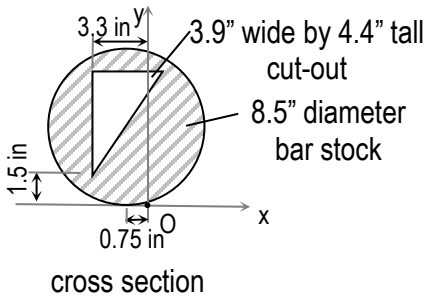
ARCH 614: Practice Quiz 3

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-programmable*** *calculator. There is a reference chart on page 2 for part 2.*



cross section

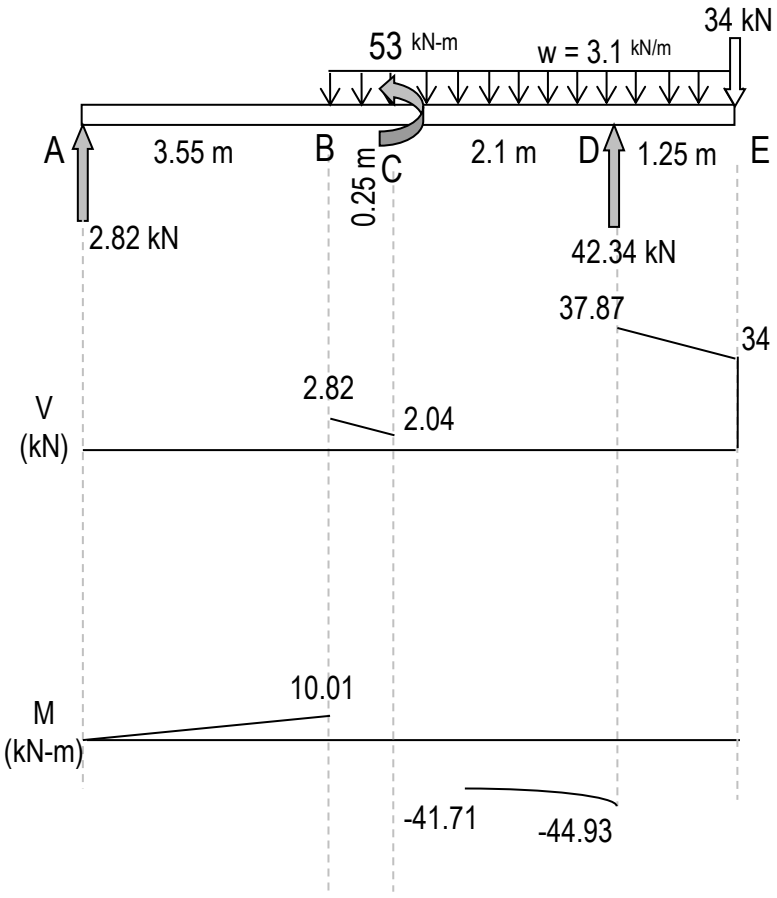
Clearly show your work and answer.

Part 1) Worth 5 points
(conceptual questions)

Part 2) Worth 45 points

(NOTE: The units, dimensions, loading and reactions for the beam can and will be changed for the quiz! The loading types will not. The units, dimensions, and basic shapes can and will be changed for the quiz! The shape will most likely consist of a solid with a hole of some type.)

Given the beam to the right with the following loading and for which all support reactions have been determined, find:



a) The completed shear diagram by indicating key values. Identify and locate the maximum shear necessary for design.

b) The completed bending moment diagram by indicating key values. Identify and locate the maximum bending moment necessary for design.

Complete the table for the cross section shown above to find:

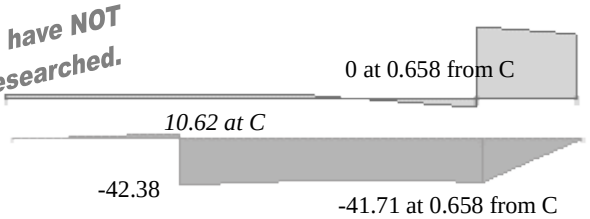
c) The moment of inertia about the x axis, I_x. when $\hat{x}$ = -0.53 in. and $\hat{y}$ = 4.22 in. [or y axis, I_y]

	A (in^2)	$\overline{y}$ (in)	I_x (in^4)	d_y (in)	Ad_y^2 (in^4)	$\overline{x}$ (in)	I_y (in^4)	d_x (in)	Ad_x^2 (in^4)
solid	56.74	4.25	256.24	-0.03	0.051	-0.75	256.24	0.22	2.75
hole	-8.58	4.43				-2			

Answers – Not provided on actual quiz!

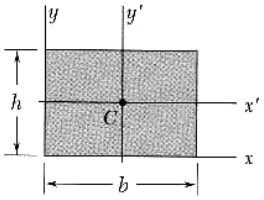
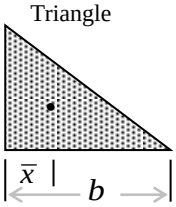
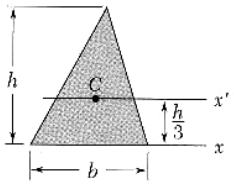
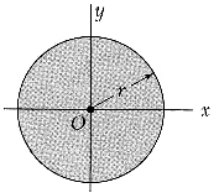
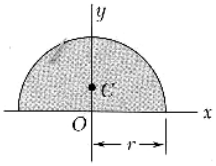
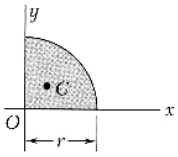
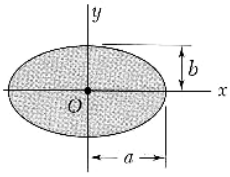
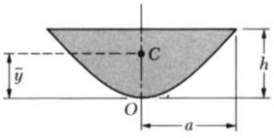
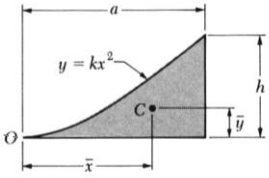
Disclaimer: Answers have NOT been painstakingly researched.

a) *values are not all marked*
b) V_{max} = 37.8 kN at D, M_{max} = -44.93 kN-m at D
c) I_x = 246.68 in^4 [or I_y = 233.2 in^4]



REFERENCE CHART FOR QUIZ 3

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 		$\bar{I}_{x'} = \frac{1}{36}bh^3$ $I_x = \frac{1}{12}bh^3$ about bottom $\bar{I}_{y'} = \frac{1}{36}b^3h$	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 $\bar{I}_y = \pi r^4/8$	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
Parabolic area		$\bar{I}_x = 16ah^3/175$ $\bar{I}_y = 4a^3h/15$	Area = $4ah/3$ $\bar{x}$ = 0 $\bar{y} = 3h/5$
Parabolic spandrel		$\bar{I}_x = 37ah^3/2100$ $\bar{I}_y = a^3h/80$	Area = $ah/3$ $\bar{x} = 3a/4$ $\bar{y} = 3h/10$