NAME _____ DATE _____

Scenario

Angela and Carlos are asked to determine the relationship between the normal force on a box of mass m and the angle of incline of the box θ as the box sits at rest on the incline.

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Using Representations

PART A: The dot at right represents the block on the incline. Draw a free-body diagram showing and labeling the forces (not components) exerted on the block. Draw the relative lengths of all vectors to reflect the relative magnitudes of all the forces. Each force must be represented by a distinct arrow starting on and pointing away from the dot. The dotted line represents the incline.
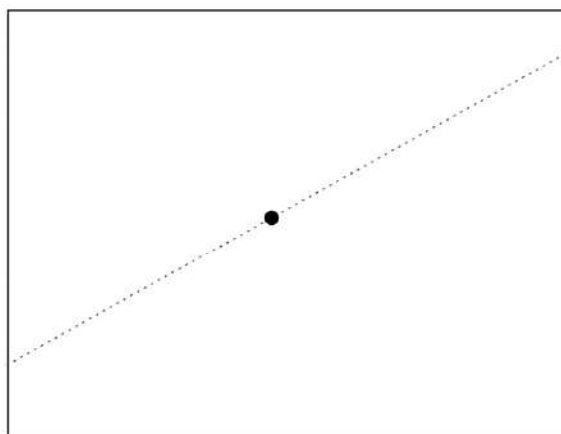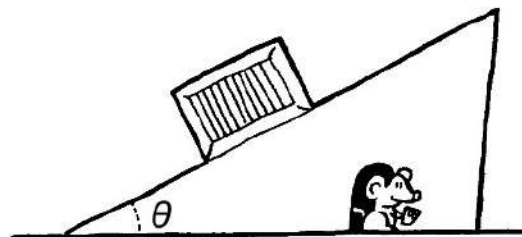
Quantitative Analysis

PART B: Start with Newton's second law to derive an equation that relates the normal force with the angle of incline. For each line of the derivation, explain in words what you did mathematically. The first line is done for you as an example. Express your answer in terms of m, $θ$, and physical constants as appropriate.

$\Sigma F_y = ma_y$	Newton's second law states that the sum of the forces in the "y" direction will be equal to the mass of the box times the acceleration of the box in the y-direction, therefore:

Analyze Data

Angela and Carlos then perform an experiment to test the equation they derived in Part B.
The following data are collected.

Normal Force (N)	Angle (degrees)
97	10
95	15
85	30
80	35
75	40
63	50
49	60

PART C: Based on the equation you created in Part B, what data should be plotted to create a linearized graph for this experiment?

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PART D: What is the physical meaning of the slope?

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