

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
JANUARY 2025

CYFNOD ARHOLIADAU
IONAWR 2025

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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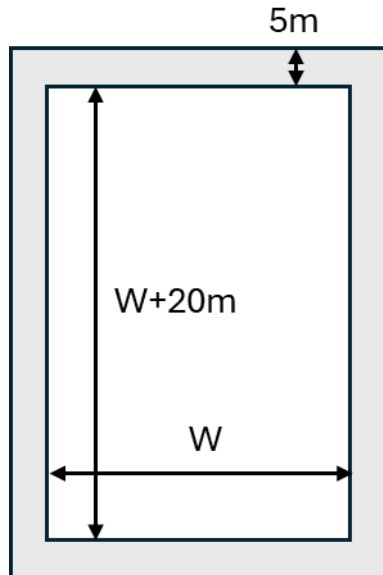
Arall/Other

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Nodwch/Please Note

ANSWER ALL QUESTIONS

1. You have been asked to design a concrete path that goes around the perimeter of a park. The length of the park is 20m more than it's width (w). The walkway has a uniform width of 5m. The total area of the park (excluding the path) is 2400m².



- Show that $w=40\text{m}$. [12 Marks]
 - Calculate the length of the park. [1 Mark]
 - If the concrete is going to have a uniform thickness of 20cm, calculate the quantity of concrete that is required. [5 Marks]
 - For security, a fence needs to be installed around the whole perimeter of the park. How long is the total length of fence? [2 Marks]
2. A rocket is fired vertically upwards with a height of h in metres is given by $h = 25t - 4.9t^2$ where the time of t in seconds is $0 \leq t \leq 5$.
- Find expressions for the velocity and acceleration. [10 Marks]
 - Determine the maximum height reached by the rocket. [10 Marks]

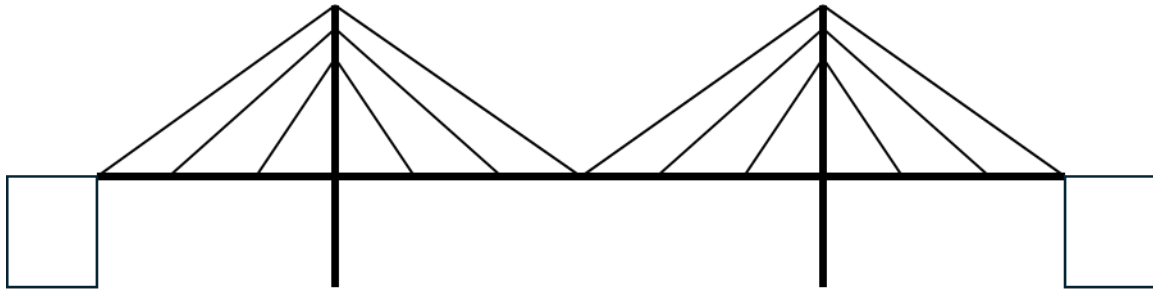
3. A simple pulley system gives the equations:

$$\begin{aligned}x_1 + x_2 &= 0 \\ -3x_1 + T &= 3g \\ -2x_2 + T &= 2g\end{aligned}$$

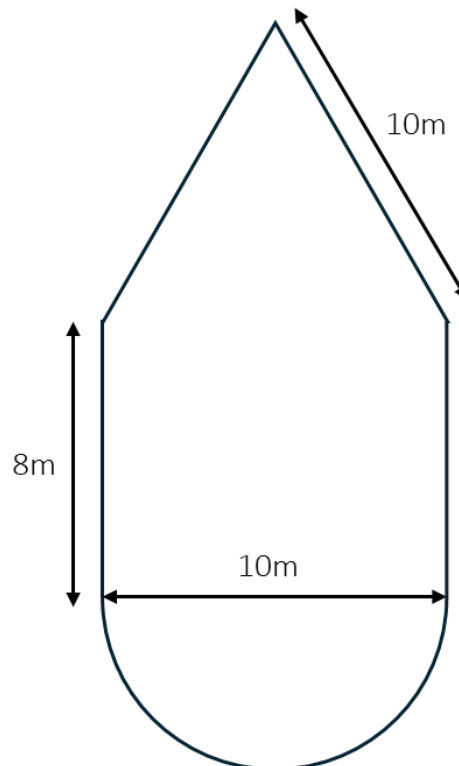
Where x_1 and x_2 represent acceleration, T is the tension in the rope and g is the acceleration due to gravity. Determine x_1 , x_2 and T . [20 Marks]

4. A cable-stayed bridge has been designed to span a gorge that is 120m wide. The towers are located 60m apart. The height of each tower above

the road deck is 25m. The cables are anchored at intervals of 10m along the road deck, and connect to the towers at intervals of 5m.



- Calculate the length of the longest cable connecting the road deck to the top of the tower. [5 Marks]
 - Calculate the angle that each cable makes with both the road deck and the tower. [9 Marks]
 - Determine the horizontal and vertical components of the force exerted by the cable attached to the top of the tower, assuming the tension in the cable is 200kN. [6 Marks]
5. A civil engineer is designing a cylindrical water tank with a conical top and hemispherical bottom. The cylindrical section has a height of 8m and a diameter of 10m. The conical top has a slant length of 10m.



- Calculate the total surface area of the tank. [9 Marks]
- Calculate the total volume of the tank. [11 Marks]

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