12.4(B) Zero Torque and Static Equilibrium

I can describe, interpret, and solve problems involving static equilibrium.

**Conditions For Equilibrium**

1.) Translational Equilibrium  
   Net Force = 0

2.) Rotational Equilibrium  
   Net Torque = 0

* Define axis of rotation

**Scaffolding**

In this example, two painters are standing on a 300 lb. scaffolding (beam) which is 12 ft. long. One painter weighs 160 lb. and the second painter weighs 140 lb. The scaffolding is supported by two cables, one at each end. As they paint, the painters begin wondering what force (tension) is in each cable.

The question is, what is the force (tension) in each cable when the painters are standing in the positions shown. Notice that for a uniform beam or bar, as far as equilibrium conditions are concerned, the beam weight may be considered to act at the center (of mass) of the bar.

\[ T_A + T_E = F_{5,B} + F_{5,C} + F_{5,D} \]
UNIT 12 IN CLASS PROBLEMS

19. A 5.00 m long diving board of negligible mass is supported by two pillars. One pillar is at the left end of the diving board and the other is 1.50 m away. Find the forces, in Newton’s, exerted by the pillars when a 90.0 kg diver stands at the far end of the board.

20. A banner is suspended from a horizontal, pivoted pole, as shown in Figure 8-30. The pole is 2.10 m long and weighs 175 N. The banner, which weighs 110 N, is suspended 1.80 m from the pivot point or axis of rotation. What is the tension in the cable supporting the pole?

\[
\tau_{cc} = \tau_c \\
F_2 r_2 \sin \theta = F_m r_m \sin \theta \\
F_2 = \frac{m_g}{r_m} r_m \\
F_2 = 2940 \text{ N} \\
F_1 = 2060 \text{ N}
\]

\[
T_c (2.10 \text{ m}) \sin 25^\circ = m_p g (1.05 \text{ m}) + (110 \text{ N})(1.80 \text{ m}) \\
T_c = 430 \text{ N}
\]