GNG 1105E – Midterm Exam

October 22 2015

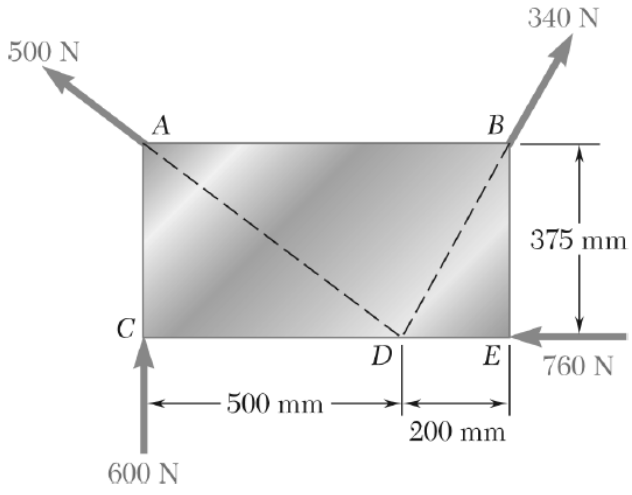
Student Number:_____

***NOTE: This exam is CLOSED BOOK and must be completed individually.**

- *Calculators are permitted.*
- *You have 1 hour and 15 minutes to complete this exam.*
- *There are **three** questions. Marks for each question are as indicated.*
- *Write your name at the top of **EACH PAGE** except the title page.*
- *This exam is double-sided. A formula sheet is provided at the back of the exam.*

Name:_____

1. Four forces act on a 700 x 375 mm plate as shown. Replace the given system of forces with a single resultant force.
    a. Find the magnitude and direction of the resultant of these forces. **[8 marks]**
    b. Locate the two points where the line of action of the resultant intersects the edge of the plate. **[7 marks]**
    c. Draw the plate with the resultant force applied. Clearly show the locations of the points identified in part b. **[2 marks]**

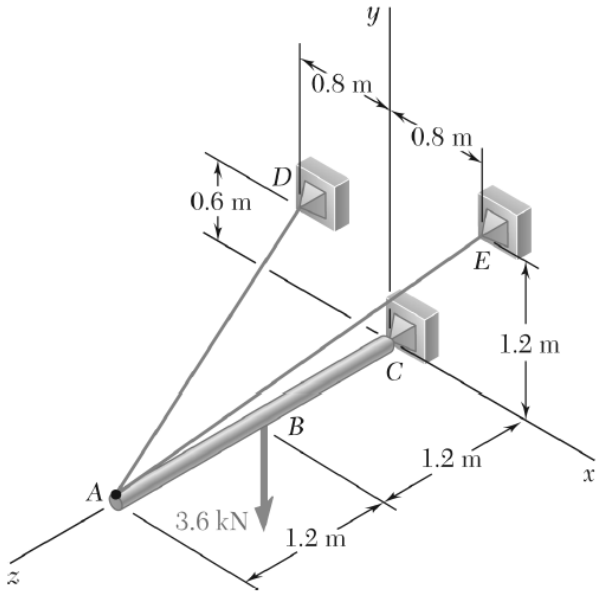


Name:_____

EXTRA WORKING SPACE FOR QUESTION 1:

Name:_____

2. A 2.4 m boom is held by a ball-and-socket joint at C and by two cables AD and AE.
   a. Draw the free-body diagram for member ABC **[5 marks]**
   b. Determine the tension in each cable **[10 marks]**
   c. Determine the reactions at C **[6 marks]**

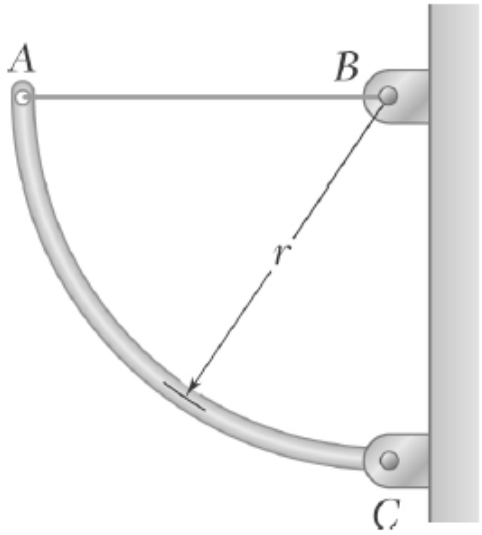


Name:_____

EXTRA WORKING SPACE FOR QUESTION 2:

Name:_____

3. A uniform circular rod of weight 40 N and radius 10 cm is attached to a pin at C and to the cable AB.
    a. Draw the free body diagram **[5 marks]**
    b. Determine the tension in the cable **[3 marks]**
    c. Determine the reactions at C **[4 marks]**



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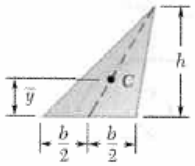
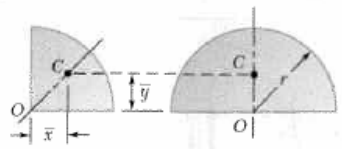
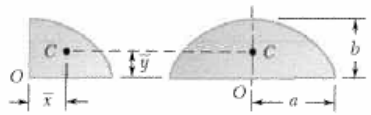
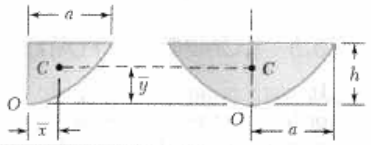
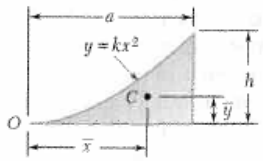
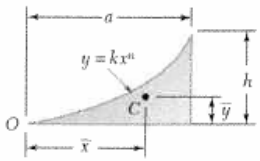
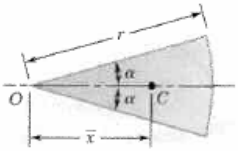
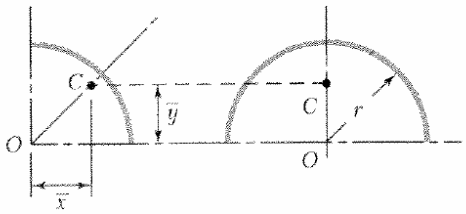
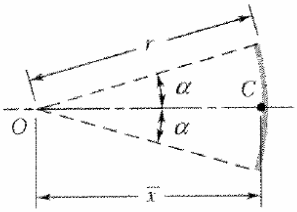
EXTRA WORKING SPACE FOR QUESTION 3:

Formula Sheet

Shape		$\bar{x}$	$\bar{y}$	Area
Triangular area			$\frac{h}{3}$	$\frac{bh}{2}$
Quarter-circular area		$\frac{4r}{3\pi}$	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{4}$
Semicircular area		0	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{2}$
Quarter-elliptical area		$\frac{4a}{3\pi}$	$\frac{4b}{3\pi}$	$\frac{\pi ab}{4}$
Semielliptical area		0	$\frac{4b}{3\pi}$	$\frac{\pi ab}{2}$
Semiparabolic area		$\frac{3a}{8}$	$\frac{3h}{5}$	$\frac{2ah}{3}$
Parabolic area		0	$\frac{3h}{5}$	$\frac{4ah}{3}$
Parabolic spandrel		$\frac{3a}{4}$	$\frac{3h}{10}$	$\frac{ah}{3}$
General spandrel		$\frac{n+1}{n+2}a$	$\frac{n+1}{4n+2}h$	$\frac{ah}{n+1}$
Circular sector		$\frac{2r\sin\alpha}{3\alpha}$	0	αr^2

Shape		$\bar{x}$	$\bar{y}$	Length
Quarter-circular arc		$\frac{2r}{\pi}$	$\frac{2r}{\pi}$	$\frac{\pi r}{2}$
Semicircular arc		0	$\frac{2r}{\pi}$	πr
Arc of circle		$\frac{r\sin\alpha}{\alpha}$	0	$2\alpha r$