9.1

An Acme-threaded power screw with a crest diameter of 1.25 in. and single thread is used to raise a load of 10,000 lb. The collar mean diameter is 0.5 in. The coefficient of friction is 0.2 for the thread and 0.15 for the collar. Determine the following:

(a) The pitch diameter of the screw.

(b) The screw torque required to raise the load.

(c) The minimum thread coefficient of friction needed to ensure the screw will self-lock if collar friction is eliminated.

Note: An Acme power screw has a standardized thread profile, and data for it is in Section 16.3 and Table 16.2.

9.2

A car jack consists of a screw and a nut, so that the car is lifted by turning the screw. The lead of the thread l = 10 mm, its pitch diameter is 25 mm, and its thread angle is 30°. The coefficient of friction is 0.15 in the threads and zero elsewhere.

Calculate the torque needed to lift a load with a mass of 1500 kg.

9.3

A standard metric coarse thread M10 bolt is connecting a steel plate to a steel beam. The bolt is tightened with a torque of 45 Nm. The thread friction coefficient is 0.15. Ignore any collar friction.

A. What is the pitch of the bolt?

B. What is the pitch diameter?

C. What is the preload on the bolt?

D. What is the resulting axial tensile stress on the bolt's tensile area?

E. What is the minimum strength grade of steel bolt that would not yield in this application?
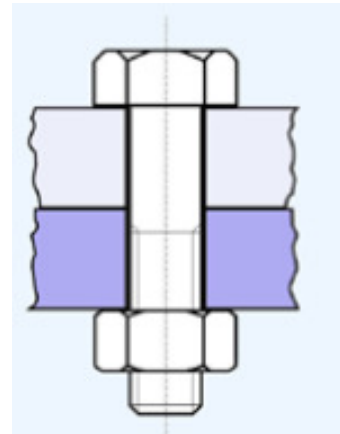
Hints: Standard fasteners have a 60° thread angle, and have standard dimensions such as shown in Table 16.9. Tightening a bolt is equivalent to raising a load.

There is no equation given for the pitch diameter of a non-Acme screw, so you will have to calculate it using Fig. 16.4, being aware of radial and diametral measurements.