SAVVAS

Math Support

FLORIDA

Experience Physics®

Master Math in Physics in 4 Steps

Crack the code! *Florida Experience Physics®* supports every student in building a solid foundation in mathematics for physics with step-by-step guidance in every Experience (lesson).

Step 1: Analyze the Problem

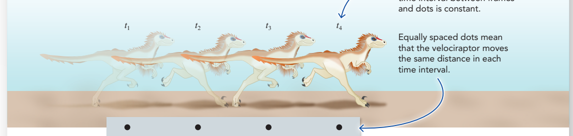
Identify key elements within the problem to help students grasp the fundamentals. Our resources guide you through each component, so you have a comprehensive understanding of the problem.

Motion Diagram Individual frames from a video of a skier are layered on top of each other. The composite image shows the skier's position at several equally spaced moments in time.

Dot Diagrams

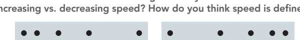
Motion is a change in position. You can use video to measure change in position with time. A video camera captures images at a fixed rate, typically 30 images every second. Each individual image is a frame. Individual frames can be layered on top of each other, producing a motion diagram. A **motion diagram** shows an object's position at several equally spaced moments in time.

To simplify a motion diagram, you can model the object as a dot. A **dot diagram** is a motion diagram in which each position of the moving object of interest is represented as a single point. A key feature of a dot diagram is that the time interval, or step, between successive dots is constant.



Dot Diagram The velociraptor's position is represented as a dot. Modeling the position as a dot simplifies the motion diagram, since you don't need to draw several velociraptors.

10 **SEP Ask Questions** The two dot diagrams show an object getting faster (left diagram) and an object getting slower (right diagram). What features about each dot diagram can you use to determine increasing vs. decreasing speed? How do you think speed is defined?



Dot Diagrams Ask students to draw a dot diagram that could represent a car coming to a stop over 5 seconds. The diagram should show that the distance between each dot gets smaller and smaller. As the car moves more slowly due to braking, its change in displacement decreases with each second.

Position Graphs Ask students how plotting a position graph might help sprinters analyze their performance during a 100-meter race. (The graph will show changes in their motion over time, which they might be able to influence by changing how they run the race. For example, it might show that they slow down just before the finish instead of running at top speed through the end.)

Speed and Velocity Reinforce that speed and velocity are different measurements. **Ask** What is the average speed and velocity of an object that moves 10 meters east in 5 seconds? (average speed = 2 m/s; average velocity = 2 m/s east) What is the average speed and velocity of an object that moves 10 meters east in 5 seconds and then immediately moves 10 meters west in 5 seconds? (average speed = 2 m/s; average velocity = 0)

Speed and Velocity Graphs Ask students to construct an explanation about the differences between the speed vs. time graph and the velocity vs. time graph in the Differentiating Speed and Velocity figure. Remind students that comparing the graphs requires that they pay attention to the scales used for the *x*- and *y*-axes in each graph and the frame of reference.

Modeling Uniform Motion In the Velocity Graph and Displacement illustrations, make sure that students understand how the area can be equal to displacement. They may have difficulty relating an area to distance, because area is generally expressed in units of squared distance. Have them work through a sample problem in which the velocity is 4 m/s and the time is 5 seconds, paying particular attention to units. **Ask** What is the area below the line in the sample calculation? (20 m)

Step 2: Solve with Precision

Apply mathematical concepts and skills to interpret the problem with accuracy. Clear, **step-by-step instructions** help you demonstrate problem-solving with ease.

Step 3: Use "Sample Problem Math Support" Callouts

Access the **Sample Problem Math Support** callouts for a list of highly recommended resources tailored to each topic. Find the best resource(s) to meet the needs of all your students at every level.

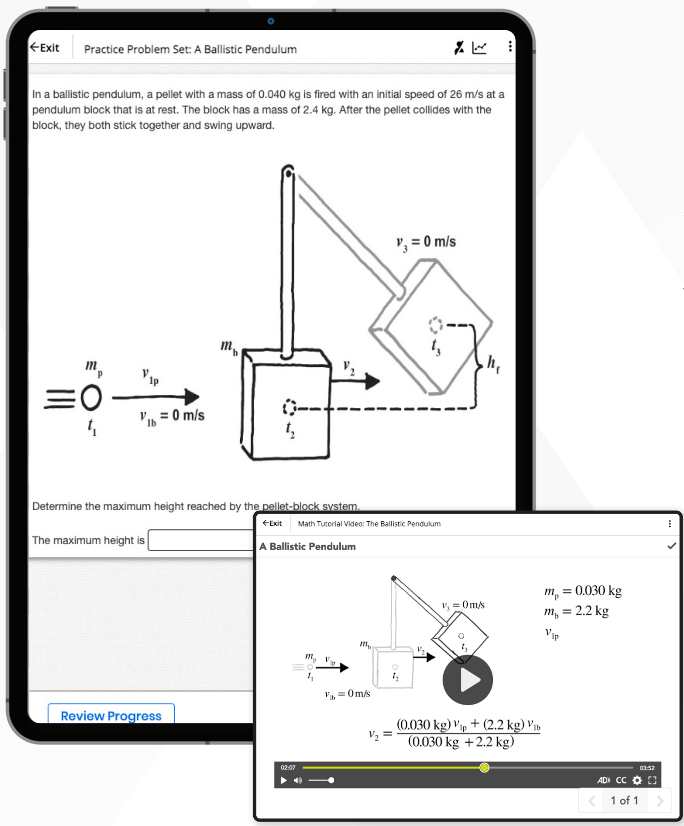
SAMPLE PROBLEM Math Support MA.K12.MTR.2.1

Math Tutorial Video In the Sample Problem, Driving Distance, students can see how to use the area under a velocity vs. time graph to find displacement. This skill is also explained in the Math Tutorial Video. Confirm that students know why finding the area provides the solution. For a constant velocity, the displacement is equal to the velocity times the time. Show students how this is represented on the graph by the area under the line during the time interval of interest.

Online Practice Problem Set There are more practice problems in the Online Practice Problem Set.

Desmos The Desmos graphing calculator can be used to plot and evaluate position vs. time graphs.

Skills Workbook Assign more practice problems from the workbook. When students are performing calculations, remind them to include the units for every value in the equation. Students should check that the unit of their answer matches the SI unit of the variable they were solving for. Encourage students to be in the habit of including units because they are a way to evaluate that their equations are correct and their answers are reasonable.



Step 4: Go Online for More Practice

Log in to **SavvasRealize.com** to reinforce these skills with additional **Practice Problem Sets** or assign **Math Tutorial Videos** to strengthen your students' understanding and confidence in applying math in physics. Explore math concepts with embedded **Desmos® calculators**! Plot functions, create tables, add sliders, and more.

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