direction of the principal axes.
- (d) The principal moments of inertia.



Solution:

Element	A	x	y	A x	A y	x-xb	y-yb	I_x	$A(y-yb)^2$	I_y	$A(x-xb)^2$	I_{xy}
1	36.00	4.5	2.0	162.00	72.00	-0.42	-0.88	48.00	27.81	243.00	6.33	13.27
2	9.75	6.5	5.3	63.38	51.68	1.58	2.42	8.24	57.15	10.16	24.36	37.31
3	-3.14	2.0	2.0	-6.28	-6.28	-2.92	-0.88	-0.79	-2.43	-0.79	-26.78	-8.06
4	-6.00	6.5	2.0	-39.00	-12.00	1.58	-0.88	-2.00	-4.63	-4.50	-14.99	8.34
	36.61			180.09	105.39			53.45	77.90	247.87	-11.07	50.86

$xb =$	4.92 cm	$I_x =$	131.35 cm ⁴	$I_u =$	257.33 cm ⁴	$2 \theta =$	43.97
$yb =$	2.88 cm	$I_y =$	236.80 cm ⁴	$I_v =$	110.82 cm ⁴	$\theta =$	21.98



$xb =$ 4.92 cm	$I_x =$ 131.35 cm ⁴	$I_u =$ 257.33 cm ⁴	$2\theta =$ 43.97
$yb =$ 2.88 cm	$I_y =$ 236.80 cm ⁴	$I_v =$ 110.82 cm ⁴	$\theta =$ 21.98