PROF. J. A. PACKER..

CIV100 – MECHANICS – SECTION J

Quiz No. 2 – Wednesday, November 17, 2010

Time Allowed: 1 hour. This is a closed-book test. Questions 1 and 2 are of equal value.

Name (PRINT IN UPPER CASE): ____________________

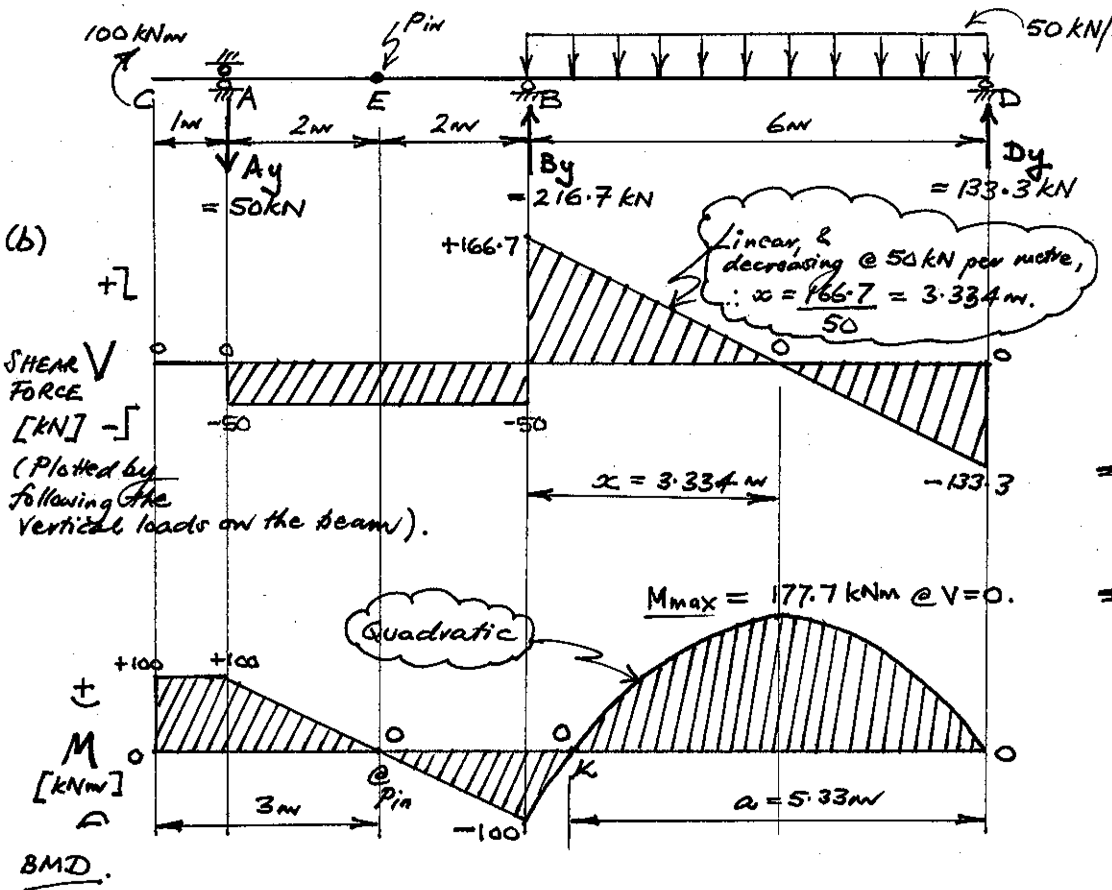
Student No: ____________________

Circle your calculator type: Casio 260 Sharp 520 Texas Instruments 30

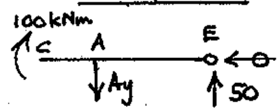
1. The statically-determinate beam, shown below, has roller supports at A, B and D, and an internal pin in the beam at E.

(a) Determine the reaction forces at A, B and D.

(b) Draw the Shear Force and Bending Moment Diagrams for CD. [Note that these must be drawn neatly, to approximate scale, and values of V and M must be given at all critical points on the diagrams (i.e. maxima, minima and at changes in slopes)]. Determine the maximum bending moment and indicate its location, as well as the points of zero bending moment.



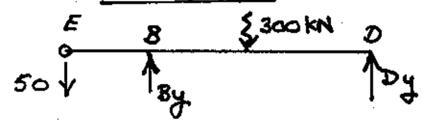
(a) FBD of CAE :—



$\Sigma M_E = 0 \therefore 100 - A_y(2) = 0$

$\therefore \underline{A_y = 50\text{kN} \downarrow}$

FBD of EBD :—



$\Sigma M_D = 0 \therefore 50(8) - B_y(6) + 300(3) = 0$

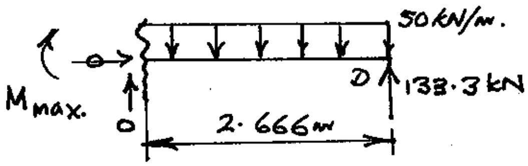
$\therefore \underline{B_y = 216.7 \text{ kN}} \uparrow$

$\Sigma F_y = 0 \therefore -50 + B_y - 300 + D_y = 0$

$\therefore \underline{D_y = 133.3 \text{ kN}} \uparrow$

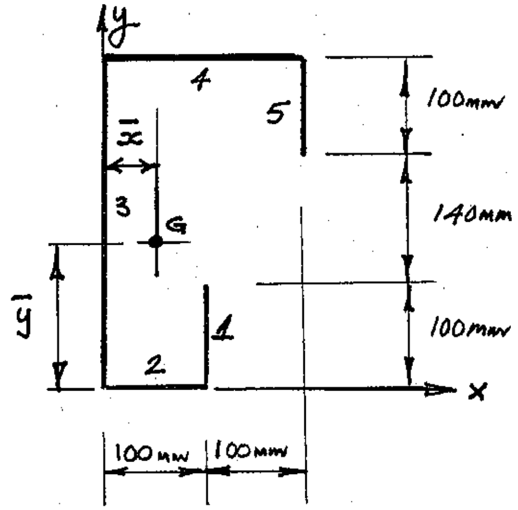
BMD.

- To locate point K, consider a FBD to right of K: $\Sigma M_K = 50(a)(\frac{a}{2}) - 133.3a = 0 \therefore 25a = 133.3$ $\therefore \underline{a = 5.332\text{m}}$
- To calculate Mmax, consider a FBD to right of Mmax :—



$\Sigma M_D = 0 \therefore \underline{M_{max.}} = 50(2.666)(\frac{2.666}{2}) = \underline{177.7 \text{ kNm.}}$

2. Determine the location of the centroid of the bent bar shown below.



$$\bar{x}\Sigma L = \Sigma x_i L_i \qquad \therefore \bar{x} = \frac{\Sigma x_i L_i}{\Sigma L}$$

$$\bar{y}\Sigma L = \Sigma y_i L_i \qquad \therefore \bar{y} = \frac{\Sigma y_i L_i}{\Sigma L}$$

Element No.	Length (mm)	x_i	y_i	$x_i L_i$	$y_i L_i$
1	100	100	50	10,000	5,000
2	100	50	0	5,000	0
3	340	0	170	0	57,800
4	200	100	340	20,000	68,000
5	100	200	290	20,000	29,000
	$\Sigma = 840$mm			$\Sigma = 55,000$	$\Sigma = 159,800$

$$\therefore \bar{x} = \frac{55,000}{840} = \underline{65.5\text{mm}}$$

$$\& \ \bar{y} = \frac{159,800}{840} = \underline{190.2\text{mm}}$$