

PHY 211 Recitation 8

February 7, 2020

1 Identifying forces

Draw a picture of each of the following scenarios. Make sure to:

- (i) Identify the system of interest.
- (ii) Identify all the objects in the environment that contact the system.
- (iii) What forces are acting on the person or object? (Remember that the only non-contact force we are using is gravity)
- (iv) Draw a free-body diagram, showing the forces as vectors.

Don't forget to include forces that cancel each other!

Problem 1(a). A person standing still on the ground.

Problem 1(b). A sled moving on a flat, frictionless surface

Problem 1(c). A projectile in the air, following a parabolic trajectory.

Problem 1(d). A block sliding down a ramp.

Problem 1(e). A sled being pulled across flat ground by a person using a rope (the system is the sled).

Problem 1(f). Two people working together to push a heavy box across the floor.

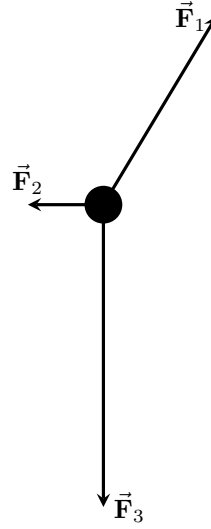
Problem 1(g). The rope in a game of tug-of-war.

Problem 1(h). A person leaning up against the wall

2 Adding up forces

A disc has three cables pulling as shown, with $\vec{\mathbf{F}}_1 = 300.0\text{N}\hat{\mathbf{i}} + 500.0\text{N}\hat{\mathbf{j}}$, $\vec{\mathbf{F}}_2 = -200.0\text{N}\hat{\mathbf{i}}$, and $\vec{\mathbf{F}}_3 = -800.0\text{N}\hat{\mathbf{j}}$.

- (a) On another part of the paper, use graphical vector addition to find the total force vector. *Do not draw this on the free body diagram.*
- (b) Draw the coordinate system on the free body diagram.
- (c) Find the net force on the disc in component form.
- (d) Find the magnitude and direction of this net force.



3 Books on a table

Problem 3(a). Three books are stacked in a pile on a table. Each book has a weight of 10 N. *For each* of the three books, draw a free-body diagram showing all the forces acting on that book. Think very carefully about how many forces act on each one, and in which direction each force acts.

Problem 3(b). It may seem that there are a lot of unknown forces. Are there any that you know have the same magnitude?

Problem 3(c). Write down the sum of the forces in the vertical direction for each book (so you should have three equations). Solve for the magnitude of the force exerted by the table on the bottom book.

Problem 3(d). Does your answer match what you would expect? What does that say about the forces between different books in the pile?