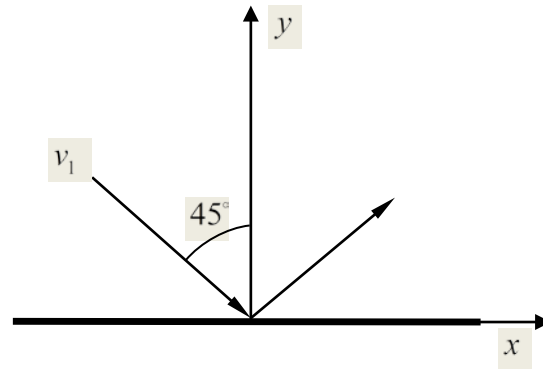4-10. A particle strikes the smooth ground with an initial velocity v_1 as shown in the figure. If the coefficient of restitution is $e = 0.8$ and $v_1 \sim N(10, 1^2)$ m/s, what are the distributions of the x and y components of the velocity of the particle after collision.

$$e = \frac{(v_2)_y - 0}{0 - (v_1)_y} = \frac{(v_2)_y - 0}{0 - (-v_1)\cos\theta}$$

$$(v_2)_y = ev_1\cos\theta$$

$$\mu_{(v_2)_y} = e\mu_{v_1}\cos\theta = 0.8(10)(0.707) = 5.66 \text{ m/s}$$

$$\sigma_{(v_2)_y} = e\sigma_{v_1}\cos\theta = 0.8(1)(0.707) = 0.57 \text{ m/s}$$

$$(v_2)_x = (v_1)_x = v_1\sin\theta$$

$$\mu_{(v_2)_x} = \mu_{v_1}\sin\theta = 10(0.707) = 7.07 \text{ m/s}$$

$$\sigma_{(v_2)_x} = \sigma_{v_1}\sin\theta = 1(0.707) = 0.71 \text{ m/s}$$

Therefore, $(v_2)_y \sim N(5.66, 0.57^2)$ m/s, $(v_2)_x \sim N(7.07, 0.71^2)$ m/s. **Ans.**