**Answer on Question 54833, Physics, Mechanics | Kinematics | Dynamics**

**Question:**

A coin with a diameter of $2.5cm$ is dropped on edge onto a horizontal surface. The coin starts out with an initial angular speed of $23\,rad/s$ and rolls in a straight line without slipping. If the rotation slows with an angular acceleration of magnitude $2.1\,rad/s^2$, how far does the coin roll before it stops?

**Solution:**

Let's first find the angular displacement $\theta$ from the kinematic equation:

$$\omega_f^2 = \omega_i^2 + 2\alpha\theta,$$

where, $\omega_f$ is the final angular speed, $\omega_i$ is the initial angular speed, $\alpha$ is the angular acceleration and $\theta$ is the angular displacement.

Since, $\omega_f = 0\,rad/s$ (coin finally stops) and angular acceleration is negative (the rotation of the coin is slow) we can rewrite our equation:

$$0 = \omega_i^2 - 2\alpha\theta.$$

From this equation we can find the angular displacement $\theta$:

$$\theta = \frac{\omega_i^2}{2\alpha} = \frac{(23\,\frac{rad}{s})^2}{2 \cdot 2.1\,\frac{rad}{s^2}} = 126rad.$$

Finally, we can find the distance that coin roll before it stops from the relation between linear and angular variables (here, $r = d/2 = 0.025m/2 = 0.0125m$ is the radius of the coin):

$$s = \theta r = 126rad \cdot 0.0125m = 1.57m.$$

**Answer:**

$s = 1.57m.$