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E126 Fall 2020 Exam 2

Problem 1

A 300 kg beam that is 1m in length is being raised by the cable BC as shown. Assume that the weight of the beam can be modeled as an appropriate point load at the midpoint of the beam and that the cable fails when the tension becomes 30 kN. Find the maximum distance d from A for which an additional 1000 kg weight can be loaded on the beam. Also find the magnitude and direction of the reaction force at A for this loading.

Use g = 9.8 m/s²
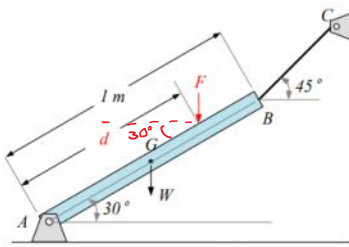
$$F = -(1000\,kg)(9.8)$$
$$F = -9800\ N.$$

$$F_x = 0$$

$$F_x = -9800\cos(30) - 2940\cos(30) - T\cos(45) = 0$$

$$T = \left(\frac{(9800 + 2940)\cos(30)}{\cos(45)}\right)$$

$$T = 15.603\ kN$$

$$T = 30\ kN$$

$$M_A = 0$$

$$M_A = -9800\cos(30)d\cos(30) - T\cos(45)\sin(30) + T\sin(45)\cos(30) - 9800\sin(30)d\sin(30) - 2940\sin(30)\cos(30)(t)$$

$$-9800\cos(30)d\cos(30) - 9800\sin(30)d\sin(30) = 3000\cos(45)\sin(30) - 30\sin(45)\cos(30) + 2940\sin(30)\cos(30)(t)$$

$$\boxed{d = .18\ m.}$$