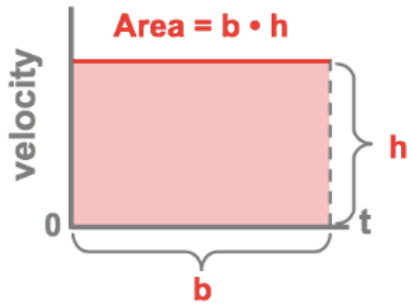
Velocity-Time Graphs: Calculating Displacement from Area

Lesson Notes

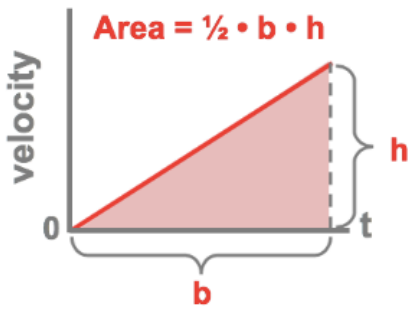
The BIG Idea:
The **area** between the line on a v-t graph and the time axis is equal to the amount of **displacement** during that time interval.

Three Types of Area Calculations

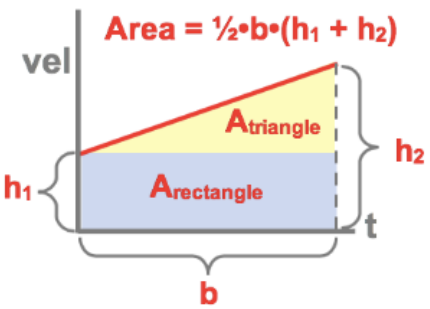
Rectangle



Triangle

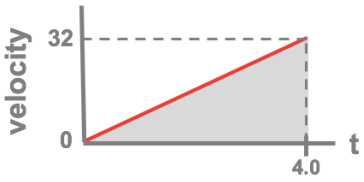


Trapezoid

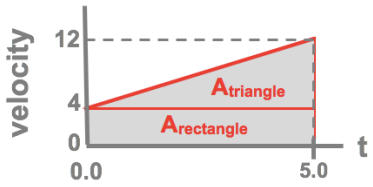


Example 1:
Lisa Ford drives at a constant speed of 18 m/s for 12 s. Determine the displacement.

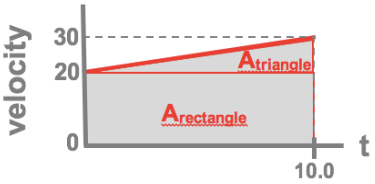
Example 2:
Inna Hurry accelerates from rest to 32 m/s in 4.0 s. Determine the displacement.



Example 3:
Jeremy accelerates from 4.0 m/s to 12.0 m/s in 5.0 s. Determine the displacement.

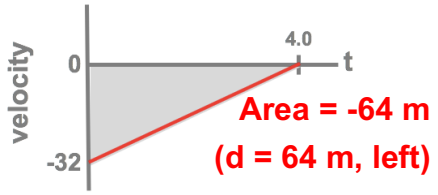


Your Turn to Practice
A car is moving at an initial speed of 20 m/s and then accelerates to 30 m/s for 10.0 seconds. Construct the v-t graph and determine the displacement.



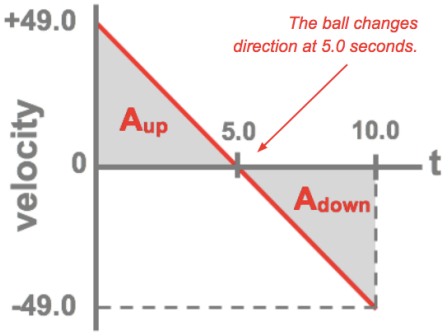
Negative Areas

A *negative area* occurs when the line is below the time axis. Negative signs in Physics seldom have numerical meaning. They typically have physical meaning. A negative sign signifies a direction ... like left or west or downward.



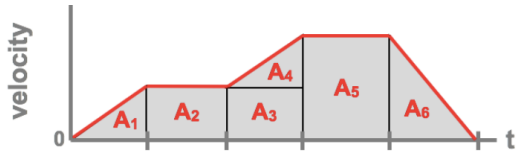
Axis Crossing

An object that changes direction will be represented by a line that crosses the time axis, like the motion of this upward-projected ball. There is a + area (for upward motion) and a - area (for downward motion.)



Area of a "Car"

For complex, multi-stage motions: break the total area into a series of smaller areas and calculate each individually.



Displacement = $A_1 + A_2 + A_3 + A_4 + A_5 + A_6$

Your Turn to Practice

Determine the displacement of the object represented by the following graph.