2.19. Figure 2.35 is a graph of the coordinate of a spider crawling along the x-axis. (a) Graph its velocity and acceleration as functions of time. (b) In a motion diagram (like Fig. 2.13b and 2.14b), show the position, velocity, and acceleration of the spider at the five times \( t = 2.5 \) s, \( t = 10 \) s, \( t = 20 \) s, \( t = 30 \) s, and \( t = 37.5 \) s.

Figure 2.35 Exercise 2.19.

2.30. At \( t = 0 \) a car is stopped at a traffic light. When the light turns green, the car starts to speed up, and gains speed at a constant rate until it reaches a speed of 20 m/s 8 seconds after the light turns green. The car continues at a constant speed for 60 m. Then the driver sees a red light up ahead at the next intersection, and starts slowing down at a constant rate. The car stops at the light, 180 m from where it was at \( t = 0 \). (a) Draw accurate \( x-t \), \( v-t \), and \( a-t \) graphs for the motion of the car. (b) In a motion diagram (like Figs. 2.13b and 2.14b), show the position, velocity, and acceleration of the car at 4 s after the light changes, while traveling at constant speed, and while slowing down.

2/4 The displacement of a particle which moves along the x-axis is given by \( s = (-2 + 3t)e^{-0.5t} \), where \( s \) is in meters and \( t \) is in seconds. Plot the displacement, velocity, and acceleration versus time for the first 20 seconds of motion. Determine the time at which the acceleration is zero.

2/30 A particle moving along the positive x-direction with an initial velocity of 12 m/s is subjected to a retarding force that gives it a negative acceleration which varies linearly with time for the first 4 seconds as shown. For the next 5 seconds the force is constant and the acceleration remains constant. Plot the velocity of the particle during the 9 seconds and specify its value at \( t = 4 \) s. Also find the distance \( \Delta x \) traveled by the particle from its position at \( t = 0 \) to the point where it reverses its direction.

\[ a_x, \text{ m/s}^2 \]