ARCH 614: Practice Quiz 4

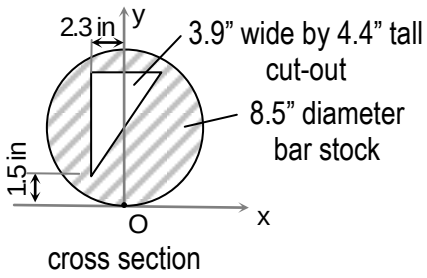
*Note: No aids are allowed for part 1. One side of a letter sized paper with notes is allowed during part 2, along with a silent, **non-programm**able calculator. There is a reference chart for part 2 on page 2.*

Clearly show your work and answer.

Part 1) Worth 5 points
(conceptual questions)

Part 2) Worth 45 points

(NOTE: The units, dimensions, and basic shapes <u>can and will</u> be changed for the quiz! The shape will most likely consist of a solid with a hole of some type.)



A beam has a maximum shear of V = 3.2 k, and maximum bending moment of M = 56 k-ft. If the beam has the cross section shape and reference origin as shown to the right, find:

a) The location of the centroid of the shape (*vertically and horizontally)*.

b) The moment of inertia about the x axis, I_x, of the section [*or* about the y axis, I_y].

c) The maximum bending stress, f_b, about the x axis for the section [if I_x is determined in part b) *or* is given as 246.68 in.^{4}].

	A (in^2)	$\bar{x}$ (in)	$\bar{x}A$ (in^2)	$\bar{y}$ (in)	$\bar{y}A$ (in)	I_x (in^4)	d_y (in)	Ad_y^2 (in^3)
solid								
hole								

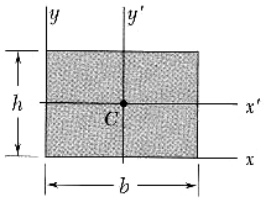
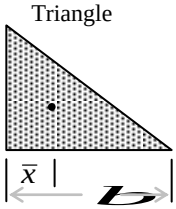
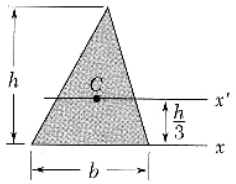
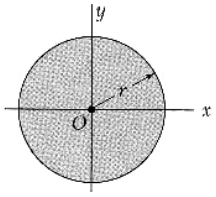
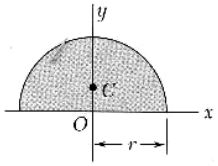
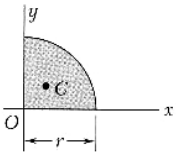
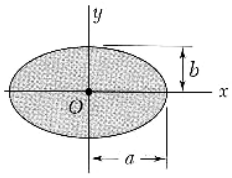
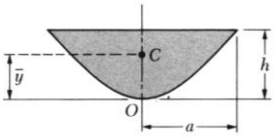
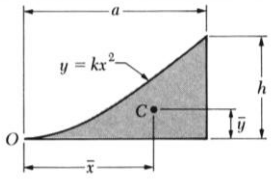
Answers – <u>Not provided on actual quiz!</u>

a) $\hat{x}$ = 0.18 in, $\hat{y}$ = 4.22 in
b) I_x = 246.68 in^4 [or I_y = 238.88 in^4]
c) f_b = 11.7 ksi

Disclaimer: Answers have NOT been painstakingly researched.

REFERENCE CHART FOR QUIZ 4

Geometric Properties of Areas

Rectangle		$\bar{I}_{x'} = \frac{1}{12}bh^3$ $\bar{I}_{y'} = \frac{1}{12}b^3h$ $I_x = \frac{1}{3}bh^3$ about bottom $I_y = \frac{1}{3}b^3h$ left $J_C = \frac{1}{12}bh(b^2 + h^2)$	Area = bh $\bar{x}$ = b/2 $\bar{y}$ = h/2
Triangle 		$\bar{I}_{x'} = \frac{1}{36}bh^3$ $I_x = \frac{1}{12}bh^3$ $\bar{I}_{y'} = \frac{1}{36}b^3h$	Area = $bh/2$ $\bar{x} = b/3$ $\bar{y} = h/3$
Circle		$\bar{I}_x = \bar{I}_y = \frac{1}{4}\pi r^4$ $J_O = \frac{1}{2}\pi r^4$	Area = $\pi r^2 = \pi d^2/4$ $\bar{x}$ = 0 $\bar{y}$ = 0
Semicircle		$\bar{I}_x$ = 0.1098r⁴ $\bar{I}_y$ = πr⁴/8	Area = $\pi r^2/2 = \pi d^2/8$ $\bar{x}$ = 0 $\bar{y} = 4r/3\pi$
Quarter circle		$\bar{I}_x$ = 0.0549r⁴ $\bar{I}_y$ = 0.0549r⁴	Area = $\pi r^2/4 = \pi d^2/16$ $\bar{x} = 4r/3\pi$ $\bar{y} = 4r/3\pi$
Ellipse		$\bar{I}_x = \frac{1}{4}\pi ab^3$ $\bar{I}_y = \frac{1}{4}\pi a^3b$ $J_O = \frac{1}{4}\pi ab(a^2 + b^2)$	Area = πab $\bar{x}$ = 0 $\bar{y}$ = 0
Semiparabolic area Parabolic area		$\bar{I}_x$ = 16ah³/175 $\bar{I}_y$ = 4a³h/15	Area = $4ah/3$ $\bar{x}$ = 0 $\bar{y} = 3h/5$
Parabolic spandrel		$\bar{I}_x$ = 37ah³/2100 $\bar{I}_y$ = a³h/80	Area = $ah/3$ $\bar{x} = 3a/4$ $\bar{y} = 3h/10$