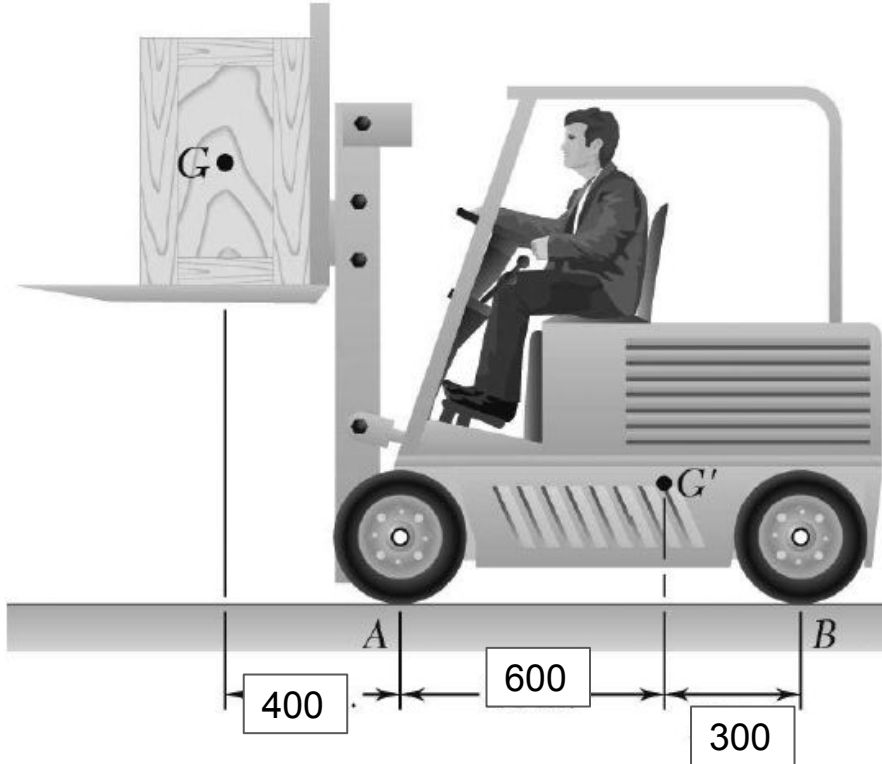# Tutorial Sheet 3.2
Chapter 4
Vector Mechanics
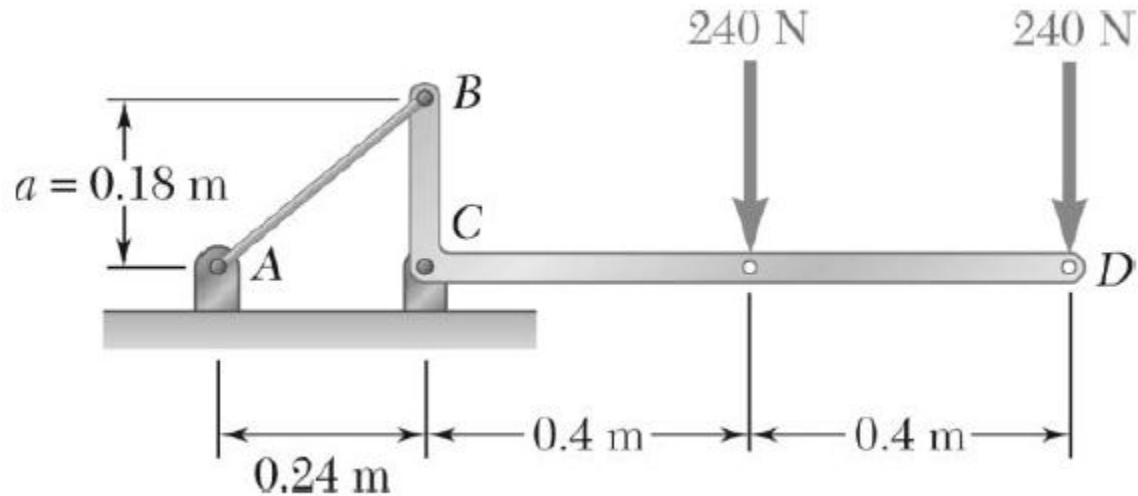### Beer, Johnston, Mazurek, Eisenberg

Problem 1

A 15 kN forklift truck is used for lifting a 8 kN crate.

Determine the reaction at each of the two (a) front wheels A, (b) rear wheels B. All dimensions are in mm.
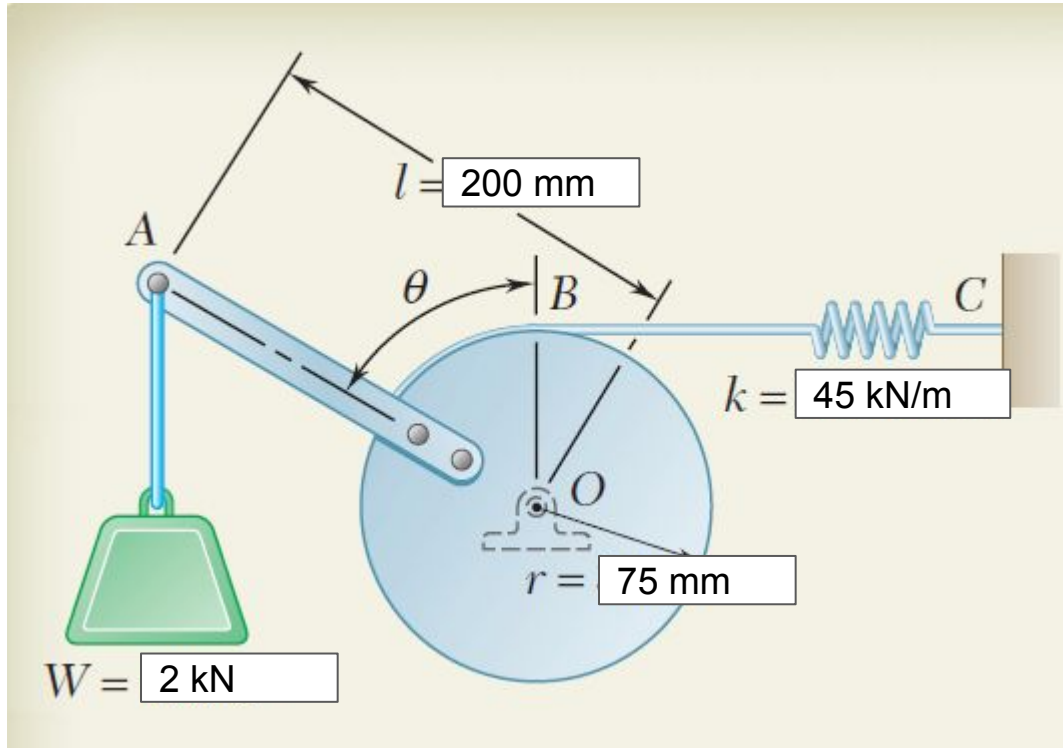
Problem 2

240 N   240 N

$a = 0.18$ m

B

C

A

D

0.24 m

0.4 m

0.4 m

The bracket BCD is attached to a control cable at B. The bracket is hinged at C.

Determine
(a) the tensionin the cable,
(b) the reaction at C.

Problem 3

$l =$ 200 mm

A

θ

B

C
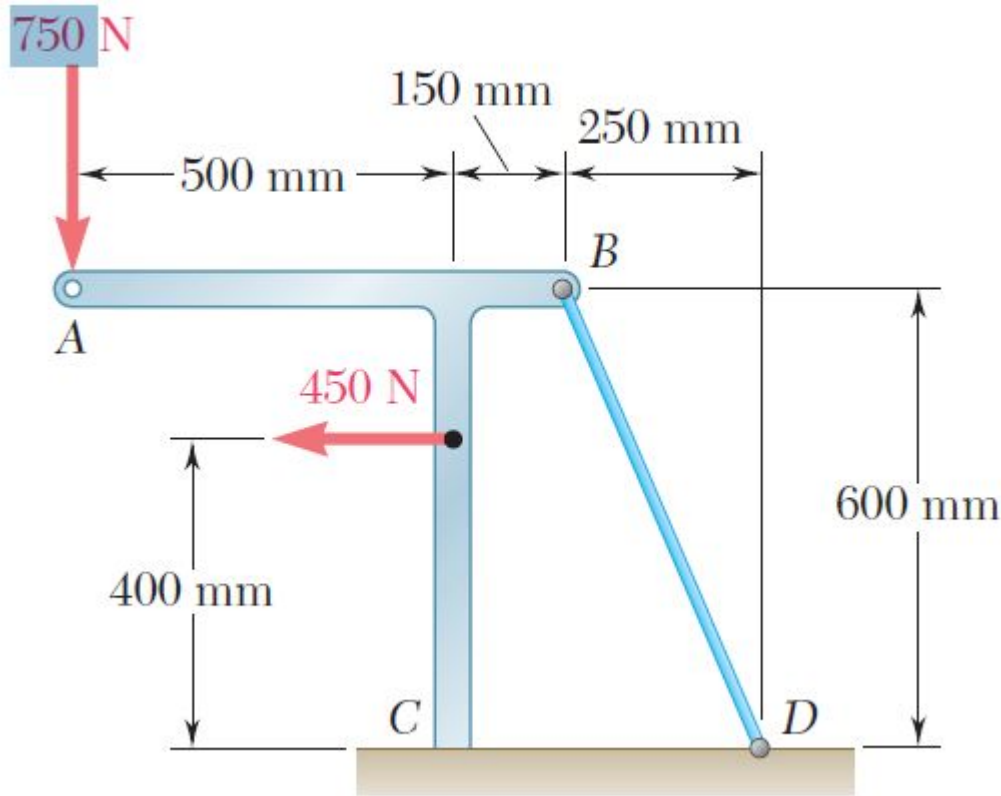
$k =$ 45 kN/m

O

$r =$ 75 mm

$W =$ 2 kN

A 2 kN weight is attached to the lever at A.

Determine the position of equilibrium.

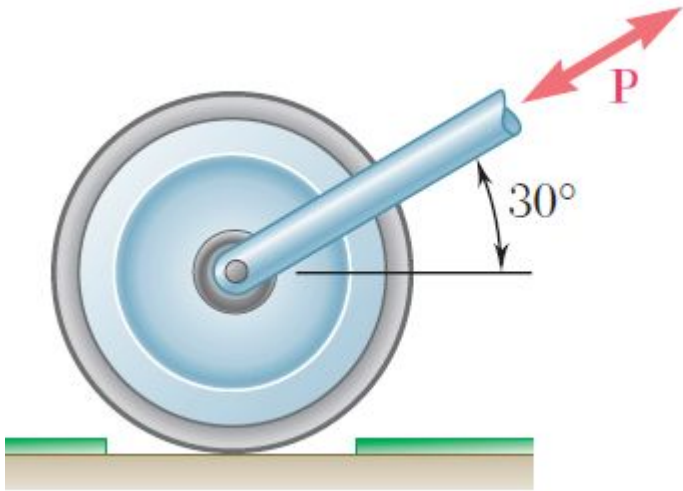The stiffness constant of the spring BC is 45 kN/m. The spring is unstretched when θ = 0.

Problem 4

750 N

150 mm

250 mm

500 mm

B

A

450 N

400 mm

C

600 mm

D

The tension in wire BD is 1300 N, determine the reaction at the fixed support C.

Determine the range of allowable values of the tension in wire BD if the magnitude of the couple at the fixed support C is not to exceed 100 N-m.
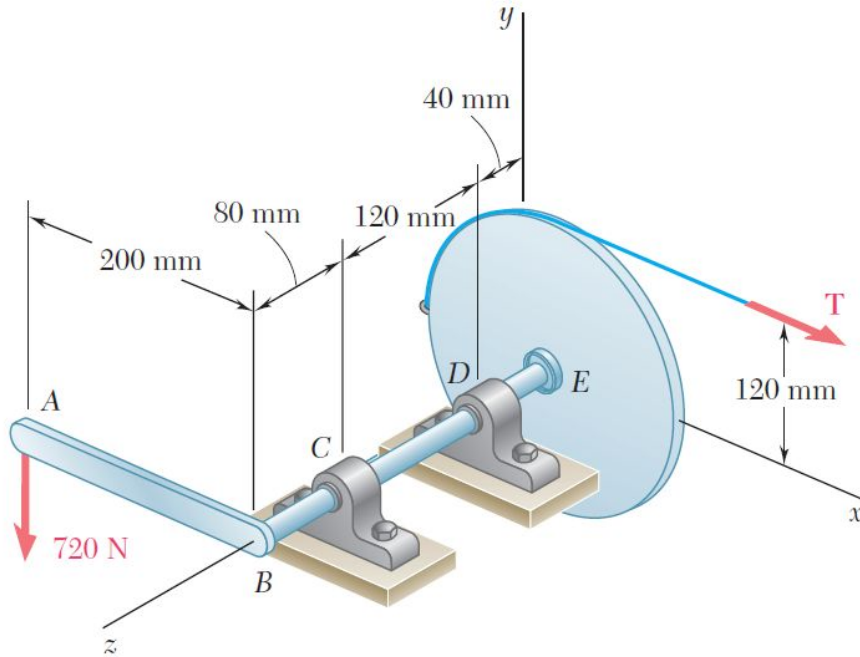
Problem 5

A 20 kg roller, of diameter 200 mm.
is resting directly on the subflooring.

The thickness of each tile is 8 mm.

Determine the force P required to
move the roller onto the tiles if the roller is (a)
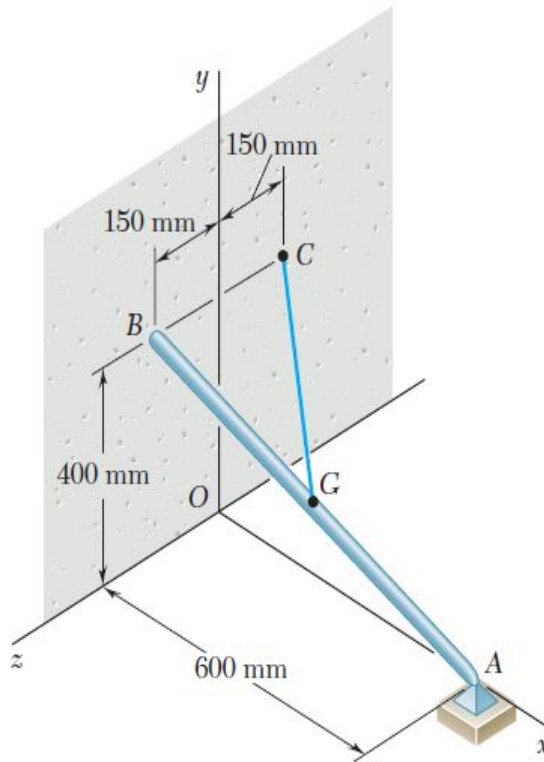pushed to the left, (b) pulled to the right.

30°

P

Problem 6

A 200-mm lever and 240-mm-diameter pulley are welded to the shaft BE that is supported by bearings at C and D.

A 720-N vertical load is applied at A when the lever is horizontal.

Determine (a) the tension in the cord, (b) the reactions at C and D.

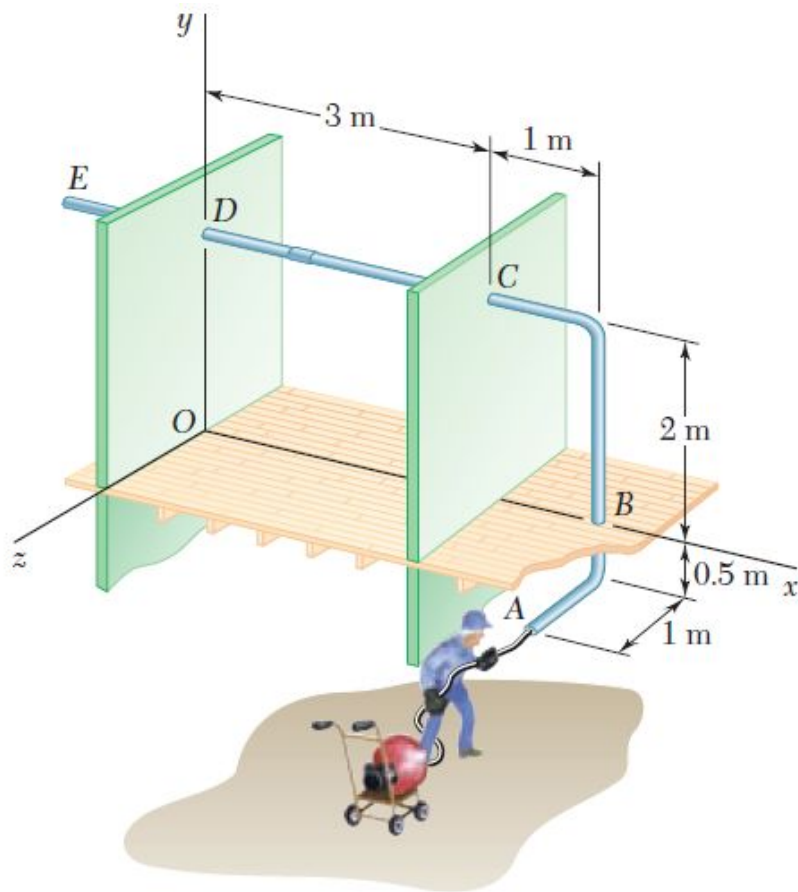Assume that the bearing at D does not exert any axial thrust.

Problem 7

The uniform 10-kg rod AB is supported by a ball-and-socket joint at A and by the cord CG attached to the midpoint G of the rod.

The rod leans against a frictionless vertical wall at B.

Determine (a) the tension in the cord, (b) the reactions at A and B.

Additional Problem


In order to clean the clogged drainpipe AE, a plumber has disconnected both ends of the pipe and inserted a power snake through the opening at A. The cutting head of the snake is connected by a heavy cable to an electric motor that rotates at a constant speed as the plumber forces the cable into the pipe. The forces exerted by the plumber and the motor on the end of the cable can be represented
by the wrench -(48 N)k, -(90 N- m)k.

Determine the additional reactions at B, C, and D caused by the cleaning operation.

Assume that the reaction at each support consists of two force components perpendicular to the pipe.

Problem 1
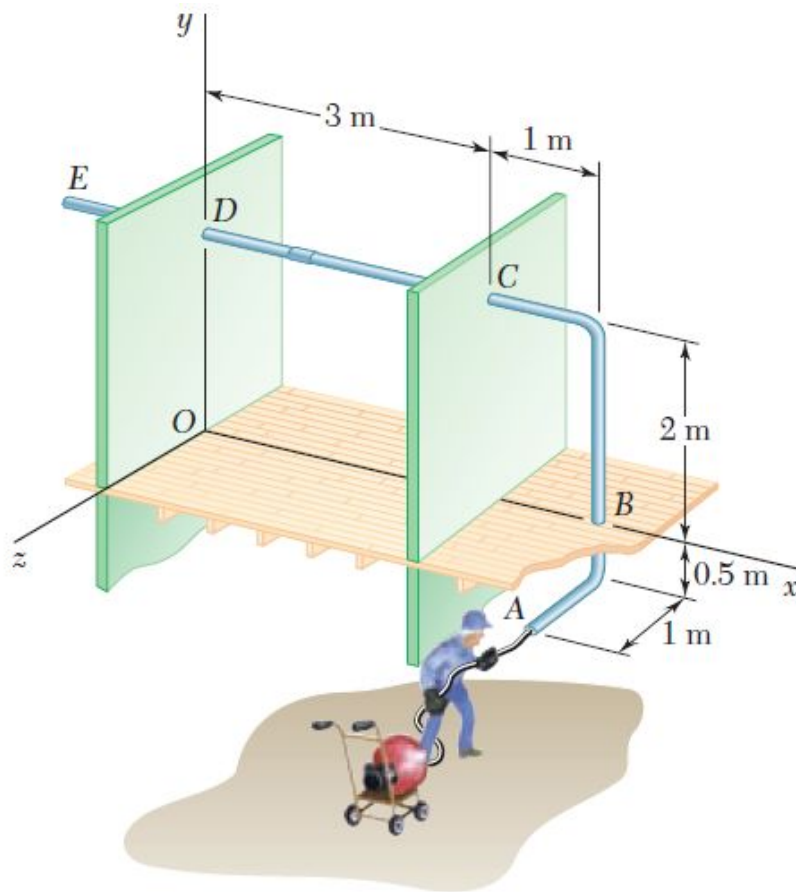
Solve additional problem 1, assuming that the plumber exerts a force -(48 N)k and that the motor is turned off).