

Same finish. Same story?

Middle school worksheet | OBML-005 | Name: _____ Date: _____

Goal: explain why speed at the finish and time for the journey need different evidence. First, use only the clue below. You may write, sketch or explain aloud.

Clue: two runs are reported to have the same speed at their finish. No journey times are reported.

MS01. Would you announce an arrival-time tie? Make a prediction and explain what information you would want before deciding.

Read after your prediction

Finish speed describes how fast an object moves at the finish. Elapsed journey time describes the interval from release to arrival. For the ideal marble comparison, equal drops give equal finish speeds. That does not specify the motion throughout the routes or establish equal journey times. Real tracks require observation; a route drawing supplies no measured winner.

Ideal marble comparison: the same marble starts from rest with no push, rolls without skidding, loses no movement energy to its surroundings, and receives no powered boost. Compare the vertical drop of its center from release to finish.

Words: endpoint means the place where a route ends; elapsed time is the interval between a chosen start event and a chosen finish event; ideal means a model that sets aside specified real complications.

MS02. Label these two questions with FINISH SPEED or JOURNEY TIME: How fast at the finish? How long from release to arrival? Explain the difference in your own words.

Read the two views



Two routes have matching release and finish heights. A straight route and a differently shaped downhill route connect them. A separate release-to-finish interval represents journey time; a marker only at the finish identifies endpoint speed. The drawing contains no measured time, speed or winning route. It is not to scale.

Ideal marble comparison: the same marble starts from rest with no push, rolls without skidding, loses no movement energy to its surroundings, and receives no powered boost. Compare the vertical drop of its center from release to finish.

MS03. Mark the release and finish in both panels. Draw a bracket for the whole interval and a circle at the place where finish speed is considered. What does the drawing let you compare, and what does it leave unknown?

MS04. A friend says, 'Route A looks shorter, so it must arrive first.' Explain why the picture alone cannot settle that claim. What observation would settle the arrival order for an actual pair of runs?

Use it somewhere else

MS05. A toy-run designer wants the marble to arrive after a cue in a pretend stop-motion film. The designer only checked the speed at the finish. Explain what needs to be recorded to check the cue, and why the finish check is insufficient. This is a proposed design problem; no trial results are supplied.

MS06. Paper activity: reread your MS01 prediction. Point to the finish marker, then trace each whole route. Write one sentence you would now keep or revise. Name a question that the drawing still cannot answer.

Activity setup: this sheet and a pencil; or use the text description and speak the answer with no materials. Trace the route with a finger, compare the two questions, then revise your reasoning. Observe the marked endpoints, not an actual marble run. This activity cannot measure a winner or prove how a homemade track behaves. No marble, track, tools, heights or road experiment is needed.

Optional next rabbit hole and sources

Everything needed for the worksheet is printed here. These links are optional. No account or online lesson completion is required.

Finish Speed versus Arrival Time - optional original micro-lesson |
<https://thisworldexplained.com/okay-but/finish-speed-versus-arrival-time/>

One More Take - Quinn ends with a timing question, rather than a timed route demonstration |
<https://thisworldexplained.com/okay-but/one-more-take/>

Harvard ball-race description - a particular cycloidal route beats a straight incline |
<https://sciencedemonstrations.fas.harvard.edu/presentations/brachistochrone>

Illinois teaching notes - whole-path time for a frictionless sliding particle, not a spinning marble |
<https://liberzon.csl.illinois.edu/teaching/cvoc/node24.html>

OpenStax Rolling Motion - ideal rolling energy and its conditions |
<https://openstax.org/books/university-physics-volume-1/pages/11-1-rolling-motion>

Free to print for classroom and home use. Answers are in the separate teacher key.