[1] A 1.0-kg physics book is given an initial velocity of 3.0 m/s up a ramp. The ramp makes an angle of 20° above the horizontal. If the coefficient of kinetic friction between the book and the surface is 0.2, how far up the ramp does the book slide?

MODEL:(*what assumptions are you going to make*?)

VISUALIZE:
Pictorial (*sketch – with coordinate axis, and all symbols, list of knowns and unknowns*)

Physical (*motion diagram*)

Physical (*Free Body Diagram*)

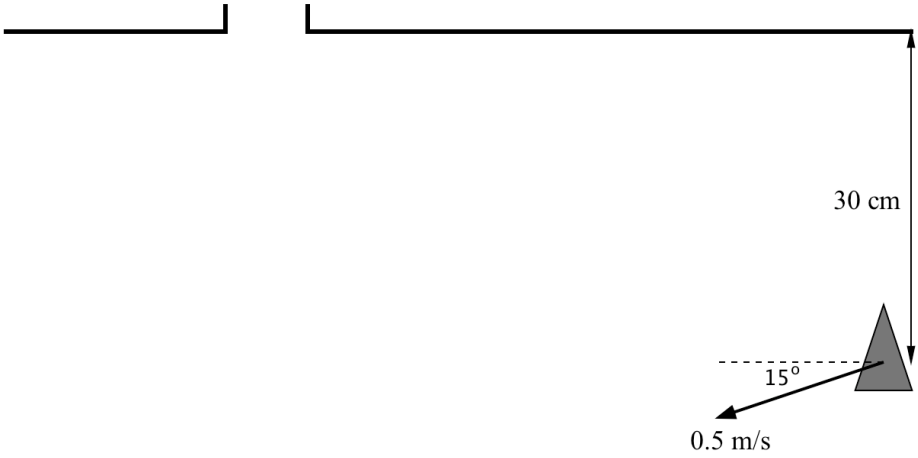
SOLVE: (*use Newton's 2nd Law for x and y and equations of motion to find the answer*)

ASSESS: (*compare your acceleration to* **g** *and justify your distance is reasonable. 1.0 m/s = 2.24 mph*)

[2] You are playing a video game where the objective is to successfully fly a spaceship into a docking bay through a small opening in a large wall. The spaceship is initially 30 cm from the wall (dimensions are scaled to what you see on your TV screen) and is moving with a velocity of 0.5m/s at 15° below the negative *x* axis as shown below. When you fire the thrusters, the spaceship accelerates upwards with a constant acceleration of 0.7 m/s^2. At what horizontal distance from the docking bay opening should you fire the thrusters in order for your ship to pass through without crashing?

MODEL: (*what assumptions are you going to make*?)

VISUALIZE:
Pictorial (*The sketch has been started for you. You need to add coordinate axis, symbols, list of knowns*)



Physical (*motion diagram*)

Graphical (*you should have 7 graphs*)

SOLVE: (*use the equations of motion for x and y to find the answer*)

ASSESS: (*compare your distance to the known initial position and the size of a TV screen*)

[4] Dr. Russell places his 20-kg daughter on a 5-kg cart to which a 2.0-m long rope is attached. He then holds the end of the rope and spins the cart and child around in a circle, keeping the rope parallel to the ground. It takes 4.44 seconds for the cart to make one complete trip around the circle. Rolling friction between the cart's wheels and the ground is negligible. The rope can support a maximum tension of 120N. Does the rope break?

MODEL: (*what assumptions are you going to make*?)

VISUALIZE:
Pictorial (*sketch with coordinate axis, symbols, list of knowns*)

Physical (*Free Body Diagram*)

SOLVE: (*Use Newton's 2nd Law to find the answers*)

ASSESS: (*What is the answer to the question? Are the speeds and forces reasonable?*)

[5] Block A is tied to the wall with a rope. It sits on top of block B. The mass of block B is greater than the mass of block B. The lower block B is pulled to the right with a rope so that B moves with constant velocity. The coefficient of kinetic friction is the same for all surfaces.

(a) Draw a free-body diagram for each block, being careful to draw the lengths of the vectors correctly. Connect, with a dashed line, any action-reaction force pairs.
(b) Rank all of the vertical forces, providing an explanation for your ranking.
(c) Rank all of the horizontal forces, providing an explanation for your ranking