



Faculty of Education  
Department of mathematics

Final Examination  
Static 1 (Mat 117)  
1<sup>st</sup> level (Math. Dep.)

Time: 2 Hours  
Date: 28/12/2023  
1<sup>st</sup> semester 2023/2024

Answer all the following questions:

**Question (1):**

- (a) The velocity of a car is given  $\vec{v} = 4\hat{i} + 3\hat{j}$  m/sec  
(i) Find the speed (magnitude of  $\vec{v}$ ) of the car.  
(ii) Find a unit vector in the direction of  $\vec{v}$ .  
(iii) Write the velocity vector as a product of its magnitude and the unit vector.

$$\frac{5}{\sqrt{10}}$$

- (b) Find the angle between the two following vectors

$$6 + 2 + 3$$

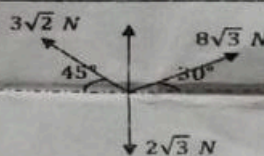
$$\vec{A} = 3\hat{i} - 2\hat{j} + \hat{k}, \quad \vec{B} = 2\hat{i} + \hat{j} + 3\hat{k}$$

- (c) Prove that

$$(i) (\vec{A} \cdot \vec{B})^2 = A^2 B^2 - |\vec{A} \wedge \vec{B}|^2 \quad (ii) \vec{A} \wedge (\vec{B} \wedge \vec{C}) = (\vec{C} \cdot \vec{A})\vec{B} - (\vec{A} \cdot \vec{B})\vec{C}$$

**Question (2):**

- (a) Find the magnitude and direction of the resultant forces which appear in the following diagram?



- (b) If the algebraic sum for the moment about the points (0,0), (1,1), (2,0) are 5, 10, 15 Nm.

Find the magnitude, direction, and the line of the resultant force.

- (c) Two blocks  $w_1, w_2$  are placed on two rough inclined planes whose inclination on the horizontal is  $\alpha$ , where,  $w_1 \geq w_2$ . These blocks are connected by a string that passes on a smooth roller at the highest level. If these blocks impending to move, prove that:  
 $\tan \alpha = \mu(w_1 + w_2) / (w_1 - w_2)$ , where  $\mu$  is the friction coefficient.

**Question (3):**

- (a) Calculate the center of mass for a lamina in the form of triangle.  
(b) Find the center of mass for a circular arc which has a central angle  $2\alpha$ .

انتموه الاسئلة

مع تمنياتي بالتوفيق والنجاح