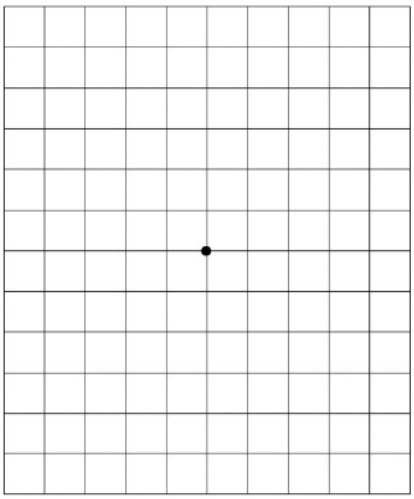
NAME _____ DATE _____

Scenario

A 300 kg *box rests on a platform attached to a forklift shown. Starting from rest at time* $t = 0$ *seconds, the box is lowered with a downward acceleration of* 1.5 m/s^2.

Using Representations

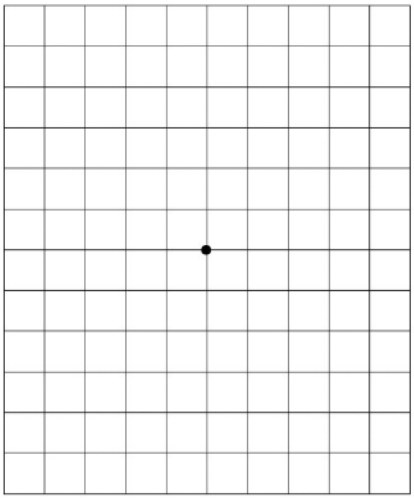
PART A: The dot below right represents the box. Draw a free-body diagram showing and labeling the forces (not components) exerted on the block. Draw the relative lengths of all vectors to reflect the relative magnitudes of all forces. Each force must be represented by a distinct arrow starting on and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



PART B: In a brief sentence, support the magnitude of the normal force in comparison to the gravitational force on the box.

Argumentation

PART C: Blake derives an equation for the height of the box as a function of time, makes a mistake, and comes up with $y = 9.8t$. Without deriving the correct equation, how can you tell that this equation is not plausible— in other words, why does it not make physical sense? Briefly explain your reasoning.



PART D: At time $t = 0$ seconds, the forklift also begins to move forward with an acceleration of 2 m/s^2 while lowering the box as described above. The box does not slip or tip over while the forklift is accelerating forward. The dot at right represents the box. 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.

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PART E: Explain in a brief sentence why the force of friction points in the direction you sketched in Part D.

Checklist:

_____ I answered the question directly.

_____ I stated a law of physics that is always true.

_____ I connected the law or laws of physics to the specific circumstances of the situation.

_____ I used physics vocabulary (force, mass, acceleration, velocity, constant, changing).

Quantitative Analysis

PART F: When the box is only being accelerated forward, a_{max} has one value. (a_{max} is the maximum acceleration the forklift can have before the box begins to slide.) When the box is both accelerating forward and down, a_{max} is less. Explain in a clear, coherent paragraph-length response why this is true.

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