<u>Worksheet 2.5</u>

Distance, Velocity and Acceleration Graphs

1. Rennata Gass is driving through town at 25.0 m/s and begins to accelerate at a constant rate of –1.0 m/s^2. Eventually Rennata comes to a complete stop.
Represent Rennata's accelerated motion by sketching a velocity-time graph. Use the velocity-time graph to determine the distance traveled while decelerating.

2. Otto Emissions is driving his car at 25.0 m/s. Otto accelerates at 2.0 m/s^2 for 5 seconds. Otto then maintains this constant velocity for 10.0 more seconds.
Represent the 15 seconds of Otto Emission's motion by sketching a velocity-time graph. Use the graph to determine the distance Otto traveled during the entire 15 seconds.

3. Chuck Wagon travels with a constant velocity of 0.5 m/s for 10 s. Chuck then decelerates at –0.25 m/s^2 for 2 seconds.
Sketch a velocity-time graph for Chuck Wagon's motion. Use the velocity-time graph to determine the total distance traveled by Chuck Wagon during the 12 seconds of motion.

4. Vera Side is traveling down the interstate at 45.0 m/s. Vera looks ahead and observes an accident which results in a pileup in the middle of the road. By the time Vera slams on the breaks, she is 50.0 m from the pileup. She slows down at a rate of –15.0 m/s^2.
Construct a velocity-time plot for Vera Side's motion. Use the plot to determine the distance which Vera would travel prior to reaching a complete stop (assuming she does not collide with the pileup). Does she hit the pile up?

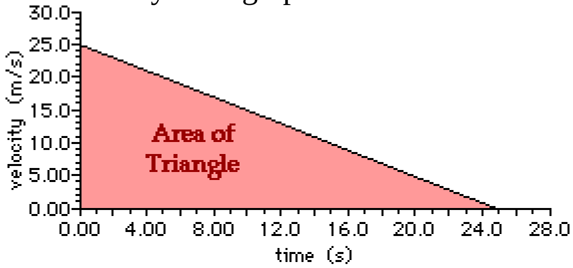
5. Earl E. Bird travels at 30.0 m/s for 10.0 seconds. He then accelerates at 3.00 m/s^2 for 5.00 seconds. Construct a velocity-time graph for Earl E. Bird's motion. Use the plot to determine the total distance traveled.

6. Luke Autbeloe, a human cannonball artist, is shot off the edge of a 100.0 m cliff with an initial upward velocity of +40.0 m/s. Luke accelerates with a constant acceleration of –10.0 m/s^2 (an approximate value of the acceleration of gravity).
Sketch a velocity-time graph for the first 10 seconds of Luke's motion and determine the time required for Luke Autbeloe to drop back to the original height of the cliff. Indicate this time on the graph.

Solutions

Solution to Question 1

The velocity-time graph for the motion is:



The distance traveled can be found by calculating the area between the line on the graph and the axes.

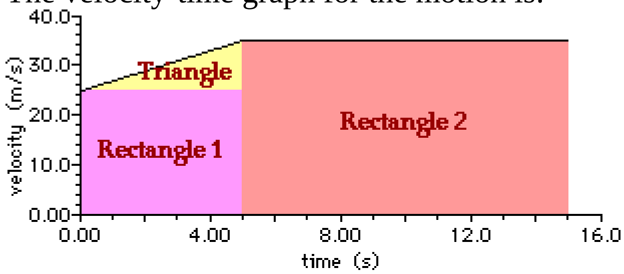
Area = 0.5*bh

Area = 0.5*(25.0 s)*(25.0 m/s)

Area = 313 m

Solution to Question 2

The velocity-time graph for the motion is:



The distance traveled can be found by calculating the area between the line on the graph and the axes.

Area = area of triangle + area of rectangle 1 + area of rectangle 2

Area = $0.5*b_1*h_t + b_1*h_1 + b_2*h_2$

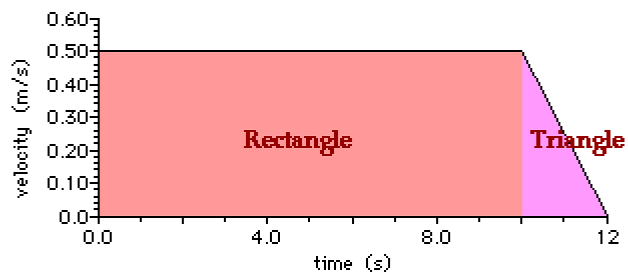
Area = 0.5*(5.0 s)*(10.0 m/s) + (5.0 s)*(25.0 m/s) + (10.0 s)*(35.0 m/s)

Area = 25 m + 125 m + 350 m

Area = 500 m

Solution to Question 3

The velocity-time graph for the motion is:



The distance traveled can be found by calculating the area between the line on the graph and the axes.

Area = area of rectangle + area of triangle

Area = $b_r h_r + 0.5 b1 h_t$

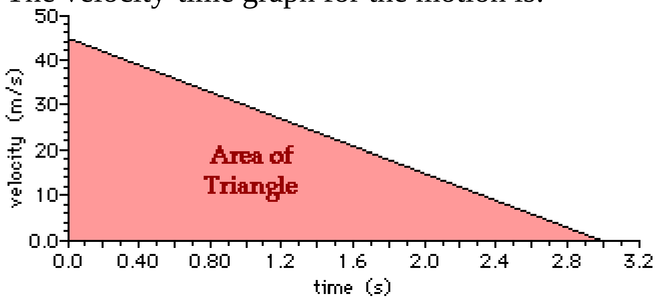
Area = (10.0 s)(0.50 m/s) + 0.5(2.0 s)(0.50 m/s)

Area = 5 m + 0.5 m

Area = 5.5 m

Solution to Question 4

The velocity-time graph for the motion is:



The distance traveled can be found by calculating the area between the line on the graph and the axes.

Area = area of triangle

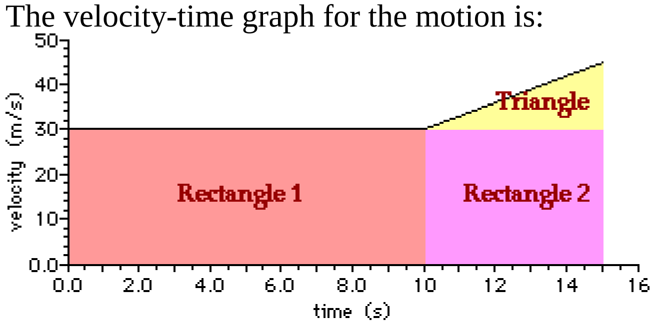
Area = 0.5*b*h

Area = 0.5*(3.0 s)*(45.0 m/s)

Area = 67.5 m

Solution to Question 5

The velocity-time graph for the motion is:



The distance traveled can be found by calculating the area between the line on the graph and the axes.

Area = area of triangle + area of rectangle 1 + area of rectangle 2

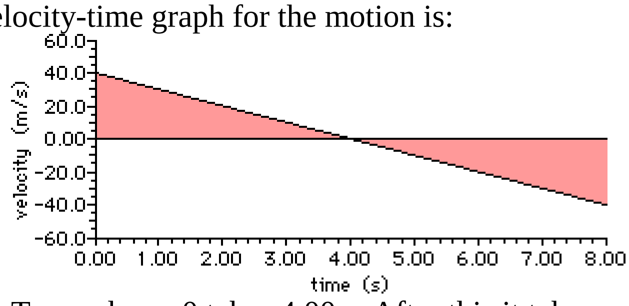
Area = $0.5*b_t*h_t + b_1*h_1 + b_2*h_2$

Area = 0.5*(5.0 s)*(15.0 m/s) + (10.0 s)*(30.0 m/s) + (5.0 s)*(30.0 m/s)

Area = 37.5 m + 300 m + 150 m = **487.5**

Solution to Question 6

The velocity-time graph for the motion is:



To reach v = 0 takes 4.00 s. After this it takes another 4.00 s for there to be an equal area below the graph as above. At this point the total displacement is zero.

t = 8.0 s