

PHYS121 2021-2022 Spring Semester
First Midterm, March 29, 2022;17:30
90 minutes

1	2	3	4	5	Total

Name Surname: Student No:Lecturer:.....

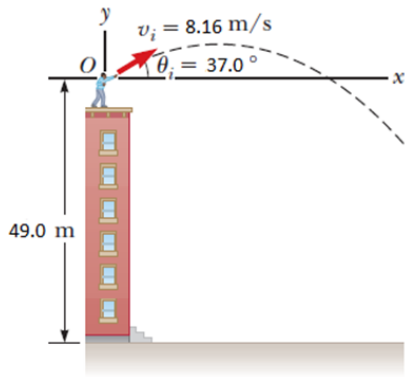
Calculators are allowed but not their exchange. Each question is worth 20 points

Take $g=9,80 \text{ m/s}^2$. Good luck.

1. The two vectors are given by $\vec{a} = 4\hat{i} + 3\hat{j} - 5\hat{k}$ and $\vec{b} = -1\hat{i} + 2\hat{j} - 6\hat{k}$ in three dimensional cartesian coordinate system. Find

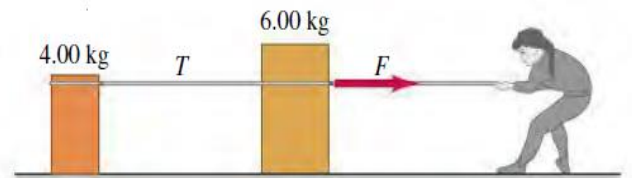
- the magnitude of \vec{a} and \vec{b}
- scalar product of $\vec{a} \cdot \vec{b}$
- the angle ϕ between the vectors \vec{a} and \vec{b}

2. A car travels at a speed of 30 m/s for 30 s along the right path. The car then moves with a constant acceleration for 40 s until reaches a speed of 50 m/s. Then it continues for 10 s at that speed and then stops for a period of 50 s by decelerating with constant acceleration.
- Plot the speed time of the car.
 - Calculate the acceleration at the moment of deceleration
 - Calculate the total displacement of the car.



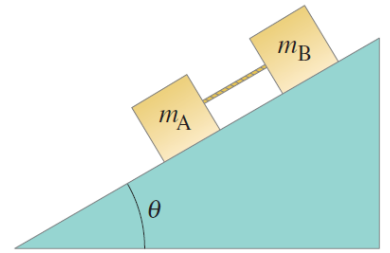
3. A stone is thrown from the top of a building upward at an angle of 37.0° to the horizontal with an initial speed of 8.16 m/s as shown in Figure . The height from which the stone is thrown is 49.0 m above the ground.

- How long does it take the stone to reach the ground?
- What is the speed of the stone just before it strikes the ground?



- 4.** Two crates, one with mass 4.0 kg and the other with mass 6.0 kg, sit on the frictionless surface of a frozen pond, connected by a light rope (shown in the figure). A woman wearing golf shoes (for traction) pulls horizontally on the 6.00-kg crate with a force F that gives the crate an acceleration of 2.50 m/s^2 .
- (a) Draw free-body diagrams.
 - (b) Calculate the tension T in the rope that connects the two crates.
 - (c) Calculate the magnitude of F ?

5. Two blocks made of different materials, connected by a thin cord, slide down a plane ramp inclined at an angle θ to the horizontal. The masses of the blocks are m_A and m_B and the coefficients of friction are μ_A and μ_B .
($m_A = 5\text{kg}$, $m_B = 5.0\text{ kg}$, $\mu_A = 0.20$, $\mu_B = 0.30$ and $\theta = 32^\circ$)



- a) Draw free-body diagrams.
- b) Find the acceleration of the blocks
- c) Find the tension in the cord