Name:

Date:

**Determining Net Force**

**(Considering forces at angles)**

1. Joe Ponder, from North Carolina, once used his teeth to lift a pumpkin with a mass of 275 kg. Suppose Ponder has a mass of 75 kg, and he stands with each foot on a platform and lifts the pumpkin with an attached rope. If he holds the pumpkin above the ground between the platforms, what is the force exerted on his feet? (Draw a free-body diagram showing all of the forces present on Ponder.)
2. In 1994, Vladimir Kurlovich, from Belarus, set the record as the world’s strongest weightlifter. He did this by lifting and holding above his head a barbell whose mass was 253 kg. Kurlovich’s mass at the time was roughly 133 kg. Draw a free-body diagram showing the various forces in the problem. Calculate the normal force exerted on each of Kurlovich’s feet during the time he was holding the barbell.
3. The net force exerted by a woodpecker’s head when its beak strikes a tree can be as large as 4.90 N, assuming that the bird’s head has a mass of 50.0 g. Assume that two different muscles pull the woodpecker’s head forward and downward, exerting a net force of 4.90 N. If the forces exerted by the muscles are at right angles to each other and the muscle that pulls the woodpecker’s head downward exerts a force of 1.70 N, what is the magnitude of the force exerted by the other muscle? Draw a free-body diagram showing the forces acting on the woodpecker’s head.
4. About 50 years ago, the San Diego Zoo, in California, had the largest gorilla on Earth: its mass was about 3.10x102 kg. Suppose a gorilla with this mass hangs from two vines, each of which makes an angle of 30.0° with the vertical. Draw a free-body diagram showing the various forces, and find the magnitude of the force of tension in each vine. What would hap-pen to the tensions if the upper ends of the vines were farther apart?
5. The mass of Zorba, a mastiff born in London, England, was measured in 1989 to be 155 kg. This mass is roughly the equivalent of the combined masses of two average adult male mastiffs. Suppose Zorba is placed in a harness that is suspended from the ceiling by two cables that are at right angles to each other. If the tension in one cable is twice as large as the tension in the other cable, what are the magnitudes of the two tensions? Assume the mass of the cables and harness to be negligible. Before doing the calculations, draw a free-body diagram showing the forces acting on Zorba.