

LOCATION:SWANSEA SA1

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

**EXAMINATION PERIOD
JANUARY 2025**

**CYFNOD ARHOLIADAU
IONAWR 2025**

MODULE CODE: ACMA4009

APPLIED ANALYTICS

TIME: 1.0 HOURS

15 minutes can be used before you start to familiarise yourselves with any formulae you need to complete the tasks and 15 minutes at the end to make your workings presentable.
(Total time for submission is 1.5 hours)

Equipment or materials required –

Calculators allowed

Formula booklets provided

ANSWER ALL QUESTIONS

CERTIFICATE OF HIGHER EDUCATION :APPLIED ANALYTICS

TASK DESCRIPTION

Consider each of the following problems and answer **all** questions.
Total marks (65) which constitutes 100%

1. Write down the base units for the following:

[5]

- a) Temperature Kelvin (K)
- b) Luminous Intensity candela (cd)
- c) Volume Cubic meter (m³)
- d) Displacement meter (m)
- e) Time second (s)

$$P = \frac{\text{kg}}{\text{m} \cdot \text{s}^2}$$

2. Given that Pressure is defined as;

$$\text{Pressure} = \text{Force} / \text{Area} \quad \text{mass (kg)}$$

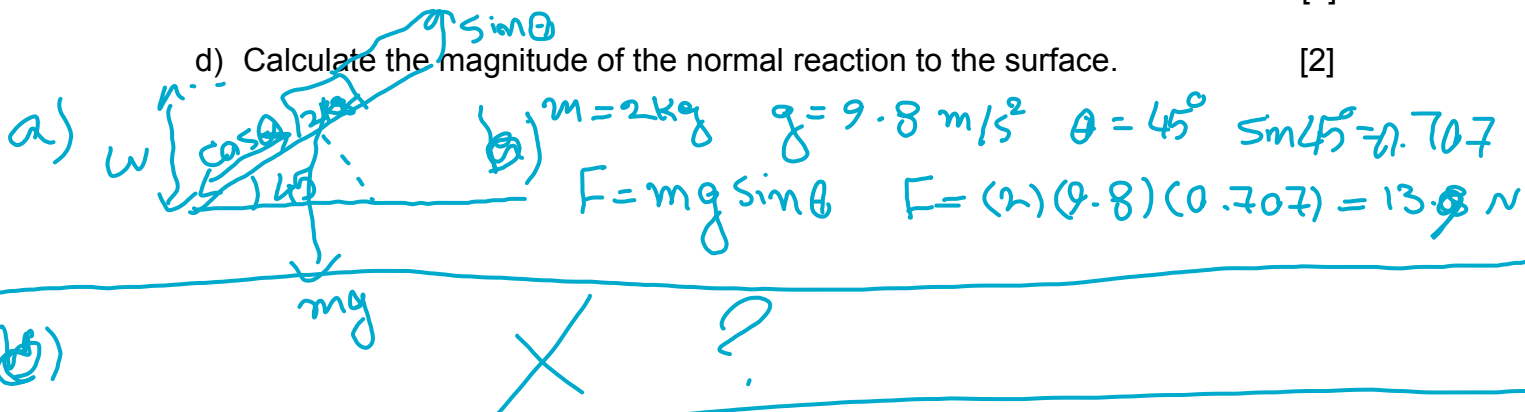
Write down the base units of Pressure. $F = m \cdot a \rightarrow \text{acceleration (m/s}^2\text{)}$ [5]

$$F = \text{kg} \cdot \text{m/s} = \text{N} \quad \text{Area} = \text{m}^2 \quad \text{pressure} = \frac{\text{N}}{\text{m}^2} = \frac{\text{kg} \cdot \text{m/s}}{\text{m}^2}$$

3. A body of mass 2kg rests in limiting equilibrium on a rough inclined plane, which is at an angle of 45° to the horizontal.

- a) Draw a free body diagram in your answer booklet showing the frictional force, normal reaction and the component of weight that acts down the slope. [3]
- b) Calculate the maximum magnitude of frictional force. [4]
- c) State which of the other forces are equal and give a reason why you can state this without calculation. [2]

d) Calculate the magnitude of the normal reaction to the surface. [2]



d) $R = mg \cos \theta \quad \cos 45^\circ = 0.707 \quad R = (2)(9.8)(0.707)$
 $R = 13.9 \text{ N}$

4. Solve the following by **factorising**:

i) $x^2 - 5x + 6 = 0$ $(x-2)(x-3) = 0$ $(x-2)=0$ $(x-3)=0$ $\boxed{x=2}$ $\boxed{x=3}$ [3]

ii) $x^2 + 7x + 6 = 0$ $(x+1)(x+6) = 0$ $(x+1)=0$ $\boxed{x=-1}$ $(x+6)=0$ $\boxed{x=-6}$ [3]

iii) $x^2 + 10x = -25$ $x^2 + 10x + 25 = 0$ $(x+5)^2 = 0$ $\boxed{x=-5, -5}$ [3]

iv) $x^2 - 2x - 15 = 0$ $(x+3)(x-5) = 0$ $(x+3)=0$ $\boxed{x=-3}$
 $(x-5)=0$ $\boxed{x=5}$ [3]

v) $2x^2 + 3x + 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(1)}}{2(2)}$
 $x = \frac{3 \pm 1}{4}$ $x = \frac{4}{4}$ $\boxed{x=1}$ $x = \frac{2}{4}$ $\boxed{x=\frac{1}{2}}$ [3]

5. Solve the following (to 2d.p's) by using the **quadratic formula**:

(i) $x^2 - 4x - 1 = 0$ $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-1)}}{2(1)} = \frac{4 \pm \sqrt{16+4}}{2}$
 $x = \frac{4 \pm 2\sqrt{5}}{2} \Rightarrow \boxed{x=2 \pm \sqrt{5}}$ [5]

(ii) $2x^2 + 3x - 1 = 0$ $x = \frac{-3 \pm \sqrt{3^2 - 4(2)(-1)}}{2(2)} = \frac{-3 \pm \sqrt{9+8}}{4} = \frac{-3 \pm \sqrt{17}}{4}$
 $x = \frac{-3 \pm \sqrt{17}}{4}$ $\boxed{x = \frac{-3 + \sqrt{17}}{4}}$ $\boxed{x = \frac{-3 - \sqrt{17}}{4}}$ [5]

6 Solve the following equations

(i) $\frac{3(x-1)}{2} = \frac{x+2}{4}$ $\frac{3x-3}{2} = \frac{x+2}{4} \Rightarrow \frac{6x-6}{4} = \frac{x+2}{4}$ [5]
 $6x-6 = x+2 \Rightarrow 6x-x = 6+2$ $5x = 8$ $\boxed{x = \frac{8}{5}}$

(ii) $2x + 5y = 7$
 $3x + 2y = 5$ [5]
 $\begin{cases} (3)2x + 5y = 7 \\ (2)3x + 2y = 5 \end{cases} + \begin{cases} 6x + 15y = 21 \\ -6x - 4y = -10 \end{cases}$
 $11y = 11 \Rightarrow \boxed{y=1}$ $2x+5=7$ $2x=2$
 $\boxed{x=1}$

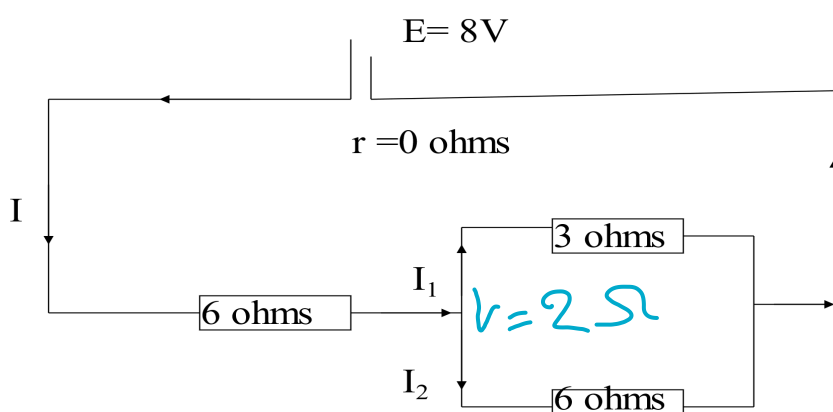
7. For the following electrical circuit :

Find:

- a) The total resistance of the circuit
- b) Current I_2 in the branched circuit.
- c) The power supplied by the cell.

$$\begin{aligned} E &= 8V \\ r &= 0\Omega \\ R &= 6\Omega \\ I_1 &= 3A \\ I_2 &= 6A \end{aligned}$$

$$\frac{1}{R_{\text{parallel}}} = \frac{1}{3} + \frac{1}{6} = \frac{1}{2}$$
$$R = 2$$



$$R_{\text{total}} = 6\Omega + 2\Omega = 8\Omega$$

$$R_{\text{total}} = 8\Omega$$

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