



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD

MAY 2024

CYFNOD ARHOLIADAU

MAI 2024

MODULE CODE: ACBA4021
Engineering Mathematics

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required. Please select from the following:

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Cyfrifiannell/Calculator

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Llyfr Agored/Open Book

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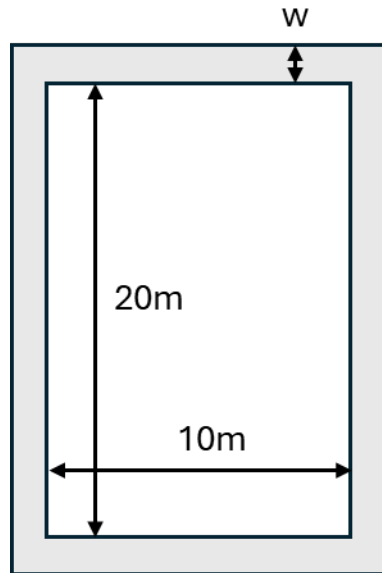
Arall/Other

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Nodwch/Please Note

ANSWER ALL QUESTIONS

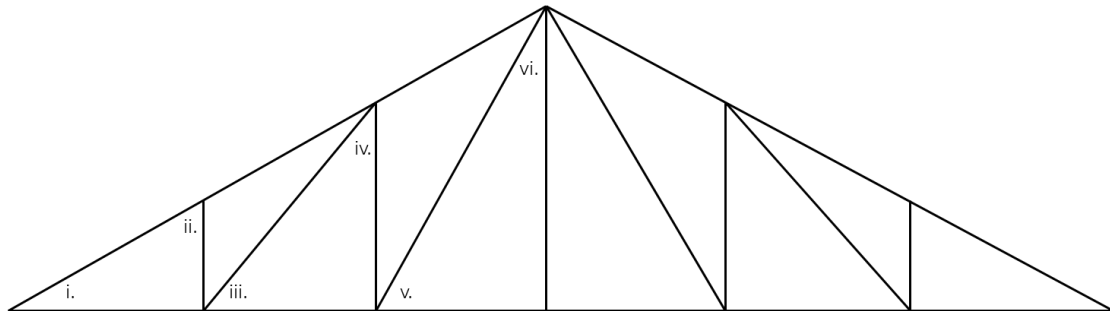
1. A construction company is designing a rectangular swimming pool that will have a deck of uniform width surrounding it. The dimensions of the swimming pool are 20m long and 10m wide. The total area of the pool plus deck is 600m^2 .



- Show that the width of the decking is 5m. [13 Marks]
- If the decking costs £65 per m^2 , what is the total cost of material. [2 Marks]
- If the pool has a uniform depth of 1.5m, calculate how long it will take to fill with water assuming a flow rate of $0.02\text{m}^3/\text{s}$. [5 Marks]

2. A beam of length 6m has a uniform distributed load, w in N give by $w = 800 + \frac{1}{2}x^3$ when x is the distance along the beam (m). The total load, P (N) about the origin is given by $P = \int_0^6 w dx$.
- Determine P . [9 Marks]
 - For the same beam, the moment, R (Nm) is given by $\int_0^6 (wx) \cdot dx$. Determine R . [11 Marks]

3. A double pratt roof truss has been designed for a roof. The truss must span 12m, with the ridge being 4m above the truss base. The truss is split horizontally into 6 equally sized segments.



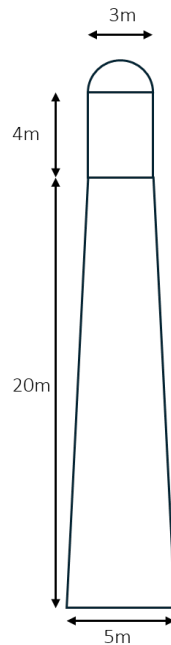
- Calculate the angles i to vi on the diagram. [10 Marks]
- Calculate the total amount of timber required for a single truss. [10 Marks]

4. A simple pulley system gives the equations:

$$\begin{aligned} a &= T - g \\ 2b &= T - 2g \\ a + b &= 0 \end{aligned}$$

Where a and b represent acceleration, T is the tension in the rope and g is the acceleration due to gravity. Determine x_1 , x_2 and T using Gaussian Elimination. [20 Marks]

5. A civil engineer is designing a lighthouse. The main structure of the lighthouse is a truncated cone (frustrum) with a height of 20m, a lower base diameter of 5m and an upper diameter of 3m. The light is housed in a cylindrical structure at the top of this frustrum with a diameter of 3m and height of 4m. The roof consists of a hemispherical dome with a diameter of 3m.



- Calculate the total surface area of the lighthouse. [10 Marks]
- Calculate the total volume of the lighthouse. [10 Marks]

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