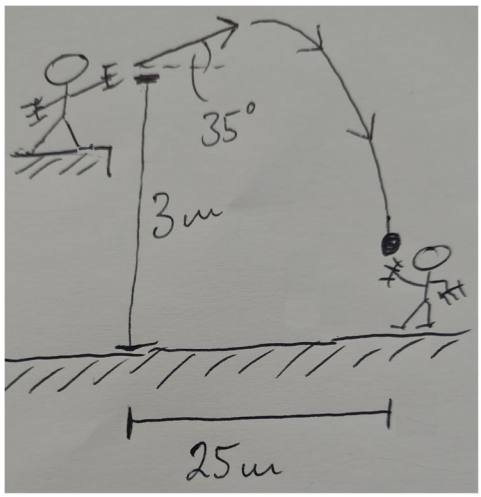
Midterm Exam (page 1/2)

Problem 1

A grasshopper jumps straight up to a maximum height of 0.600 m.
(a) What is its initial velocity as it leaves the ground?
(b) How long is it in the air before landing again?

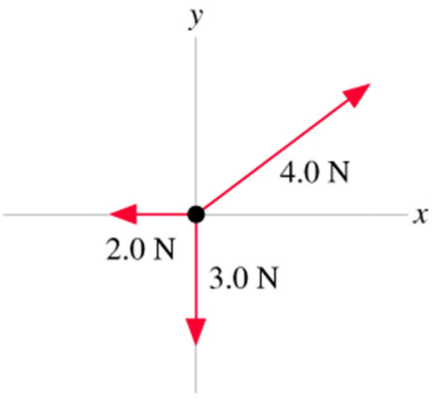
Problem 2

Daniel stands on an elevated platform. He throws a baseball at a height of 3 meters, and at an angle of 35° above the horizontal with a speed of 15 m/s. Maya is standing at a horizontal distance of 25 meters to Daniel when she catches the ball. How long does it take the ball to travel from Daniel to Maya, and at which height does she catch it?



Problem 3

Three forces act on an object as shown below. Assume that the mass of the object is 1 kg and that the angle between the force vector with magnitude 4N and the x-axis is 30 degrees. Compute the magnitude of the net acceleration vector of the object.



Please see next page!

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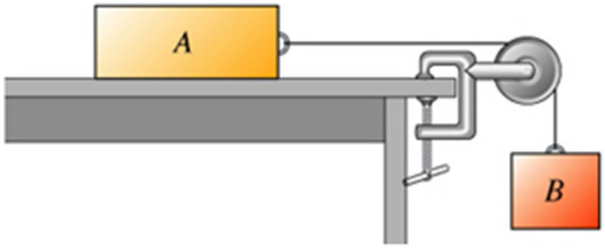
Problem 4

Block A has a weight of 6.0 N and block B has a weight of 4.0 N. When block B is released, it moves downward at constant speed. Assuming the pulley is frictionless and massless, find the coefficient of kinetic friction μ_k between block A and the tabletop.



Problem 5

In a swing ride at an amusement park, each chair is suspended by a chain and moves in a 20.0 m–radius circle. Riders take 8.0 s to complete one revolution. What is the angle of the chains measured from the vertical?

Hint: use $v = 2\pi r/T$, and the formula for the banked curve $v = \sqrt{g\, r \tan(\theta)}$.

Problem 6

The specifications for a motorcycle engine require tightening a spark plug to a torque of 40 Nm. You use a 25-cm-long wrench but must pull at an angle of 120° relative to the wrench handle. What force must you apply?

Good Luck!