Work-Energy Method

Mechanical Engineering

Net work equals change in kinetic energy, translation and rotation together.

The net work done on a body equals the change in its total kinetic energy.

$$\Sigma U = \Delta T \cdot T = \tfrac{1}{2}mv^2 + \tfrac{1}{2}I_G\,\omega^2$$

Solid cylinder, rolling

$T = 0.75\ m\ v^2$

Spin adds half again.

Spring compressed x

$U = -\tfrac{1}{2}kx^2$

Work done on it.

Friction over distance s

$U = -\mu N\ s$

Always negative.

THE COMMON MISTAKE

× **Counting the normal reaction as doing work**

✓ **It is perpendicular to motion**

Work needs a force component along the displacement. A normal reaction, and the contact point of a rolling wheel, both do zero work.

Energy methods skip the time history entirely. If the question asks for a time, use impulse and momentum.