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Notes for Free Body Diagram Worksheet

Why do you need to split forces into parts? We want all forces to be at right angles or directly across from each other to make solving the problems easier.

Question to ask when splitting up the forces:

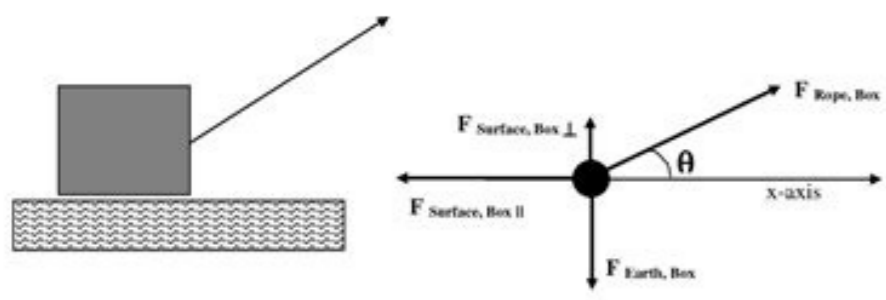
Is the object on a hillside / inclined plane?

YES → Split the Force of the Earth ($F_{Earth,object}$) into two parts. Use parallel \parallel and perpendicular \perp symbols at the end of the Force. ($F_{Earth,object \perp}$).

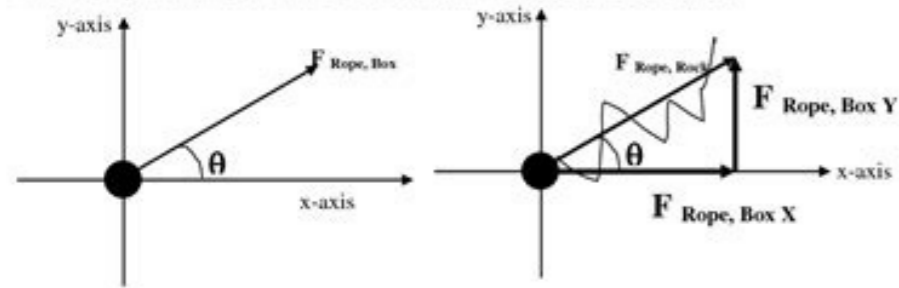
NO → Split up any force not on an X or Y axis line, in other words split any force not on a right angle or opposite of the $F_{Earth,object}$.

Here are a couple of examples of how to divide forces at an angle up in to parts.

A box is pulled across the floor at a constant speed (No acceleration = all Forces will cancel out.)



The Force of the rope on the box ($F_{Rope, Box}$) at the angle can be split up in to two parts, a horizontal and a vertical component. We do this to so we can show why there is no acceleration.



Another way of showing the parts that make up the $F_{Rope, Box}$ is to draw the X and Y forces like I have below. Then cross out the Force you split into parts ($F_{Rope, Box}$).

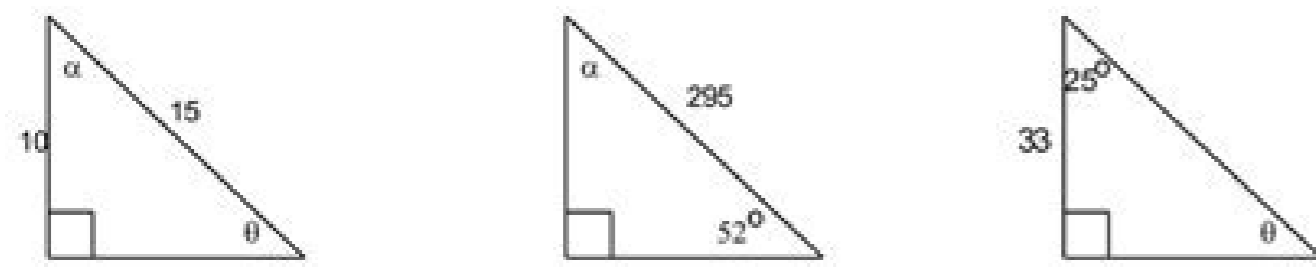
Worksheet 3.1 – Independence of Perpendicular Vectors

1. A plane is flying round trip to an destination 250 km North of its starting point. The plane flies with an airspeed of 325 km/h and the wind is blowing at 50.0 km/h due North.
a) How long does it take to get to the destination? b) How long does it take to return to the starting point?

2) A tourist starts at the back of train that is 45 m long and walks towards the front at 1.5 m/s. The train is moving at 12 m/s.
a) How long does it take for the tourist to reach the front of the train, and how far has the tourist moved relative to the ground outside the train by the time they reach the front?

b) If the tourist decides to run all the way back to the end of the train at 6.0 m/s, how far have they travelled relative to the ground outside in this time?

3) Solve the following triangles (all sides and angles) using SOH – CAH - TOA and Pythagoras



4) Add the following x and y vectors, draw the resultant vector and solve its magnitude and direction.

- a) x: 3.4 m y: 2.7 m
- b) x: 5.6 m/s y: -7.1 m/s
- c) x: -211 m y: -44.0 m

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