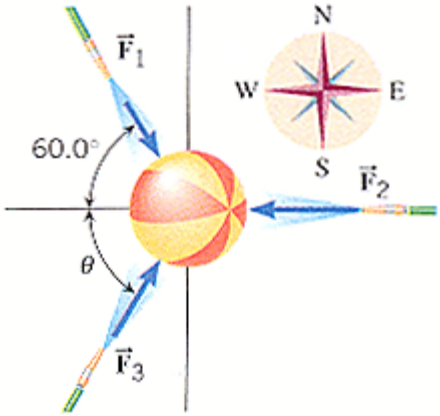
Answer on Question #69387-Physics-Mechanics-Relativity

At a picnic, there is a contest in which hoses are used to shoot water at a beach ball from three directions. As a result, three forces act on the ball, Upper F Subscript 1 Baseline Overscript right-arrow EndScripts, Upper F Subscript 2 Baseline Overscript right-arrow EndScripts, and Upper F Subscript 3 Baseline Overscript right-arrow EndScripts (see the drawing). The magnitudes of Upper F Subscript 1 Baseline Overscript right-arrow EndScripts and Upper F Subscript 2 Baseline Overscript right-arrow EndScripts are F1 = 27.0 newtons (N) and F2 = 61.0 N. Determine

(a) the magnitude of Upper F Subscript 3 Baseline Overscript right-arrow EndScripts and

(b) the angle θ such that the resultant force acting on the ball is zero.

Solution



$$F_1 \sin 60 = F_3 \sin\theta \rightarrow F_3 = \frac{F_1 \sin 60}{\sin\theta}$$

$$F_1 \cos 60 + F_3 \cos\theta = F_2$$

$$F_1 \cos 60 + \frac{F_1 \sin 60}{\sin\theta}\cos\theta = F_2$$

$$\cot\theta = \frac{F_2 - F_1 \cos 60}{F_1 \sin 60} = \frac{61 - 27\cos 60}{27 \sin 60}$$

$$\theta = \cot^{-1}\left(\frac{61 - 27\cos 60}{27 \sin 60}\right) = 26.2°$$

(a)

$$F_3 = \frac{27 \sin 60}{\sin 26.2} = 52.9\ N.$$

(b)

$$\theta = \cot^{-1}\left(\frac{61 - 27\cos 60}{27 \sin 60}\right) = 26.2°$$