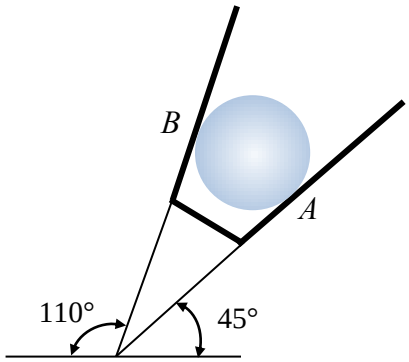
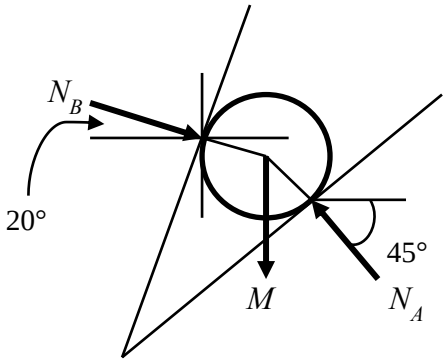
6. A steel ball with a random weight $M \sim N(12, 0.5^2)$ lb rests between two smooth inclined surfaces. Determine the distributions of the reactions on the two supports.



Solution



From equilibrium, we have

$$\sum F_x = 0; \quad N_B \cos 20^\circ - N_A \cos 45^\circ = 0,$$
$$\sum F_y = 0; \quad N_A \sin 45^\circ - N_B \sin 20^\circ - M = 0.$$

From the equations, we have $N_B = \dfrac{\cos 45^\circ}{\cos 20^\circ} N_A$, and M follows a normal distribution $M \sim N(12, 0.5^2)$ lb.

Thus, the distributions of the reactions at the two supports are

$$N_A \sim N(26.68, 1.11^2) \text{ lb} \qquad \textbf{Ans.}$$

$$N_B \sim N(20.08, 0.84^2) \text{ lb} \qquad \textbf{Ans.}$$