NAME _____ DATE _____ CLASS _____

**3.** A saguaro cactus with a height of 24 m and an estimated age of 150 years was discovered in 1978 in Arizona. Unfortunately, a storm toppled it in 1986. Suppose the storm applied a torque of $2.00 \times 10^5$ N•m to the cactus and the cactus could withstand a torque of only $1.20 \times 10^5$ N•m. What minimum force could have been applied to the cactus to make it withstand the storm? At what point and in what direction should this force have been applied? Assume that the cactus itself was very strong and that the roots were just pulled out of the ground.

**4.** Goliath, a giant Galápagos tortoise living in Florida, has a mass of $3.6 \times 10^2$ kg. Suppose Goliath walks along a heavy board above a swimming pool. The board has a mass of $6.0 \times 10^2$ kg and a length of 15 m, and it is placed horizontally on the edge of the pool so that only 5.0 m of it extends over the water. How far out along this 5.0 m extension of the board can Goliath walk before he falls into the pool?

**5.** The largest pumpkin ever grown had a mass of 449 kg. Suppose this pumpkin is placed on a platform that is supported by two bases 5.0 m apart. If the left base exerts a normal force of $2.70 \times 10^3$ N on the platform, how far must the pumpkin be from the platform's left edge? The platform has negligible mass.

**6.** In 1991, a giant stick of Brighton rock (a type of rock candy) was made in England. The candy had a mass of 414 kg and a length of 5.00 m. Imagine the candy is balanced horizontally on a fulcrum. A child with a mass of 40.0 kg sits on one end of the stick. How far must the fulcrum be from the child in order to maintain equilibrium?

**7.** In 1994, John Evans set a record for brick balancing by holding a load of bricks with a mass of 134 kg on his head for 10 s. Another, less extreme method of balancing this load would be to use a lever. Suppose a board with a length of 7.00 m is placed on a fulcrum and the bricks are set on one end of the board at a distance of 2.00 m from the fulcrum. If a force is applied on the other end of the board and the force has a direction that is 60.0° below the horizontal and away from the bricks, how great must this force be to keep the load in equilibrium? Assume the board has negligible mass.

**8.** In 1994, a vanilla ice lollipop with a mass of $8.8 \times 10^3$ kg was made in Poland. Suppose this ice lollipop is placed on the end of a lever that is 15 m in length. A fulcrum is placed 3.0 m from the lollipop so that the lever makes an angle of 20.0° with the ground. If a force is applied perpendicular to the lever, what is the smallest magnitude this force can have and still lift the lollipop? Neglect the mass of the lever.