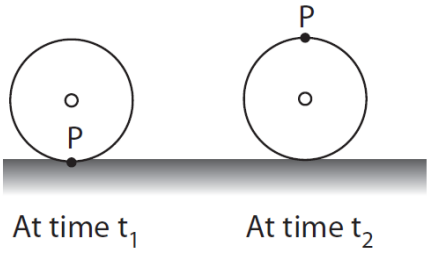
GG 450: Geophysical Methods

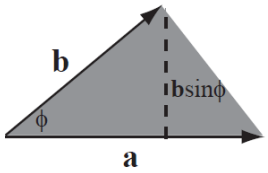
Homework 1: Math and Physics Review

Read Robinson & Coruh Chapter 1 (and refer to an Intro. Physics Text book)
Due Thu 1/14/09

1. A wheel with radius *a* rolls without slipping along a horizontal floor, as shown in Fig. 2-18. *P* is a dot painted on the rim of the wheel. At time t_1, *P* is at the point of contact between the wheel and the floor. At a later time t_2, the wheel has rolled through one-half of a revolution. What is the displacement of *P* during this interval?

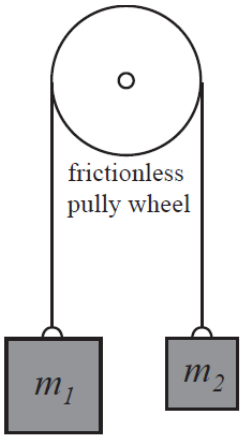


2. Show that the area of the triangle contained between the vectors **a** and **b** in the figure to the right is ½|**a** x **b**| (vertical bars signify magnitude).

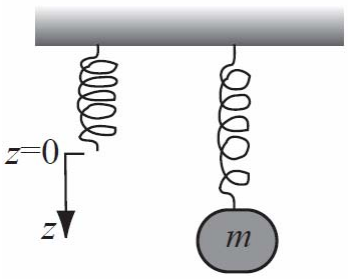


3. The Owner's Manual for a Toyota 4-door sedan says that, if lightly loaded, the car can be braked to a halt from 60 mi/h on dry roads in 43 m. (a) What acceleration does this imply? Express your answer in both SI units and in units of "*g*" (9.8 m/s^2). (b) How long does it take to stop? (c) If your reaction time for breaking is 0.4 s, what will the total stopping distance be?

4. A wire is looped around a frictionless pully wheel and two masses are attached to the two ends (see diagram on right). One mass (m_1) is greater than the other (m_2). Once the masses are released and gravity is allowed to pull on them, the wheel will start to turn and the masses will accelerate. (a) In which direction will each mass accelerate ? (b) What is the magnitude of the acceleration? (c) What is the tension (in N) on the wire?



5. A mass *m* is suspended vertically on one end of spring and experiences the downward pull of gravity. The reference position of the tip of the spring without the mass attached is $z = 0$. (a) Write the equation of motion (force balance) equation in terms of the acceleration of gravity *g*, acceleration d^2z/dt^2, displacement *z*, mass *m*, and spring constant *k*. (b) How much will the spring be stretched (i.e., what is *z*) when the mass is perfectly at rest (i.e., $d^2z/dt^2=0$). (c) What will happen if the mass is suddenly perturbed from this equilibrium (resting) position?



Extra credit: Prove your answer to (c) by showing the solution of $z(t)$.