Section 1 (Answers may vary)

1. In no more than 50 words, how might imbalances between medial and lateral knee muscle activity facilitate an increased external net knee joint abduction torque?

Imbalances between medial and lateral knee muscle activity facilitate an increased external net knee joint abduction torque because it promotes larger valgus knee angles. Larger valgus knee angles increase the perpendicular distance between the point of application of force and the axis promoting higher torque and excessive knee abduction.

2. In fewer than 50 words, how might a female athlete decrease this external net knee joint abduction torque?

A female athlete might decrease this external net knee joint abduction torque by balancing medial-to lateral Q:H activation. Sportsmetrics, which is a plyometric training program, can be effective in reducing varus and valgus torques in women and, thus, may be effective in minimizing the incidence of ACL injury.

Section 2 (Answers may not vary)

1. (2 points) A weightlifter hoists a barbell above his head. The total length of the bar is 2 meters. Eighty kg of weight are added to each side, with the center of the weights lying .23 m from the outside tip of the bar on both sides. If the barbell was hoisted from the very center of the bar, what would be the torque applied on each side? (Just one side, not the sum of both together) (Disregard the weight of the bar).

Using the equation \( T = F \times \perp \), we know the force to be 80kg and the perpendicular distance from the weight to the center is .77 m. So, \( T = 80 \times 9.81 \times 0.77 \). \( T = 604.3 \text{ Nm} \)

2. (2 points) If the barbell was now loaded with only 20 kg on one side and 30 kg on the other, how far from the 30 kg side should the bar be grasped (one handed) in order to carry the bar balanced? Assume the centers of the weights are still .23 m from each side. Give the final answer in distance from the weight on the 30 kg side. (Again disregard the weight of the bar).

Set one of the sides of the bar as the reference point. Because the question is asking to give the final answer in distance from the weight on the 30 kg side, set that side as the reference point. Using the equation \( \Sigma(Wr) = (\Sigma W) \times r_{cog} \), we know that the first part of the equation is \( \Sigma T = ((30 \times 9.81) \times .23) + ((20 \times 9.81) \times 1.77) \). The sum of the Torque is equal to -414.963. This means that, once again, use the equation, -414.963 = (-490.5) *
\( r_{\text{cog}} \). Solving for \( r_{\text{cog}} \), we get 0.846 m. Now we have to subtract 0.23 m to get the distance from the 30 kg side. 0.846 – 0.23 = \textbf{0.62 m}

3. (2 points) A person holds a gallon of milk with a mass of 3 kg away from their body so that their forearm is completely parallel with the ground. The length of the forearm is .38 meters. The biceps brachii attaches to the forearm 4 cm from the elbow at an angle of 60°. How much force must be exerted by the bicep in order to keep the forearm level while holding the milk?

Draw what you know.

Using the equation, \( T = F \times L \), we know that \( T = (3 \times 9.81) \times .38 \text{ m} = 11.1834 \). To find the force of the bicep we use the same equation above. \( 11.1834 = (\sin 60 \times F_b) \times .04 \text{ m} \). Solving for the force of the bicep (\( F_b \)) we get \( F_b = 322.84 \text{ N} \)