

Study Guide (Midterm II)

1. Additional Math Concepts

Vector calculation

Multiplying: Scalar (dot) product, (definition, calculation)

$$\vec{A} \cdot \vec{B} = |\vec{A}| |\vec{B}| \cos \varphi$$

2. Forces (continued after Midterm I):

A. Normal force and friction.

1. Directions of the normal forces and frictions.
2. Static friction and kinetic friction
3. What is the relation between friction and the normal force?

B. Application of Newton's Laws:

1. System in rest (equilibrium require the total force is zero)
2. System in motion with acceleration needs to apply the Newton's second Law.

Examples: tilted surfaces, projectile objects, objects linked by strings.

3. Work and Energy:

A. Definition of work, and kinetic energy. What are their units? Are they scalar or vector? (Potential energy will be covered in next test)

B. Work theorem: $W = \Delta E = E_f - E_i$

C. How do we calculate work and kinetic energy?

1. Work done along by constant force,
2. Work done by a force which is not at the same direction of the displacement,
3. Special case, work done by gravitational force.

D. Applications of mechanical energy:

2. Using work-energy relation to find out velocities, height, etc.

4. Momentum

Definition of momentum, impulse.

Momentum conservation. (When no EXTERNAL forces on the system.)

(how to select a system? What forces are internal, external?)

Application: (collision, explosion, changing mass/rocket)

Under what situation the momentum is approximately conserved?