Sample Midterm 1

You must show your work to get full credit.

1. A cannon on a 45° slope is fired at an angle $\theta$ above the horizontal. The initial speed of the cannonball is $v_0$. How far from the cannon does the cannonball hit the slope? Express your answer in terms of $v_0$, $\theta$, and the acceleration due to gravity $g$.

2. Consider two blocks of mass $m_1$ and $m_2$ attached to a pulley as shown below. The coefficient of static friction between the blocks is $\mu_k$. Neglect friction between the lower block and the ground. What external force $F_{\text{ext}}$ is required to set the blocks in motion? What is the tension in the string?
3. A ball of mass $m$ is hanging by a string attached to a pole. The ball is rotating in a horizontal circle around the pole with period $T$. What is the tension in the string? What is the angle $\theta$ that the string makes with the pole?