Big Exam! #6

1. You see something slide.

a) Estimate the coefficient of friction between the two surfaces This is clearly a dynamics lens because we're dealing with forces and acceleration. So we need to do a FBD, label forces, and ask ourselves that important question that results in us picking the correct axis. Because it's accelerating down the slope, you pick the axis to be parallel and perpendicular to the surface and you realize you must decompose F_g into components parallel to the surface (pulling the object downward) and perpendicular to the surface (pulling the object into the surface). We estimate that in order to find the maximum frictional force at which the static friction fails, we say that $a_{//} = 0$ at that moment.

b) If the surface were inclined at a 45° angle, estimate the acceleration of an object moving up the slope. Similar to the above, except that now the sum of the forces in the parallel direction are not zero. Find what it is and divide by mass. Again, do a good FBD and show the forces adding to give a resultant force that is in the direction of the acceleration.

2. You see a ball on a string.
   a) Calculate the speed of the ball. Again, I see forces and (centripetal) acceleration, so I am going to us a dynamics lens. I better make a FBD and ask that important question which tells me that it's not the gravity that I need to decompose, but the force of the string. WHY? With a good vector diagram, I can show that the sum of the forces is less than F_g, allowing me to estimate the acceleration. This is centripetal acceleration. If we know the centripetal acceleration, can we find the speed?
   b) Calculate the tension in the string. Can you see from your force diagram that the tension is slightly more than F_g?

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