

**MECHANICS SWK122 MEGANIKA**  
**RE-EXAMINATION – HEREKSAMEN**

VAN en VOORLETTERS	HANDTEKENING	STUDENTENOMMER							
		1	2	3	4	5	6	7	8
SURNAME and INITIALS	SIGNATURE	STUDENT NUMBER							

**Volpunte / Full Marks: 60**

**Tyd / Time: 1½ ure / hours**

**1 December 2008**

1	2	3	4	Σ	
20	10	10	20	60	

**INSTRUCTIONS ..... READ:**

- ⇒ Answer all questions in the provided spaces.
- ⇒ The invigilators will supply no additional or loose pages.
- ⇒ The final blank page may be used as a scratch pad but this page will not be marked.
- ⇒ Answers in pencil will not be marked.
- ⇒ Tippex or any other similar product may not be used.
- ⇒ No highlighter may be used.
- ⇒ Students may ask no questions for whatever reason during the exam or test. If you are of the opinion that you need additional information, make assumptions and state these assumptions.
- ⇒ The relevant units must substantiate all answers.
- ⇒ All aspects as described in the EXAMINATION REGULATIONS are applicable.
- ⇒ All calculations to reach an answer must be shown.

**INSTRUKSIES..... LEES:**

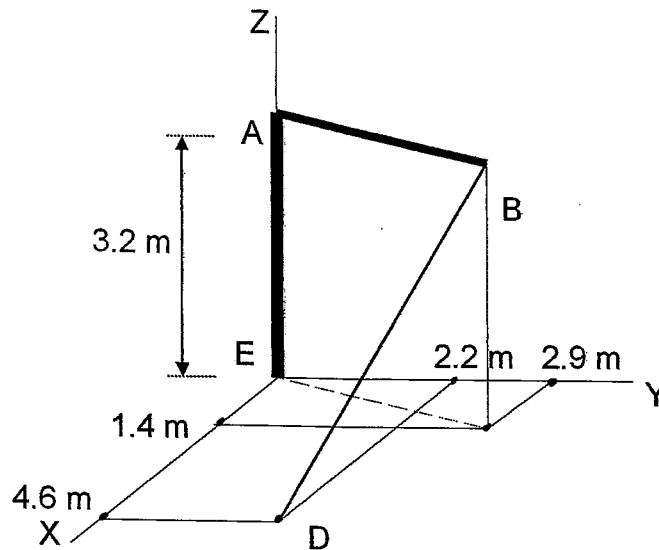
- ⇒ Beantwoord alle vrae in die spasies voorsien.
- ⇒ Die toesighouers sal geen addisionele of los bladsye voorsien nie.
- ⇒ Rofwerk mag op die laaste blanko bladsy gedoen word en hierdie bladsy word nie gemerk nie.
- ⇒ Antwoorde in potlood word nie gemerk nie.
- ⇒ Tippex of enige soortgelyke produk mag nie gebruik word nie.
- ⇒ Geen glimpen [ "highlighter" ] mag gebruik word nie.
- ⇒ Studente mag nie tydens die eksamen vrae vra nie – om watter rede ookal. Indien u van mening is dat addisionele inligting benodig word, maak aannames en stel die aannames.
- ⇒ Alle antwoorde moet deur die nodige eenhede bevestig word.
- ⇒ Alle aspekte soos vervat in die EKSAMENREGULASIES is van toepassing.
- ⇒ Alle berekeninge om antwoorde te bepaal moet getoon word.

<b>Dosente / Lecturers:</b> Prof H Gräbe Dr E Chaparanganda	Prof L Maree Mr J Pretorius	Prof C Roth Mnr F van Graan
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<b>Eksterne Eksaminator / External Examiner:</b> Prof BWJ VAN RENSBURG
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**QUESTION 1 / VRAAG 1**

**[20]**



**FIGURE 1 / FIGUUR 1**

The force in cable BD is 24 kN. Pole EA weighs 20 kN and arm AB weighs 10.2 kN. Arm AB is horizontal.

Die krag in kabel BD is 24 kN. Paal EA weeg 20 kN en arm AB weeg 10.2 kN. Arm AB is horisontaal.

**1[a].** Draw the Free Body Diagram for the structure on FIGURE 1.

**[3]**

Teken die Vryliggaamskets vir die struktuur op FIGUUR 1.

**1[b].** Calculate the length of cable BD.

**[2]**

Bereken die lengte van kabel BD.

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**1[c].** Write the force in cable DB in Cartesian format.

**[2]**

Skryf die krag in kabel DB in Cartesiese formaat.

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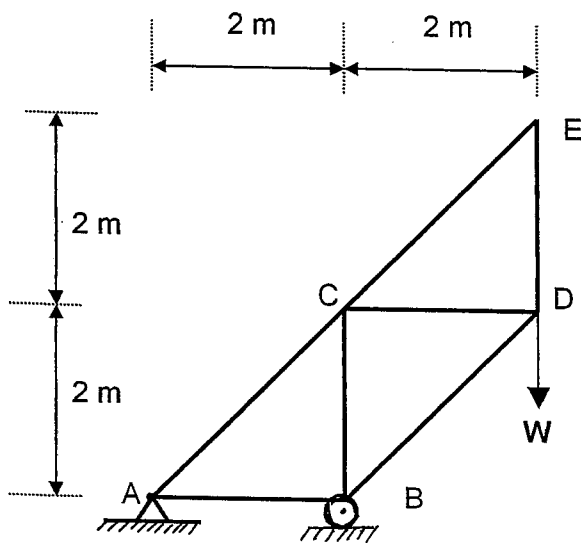


**QUESTION 2 / VRAAG 2**

**[10]**

The members of the given truss are all connected by means of smooth pins.

Alle dele van die gegewe vakwerk is met gladde penne verbind.



**2[a]** Calculate the horizontal and vertical components of the reactions at A and B.

**[2]**

Bereken die horisontale en vertikale komponente van die reaksies by A en B.

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**2[b]** Determine if there are any zero force members and, if any, note these members in Table 1.

**[1]**

Bepaal of daar enige nulkragstange is en, indien wel, dui hierdie stange aan in Tabel 1.

Zero force members =

Nulkragstange =

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**Table 1 / Tabel 1**

**2[c]** Determine the maximum value of **W** if the maximum compression force in any structural member should not exceed 1 kN and the maximum tension force in any structural member should not exceed 1.2 kN. **[7]**

Bepaal die maksimum waarde van **W** indien die maksimum drukkrag in enige struktuurdeel nie 1 kN mag oorskrei nie en die maksimum trekkrag in enige struktuurdeel nie 1.2 kN mag oorskrei nie.

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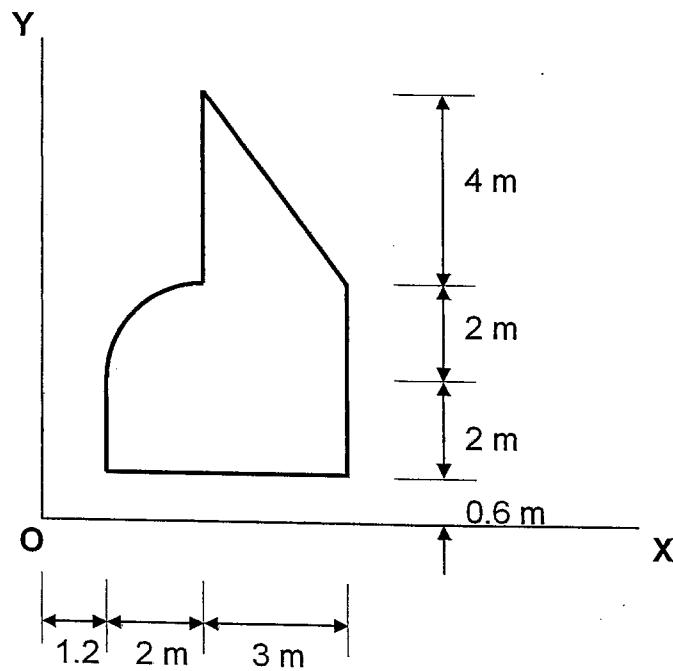
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**3[a]** Determine the **x** co-ordinate of the centroid of the given thin flat metal sheet.

**[4]**

Bepaal die **x**-koördinaat van die sentroïde van die gegewe dun plat metaalplaat.

This image shows a single sheet of white paper with ten evenly spaced horizontal dotted lines. The lines are black and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the paper.

**3[b]** Determine the Moment of Inertia of the given thin flat metal sheet about the **Y**-axis [  $I_Y$  ]. **[6]**

Bepaal die Traagheidsmoment van die gegewe dun plat metaalplaat om die **Y**-as [  $I_Y$  ].

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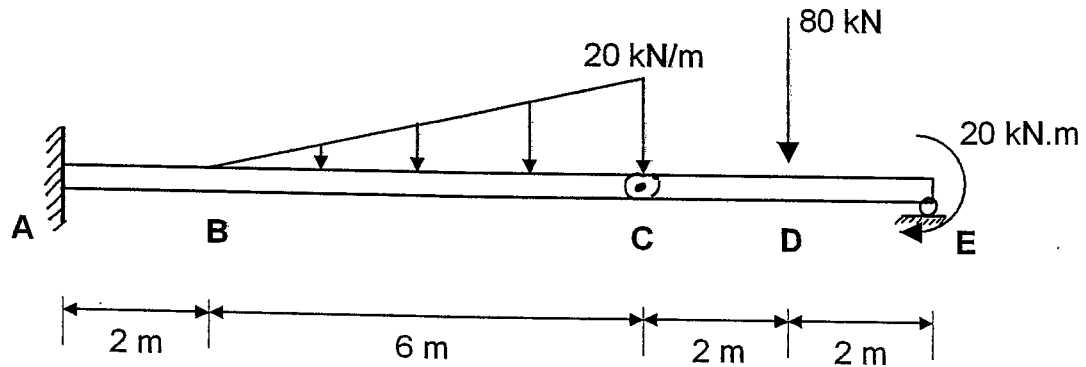
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**QUESTION 4 / VRAAG 4****[20]**

Beam AE is fixed at A, is supported by a roller at E and has a hinge at C.

Balk AE is ingebou by A, word ondersteun deur 'n roller by E en het 'n skarnier by C.



**4[a]** Calculate the reactions at A and E.

**[6]**

Bereken die reaksies by A en E.

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**4[b]** Design an equation [in terms of  $x$ ] that gives Bending Moment in region BC .

**[6]**

Ontwerp 'n uitdrukking [in terme van  $x$ ] wat Buigmoment in gebied BC gee.

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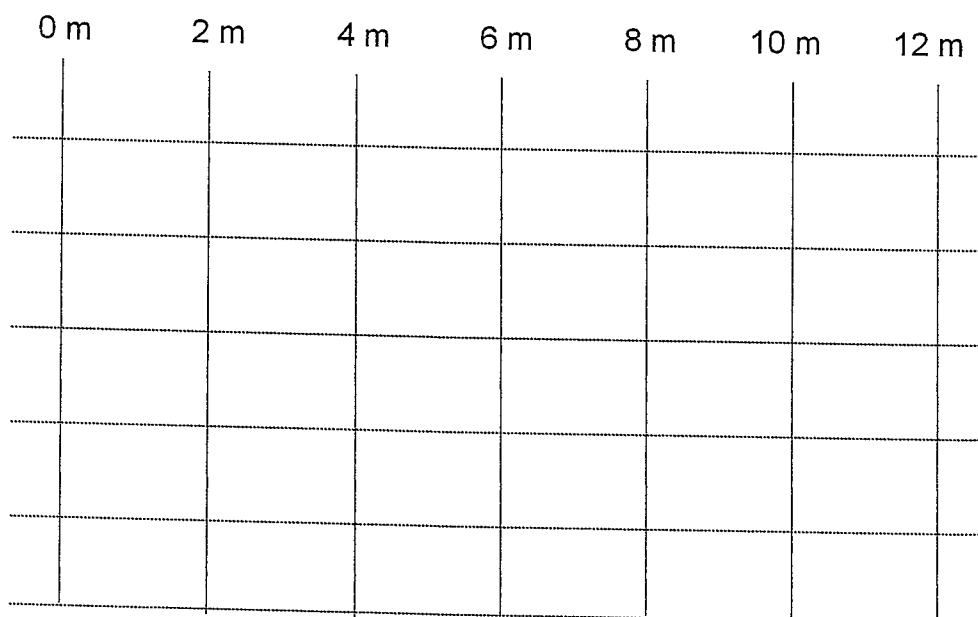
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**4[c]** Draw the Bending Moment Diagram for the beam and also indicate the values at every 2m interval.

**[8]**

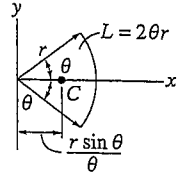
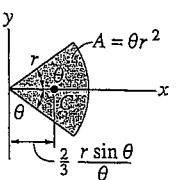
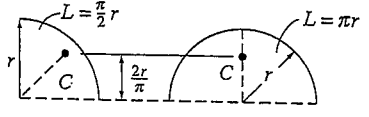
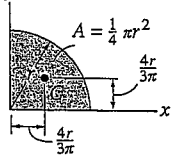
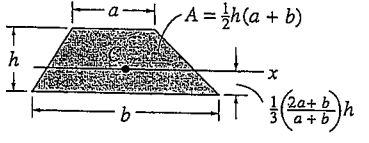
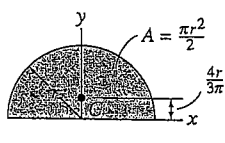
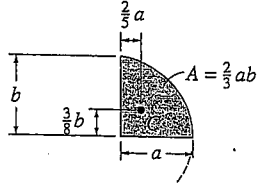
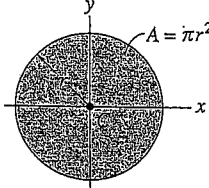
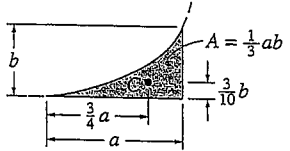
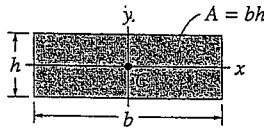
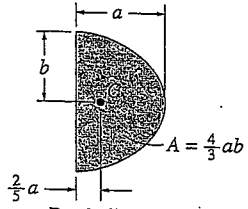
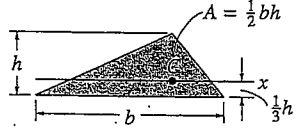
Teken die Buigmomentdiagram vir die balk en dui die waardes op elke 2m interval aan.



**BM in  
kN.m**

# INFORMATION SHEET / INLIGTINGSTABEL

## Geometric Properties of Line and Area Elements

<p>Centroid Location</p>  <p>Circular arc segment</p>	<p>Centroid Location</p>  <p>Area Moment of Inertia</p> $I_x = \frac{1}{4} r^4 (\theta - \frac{1}{2} \sin 2\theta)$ $I_y = \frac{1}{4} r^4 (\theta + \frac{1}{2} \sin 2\theta)$ <p>Circular sector area</p>
 <p>Quarter and semicircle arcs</p>	 $I_x = \frac{1}{16} \pi r^4$ $I_y = \frac{1}{16} \pi r^4$ <p>Quarter circle area</p>
 <p>Trapezoidal area</p>	 $I_x = \frac{1}{8} \pi r^4$ $I_y = \frac{1}{8} \pi r^4$ <p>Semicircular area</p>
 <p>Semiparabolic area</p>	 $I_x = \frac{1}{4} \pi r^4$ $I_y = \frac{1}{4} \pi r^4$ <p>Circular area</p>
 <p>Exparabolic area</p>	 $I_x = \frac{1}{12} b h^3$ $I_y = \frac{1}{12} h b^3$ <p>Rectangular area</p>
 <p>Parabolic area</p>	 $I_x = \frac{1}{36} b h^3$ <p>Triangular area</p>

## SCRATCHPAD / ROFWERK