

ROLLING VERSUS SLIDING

Middle school worksheet

Name: _____ Date: _____

A moving dot - what can it tell you?

Imagine a clip of a marked ball travelling to the right. The dot turns around its center. Does that settle whether the ball is skidding? Before reading the explanation, jot down a prediction and one reason.

MS01 | My first prediction: what could this clip tell me, and what might it leave uncertain?

Read the idea

A ball can travel along a track while turning around its center. Travelling is called translation; turning is rotation or spin. A block can slide without turning. A spinning ball can also skid: the touching surfaces slide relative to one another. For ideal rolling without slipping on a stationary rigid track, contact does not slide against the track. Friction at that contact can help the ball turn without draining movement energy through sliding. Real deformation and skidding have different limits.

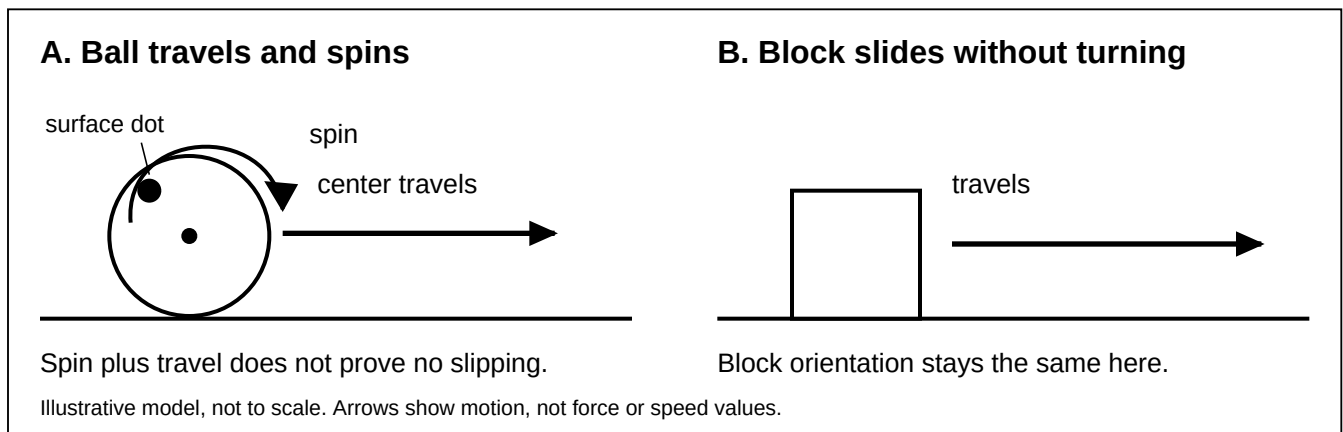


Diagram text: A ball has a rightward arrow for its center travelling and a clockwise arrow for spinning; a marked dot turns around its center. These two motions alone do not establish whether contact slips. A separate block moves right without turning. Arrows describe motion, not forces or measured speeds; the drawing is illustrative and not to scale.

MS02 | In diagram A, name the two motions. In B, name the motion shown and the motion absent in this example. Use the arrows and shapes as evidence.

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Middle school worksheet - continued

Use the distinction

MS03 | A friend says, "The dot goes around, so the ball cannot be skidding." Explain what the dot establishes and what additional contact information is needed.

MS04 | Paper activity: sketch a ball and a sliding block. Give the ball one arrow for travelling and one for spin. Give the block a travelling arrow but no spin arrow. Label what each arrow means; mark the drawing as illustrative.



For MS04: use this sheet and a pencil. Read the comparison, draw your two cases, then compare the labels. You can describe them aloud instead of drawing. No moving object, tools or physical trial is needed; the sketch explains an idea and supplies no measured result.

MS05 | Different setting, same question: in a hypothetical bowling clip, a ball travels and spins. What would you need to know about its contact with the lane before calling it rolling without slipping? Do not perform a bowling test.

MS06 | Revise your MS01 prediction. State one claim the clip supports and one claim it cannot establish by itself.

Optional deeper thought: Both travelling and spinning carry movement energy. The sharing depends on shape and how mass is distributed, so a cylinder result cannot automatically be used for a marble. This sheet gives qualitative reasoning, with no numerical speed or energy calculation.

Optional reading - follow a question

Rolling versus Sliding is the source micro-lesson: revisit the distinction between spin and non-slipping contact.

One More Take is the related ramp story: its explanation mentions travelling and spinning. It does not separately test rolling against sliding. These links are optional; this sheet contains the explanation needed to work offline.

Sources for the explanation

MIT: Rigid Body Dynamics, Examples 21.4-21.5 - rolling contact, spin and the distinction from sliding.

OpenStax: Rolling Motion, section 11.1 - translation and rotation, slipping and the ideal energy boundary.