

PAPUR ARHOLIAD / EXAMINATION PAPER

LLEOLIAD / LOCATION:	ABERTAWE / SWANSEA
CYFNOD ARHOLIADAU / EXAMINATION PERIOD:	IONAWR 2026 / JANUARY 2026
LEFEL / LEVEL:	4

MODIWL / MODULE: ACBA4021 Engineering Mathematics

AMSER / TIME:	2 HOURS
CYFARWYDDIADAU / INSTRUCTIONS:	ANSWER <u>ALL</u> QUESTIONS

Adnoddau neu ddefnyddiau sydd eu hangen / Equipment or materials required:
Dewiswch o'r canlynol os gwelwch yn dda / Please select from the following:

Cyfrifiannell / Calculator ☒

Llyfr Agored / Open Book ☐

Llyfr Fformiwla / Formula Book ☒

Arall nodwch os gwelwch yn dda / Other please specify

DO NOT change Margins/Headers/Footers/Layout of Cover page

Font: Arial

Headings: **14px** and **BOLD**

Body text: 12px

Office Use Only:			
Author:		Semester:	
Internal Verifier:		R Y/N?	Yes / No (Please delete as applicable)
Contribution to Overall Module Assessment (%):			

ANSWER ALL QUESTIONS

1. You are tasked with designing a rectangular concrete slab for the foundation of a small equipment shelter. The length of the slab is 3m more than it's width (w). The area of the slab must be exactly 150m^2 .
 - a. Find the dimensions of the slab [10 Marks]
 - b. If the slab is to be poured to a thickness of 0.15m, what is the total volume of concrete required in cubic metres? [2 Marks]
 - c. To pour the concrete, a formwork is required around the perimeter of the slab, this will be made from plywood. What length of plywood will be required? [2 Marks]
 - d. If concrete is £120 per m^3 and plywood is £2.80 per m, what is the total material cost for the slab? Assume there will be 10% wastage of concrete. [4 Marks]
 - e. If the concrete is pumped at a rate of $0.01\text{m}^3/\text{s}$, how many minutes will it take to pour the whole slab? [2 Marks]

2. A concrete bucket is lifted vertically by a crane to pour concrete into formwork for a high-rise column. The height (h) in metres, of the bucket above the ground after (t) seconds is modelled by the function:

$$h(t) = 20t - 3.2t^2 \quad \text{where } 0 \leq t \leq 5$$

- a. Find expressions for the velocity and acceleration of the bucket as functions of time. [10 Marks]
- b. Determine the maximum height reached by the bucket and the time at which this occurs. [10 Marks]

3. In a simplified municipal water distribution system, three interconnected pipes distribute water from a main reservoir to different sectors of a town. The flow rates in the three pipes are represented by x_1 , x_2 and x_3 (in l/s). The system follows these constraints:

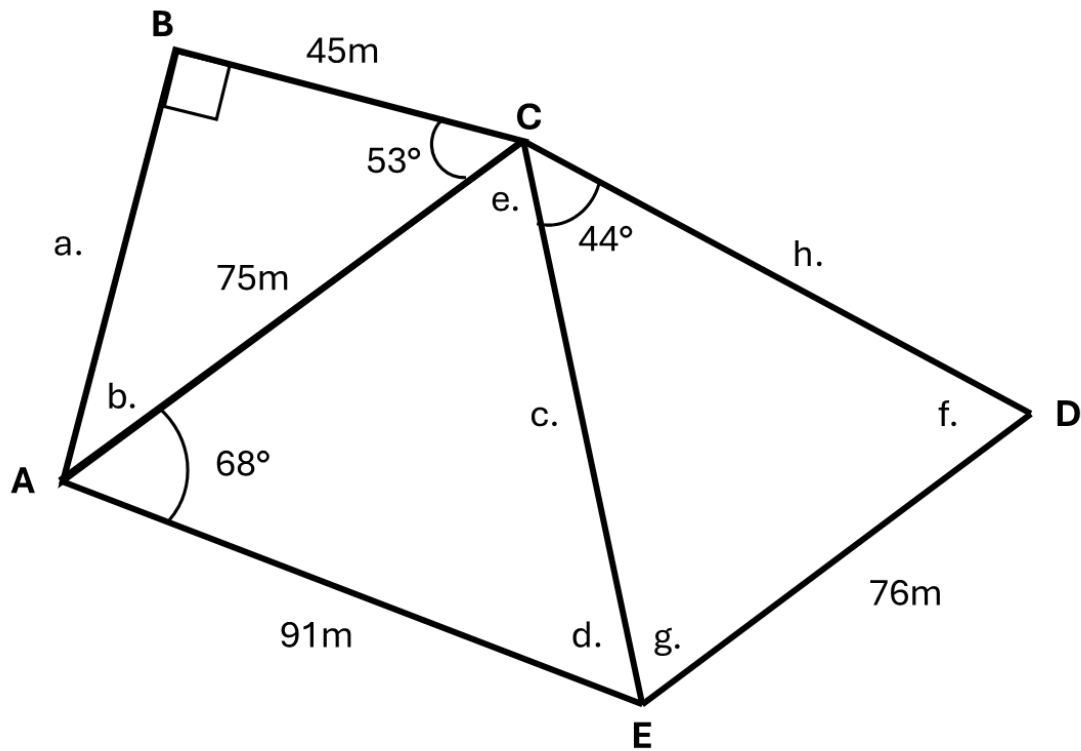
$$x_1 + x_2 = 5$$

$$2x_1 - x_3 = 10$$

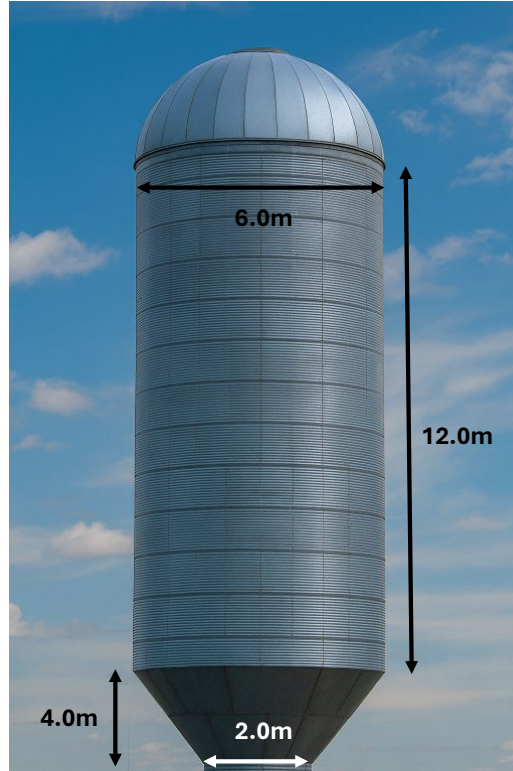
$$-x_2 + 3x_3 = 30$$

Determine the flow rates x_1 , x_2 and x_3 in the three pipes [20 Marks]

4. Three triangles of land are joined together to form a larger surveyed area, as shown below. Each triangle shares a side with the next, forming a continuous, irregular shape. A local council plans to develop these areas for community use and needs accurate measurements. Find the unknown angles (b, e, d, f, g) and lengths (a, c, h). [20 Marks]



5. An engineer is designing a storage silo that consists of a cylindrical body with a hemispherical top and a truncated cone bottom. The cylinder has a height of 12 m and a diameter of 6 m. The truncated cone bottom has a vertical height of 4 m and a bottom diameter of 2.0m, and the hemispherical top has the same radius as the cylinder.



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

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