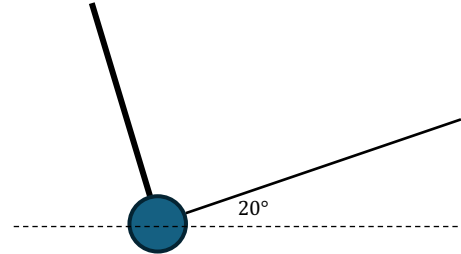
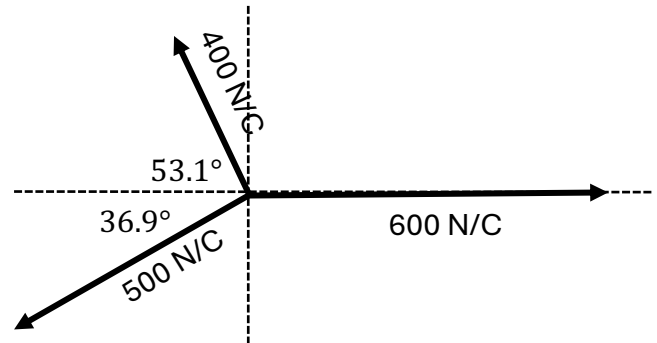


Mastering Physics Prerequisites
Manipulating Vectors
Problems 6-10

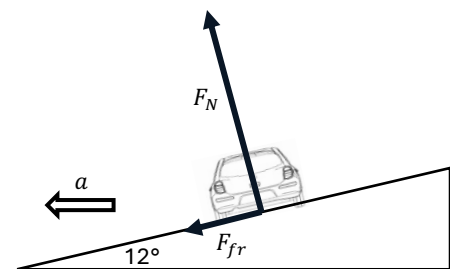
6. There are three forces on a 500 kg wrecking ball. The gravitational force which is 5000 N and straight down. The cable on the right is pulling the wrecking ball aside. The angle this cable makes with the horizontal is 20° above the horizontal and it has a tension of 500 N. What is the angle that the second main cable supporting the ball makes with the horizontal?



7. There are three charges in the x-y plane. One produces an electric field of 600 N/C to the right at the origin, another produces an electric field of 500 N/C at 36.9° below the negative x axis at the origin and the third produces an electric field of 400 N/C that is 53.1° above the negative x axis at the origin. What is the electric field at the origin? Of course, you must give the magnitude and the direction.

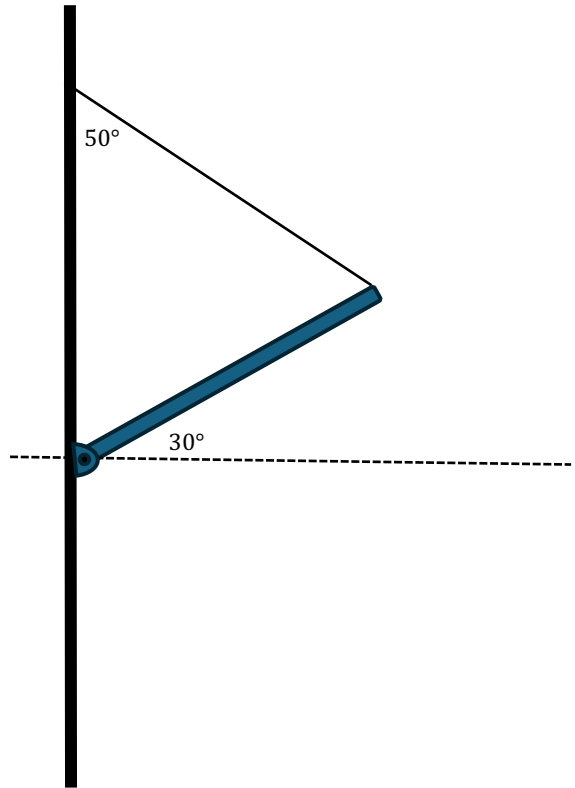


8. A car is going through a turn that is banked inward at 12° and is accelerating to the left as shown in the diagram. The frictional force, F_{fr} , on the car is 1500 newtons inward along the road and the normal force, F_N , on the car is 10000 newtons perpendicular to the road, as indicated by the red arrows in the diagram. These two forces combine to accelerate the car around the turn. To calculate the acceleration from the forces, you must get the components of the forces that are along the acceleration.



- What is the net horizontal force on the car?
- The gravitational force is not shown in the diagram. Figure out what it is knowing that that the net vertical force on the car must be zero.

9. It is often the case that the components of a vector that are useful in solving the problem are not the horizontal and vertical components. When dealing with torques, the relevant components are the force perpendicular to the distance from the axis of rotation and the force along the axis of rotation. In the diagram to the right, the tension in the rope is 800 newtons and it makes an angle of 50° with the wall. The beam it supports is hinged at one end and it makes an angle of 30° with the horizontal. The component of the tension that is perpendicular to the beam is producing a counterclockwise torque that is preventing it from falling. The component of the tension that is along the beam is not supporting the beam.



- a) What is the component of the tension in the rope that is along the beam?
- b) What is the component of the tension that is perpendicular to the beam?

10. When determining the position and speed of a projectile some time after it is released, it is helpful to get the horizontal and vertical components of the velocity because we know that the speed in the horizontal direction is constant and the speed in the vertical direction changes at the acceleration due to gravity.

An arrow is shot at an angle of 35° above the horizontal at a speed of 80 m/sec.

- a) What is the horizontal component of the initial velocity of the arrow?
- b) What is the vertical component of the initial velocity of the arrow?
- c) Determine the velocity of the arrow two seconds after it was shot. Note that velocity is a vector, so you will need to report the speed and the direction.

