Chapter 2 Solutions

P2.4 $x = 10t^2$: By substitution, for $\begin{array}{lllll} t(\text{s}) & = & 2.0 & 2.1 & 3.0 \\ x(\text{m}) & = & 40 & 44.1 & 90 \end{array}$

(a) $v_{avg} = \frac{\Delta x}{\Delta t} = \frac{50 \text{ m}}{1.0 \text{ s}} = \boxed{50.0 \text{ m/s}}$

(b) $v_{avg} = \frac{\Delta x}{\Delta t} = \frac{4.1 \text{ m}}{0.1 \text{ s}} = \boxed{41.0 \text{ m/s}}$

P2.6 (a) At any time, t, the position is given by $x = (3.00 \text{ m/s}^2)t^2$.

Thus, at $t_i = 3.00 \text{ s}$: $x_i = (3.00 \text{ m/s}^2)(3.00 \text{ s})^2 = \boxed{27.0 \text{ m}}$.

(b) At $t_f = 3.00 \text{ s} + \Delta t$: $x_f = (3.00 \text{ m/s}^2)(3.00 \text{ s} + \Delta t)^2$, or

$$x_f = \boxed{27.0 \text{ m} + (18.0 \text{ m/s})\Delta t + (3.00 \text{ m/s}^2)(\Delta t)^2}.$$

(c) The instantaneous velocity at $t = 3.00 \text{ s}$ is:

$$v = \lim_{\Delta t \to 0}\left(\frac{x_f - x_i}{\Delta t}\right) = \lim_{\Delta t \to 0}\left(18.0 \text{ m/s} + (3.00 \text{ m/s}^2)\Delta t\right) = \boxed{18.0 \text{ m/s}}.$$

At $t = 2.0 \text{ s}$, the slope is $v \approx \frac{36 \text{ m}}{4.0 \text{ s}} = \boxed{9.0 \text{ m/s}}$.

(c) $a_{avg} = \frac{\Delta v}{\Delta t} \approx \frac{23 \text{ m/s}}{5.0 \text{ s}} = \boxed{4.6 \text{ m/s}^2}$

(d) Initial velocity of the car was $\boxed{\text{zero}}$.

P2.8 (a) $v = \frac{(5-0) \text{ m}}{(1-0) \text{ s}} = \boxed{5 \text{ m/s}}$

(b) $v = \frac{(5-10) \text{ m}}{(4-2) \text{ s}} = \boxed{-2.5 \text{ m/s}}$

(c) $v = \frac{(5 \text{ m} - 5 \text{ m})}{(5 \text{ s} - 4 \text{ s})} = \boxed{0}$

(d) $v = \frac{0 - (-5 \text{ m})}{(8 \text{ s} - 7 \text{ s})} = \boxed{+5 \text{ m/s}}$

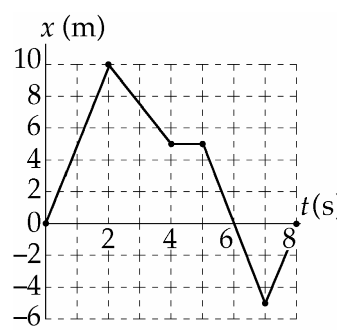


FIG. P2.8

P2.10 Choose the positive direction to be the outward direction, perpendicular to the wall.

$$v_f = v_i + at: \quad a = \frac{\Delta v}{\Delta t} = \frac{22.0 \text{ m/s} - (-25.0 \text{ m/s})}{3.50 \times 10^{-3} \text{ s}} = \boxed{1.34 \times 10^4 \text{ m/s}^2}$$

P2.12 (a) Acceleration is the slope of the graph of v versus t.

For $0 < t < 5.00$ s, $a = 0$.

For $15.0 \text{ s} < t < 20.0$ s, $a = 0$.

For $5.0 \text{ s} < t < 15.0$ s, $a = \frac{v_f - v_i}{t_f - t_i}$.

$$a = \frac{8.00 - (-8.00)}{15.0 - 5.00} = 1.60 \text{ m/s}^2$$

We can plot $a(t)$ as shown.

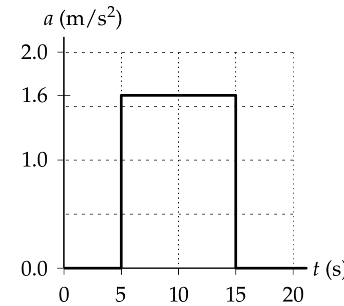


FIG. P2.12

(b) $a = \frac{v_f - v_i}{t_f - t_i}$

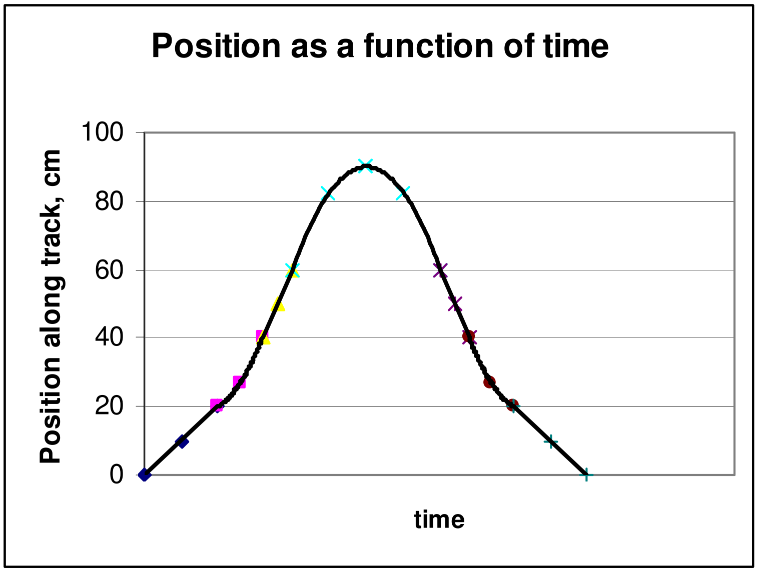
(i) For $5.00 \text{ s} < t < 15.0$ s, $t_i = 5.00$ s, $v_i = -8.00$ m/s,

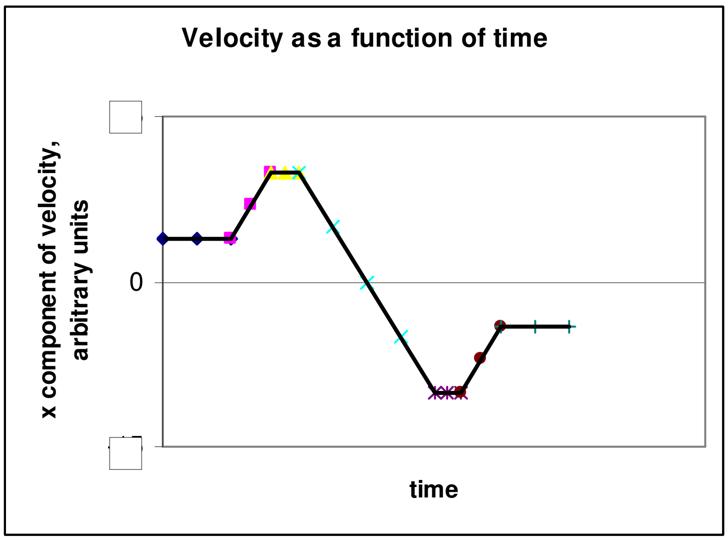
$$t_f = 15.0 \text{ s}$$
$$v_f = 8.00 \text{ m/s}$$
$$a = \frac{v_f - v_i}{t_f - t_i} = \frac{8.00 - (-8.00)}{15.0 - 5.00} = \boxed{1.60 \text{ m/s}^2}.$$

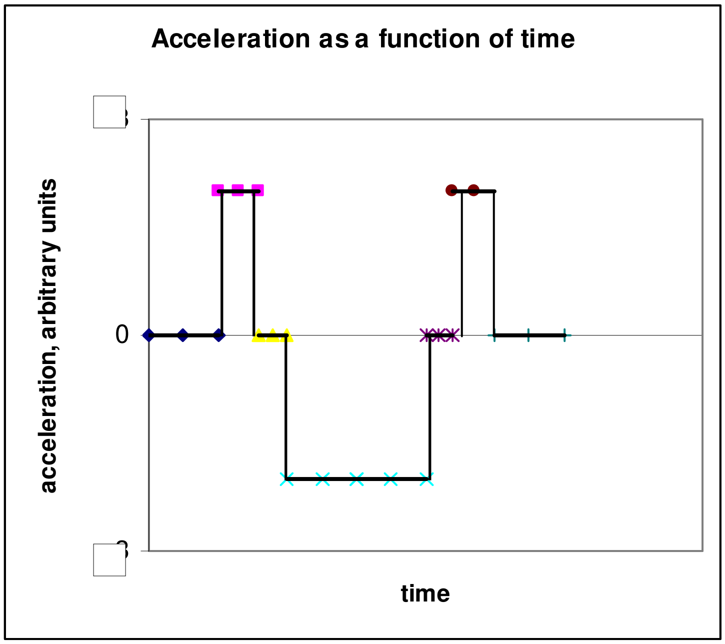
(ii) $t_i = 0$, $v_i = -8.00$ m/s, $t_f = 20.0$ s, $v_f = 8.00$ m/s

$$a = \frac{v_f - v_i}{t_f - t_i} = \frac{8.00 - (-8.00)}{20.0 - 0} = \boxed{0.800 \text{ m/s}^2}$$

***P2.14** The acceleration is zero whenever the marble is on a horizontal section. The acceleration has a constant positive value when the marble is rolling on the 20-to-40-cm section and has a constant negative value when it is rolling on the second sloping section. The position graph is a straight sloping line whenever the speed is constant and a section of a parabola when the speed changes.


Position as a function of time
100
80
60
40
20
0
Position along track, cm
time


Velocity as a function of time
0
x component of velocity, arbitrary units
time

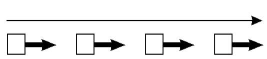


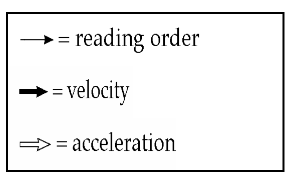
P2.16 (a) $a = \dfrac{\Delta v}{\Delta t} = \dfrac{8.00\ \text{m/s}}{6.00\ \text{s}} = \boxed{1.3\ \text{m/s}^2}$

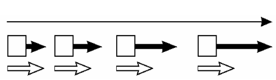
(b) Maximum positive acceleration is at $t = 3$ s, and is the slope of the graph, approximately $(6-2)/(4-2) = \boxed{2\ \text{m/s}^2}$.

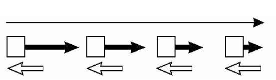
(c) $a = 0$ at $\boxed{t = 6\ \text{s}}$, and also for $\boxed{t > 10\ \text{s}}$.

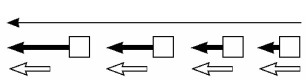
(d) Maximum negative acceleration is at $t = 8$ s, and is the slope of the graph, approximately $\boxed{-1.5\ \text{m/s}^2}$.

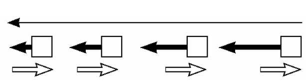
P2.18 (a) 



(b) 

(c) 

(d) 

(e) 

(f) One way of phrasing the answer: The spacing of the successive positions would change with less regularity.

Another way: The object would move with some combination of the kinds of motion shown in (a) through (e). Within one drawing, the accelerations vectors would vary in magnitude and direction.

P2.22 (a) Total displacement = area under the $(v,\ t)$ curve from $t = 0$ to 50 s.

$$\Delta x = \frac{1}{2}(50\ \text{m/s})(15\ \text{s}) + (50\ \text{m/s})(40-15)\ \text{s} + \frac{1}{2}(50\ \text{m/s})(10\ \text{s})$$

$$\Delta x = 1875\ \text{m} = \boxed{1.88\ \text{km}}$$

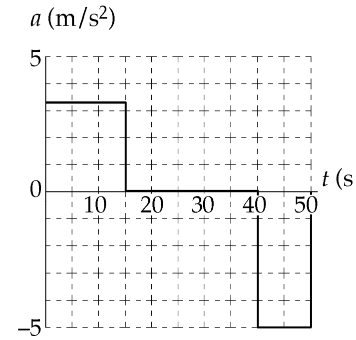


FIG. P2.22

(b) From $t = 10\ \text{s}$ to $t = 40\ \text{s}$, displacement is

$$\Delta x = \frac{1}{2}(50\ \text{m/s} + 33\ \text{m/s})(5\ \text{s}) + (50\ \text{m/s})(25\ \text{s}) = \boxed{1.46\ \text{km}}$$

(c) $0 \le t \le 15\ \text{s}$: $a_1 = \dfrac{\Delta v}{\Delta t} = \dfrac{(50-0)\ \text{m/s}}{15\ \text{s} - 0} = \boxed{3.3\ \text{m/s}^2}$

$15\ \text{s} < t < 40\ \text{s}$: $\boxed{a_2 = 0}$

$40\ \text{s} \le t \le 50\ \text{s}$: $a_3 = \dfrac{\Delta v}{\Delta t} = \dfrac{(0-50)\ \text{m/s}}{50\ \text{s} - 40\ \text{s}} = \boxed{-5.0\ \text{m/s}^2}$

(d) (i) $x_1 = 0 + \dfrac{1}{2}a_1 t^2 = \dfrac{1}{2}(3.3\ \text{m/s}^2)t^2$ or $\boxed{x_1 = (1.67\ \text{m/s}^2)t^2}$

(ii) $x_2 = \dfrac{1}{2}(15\ \text{s})[50\ \text{m/s} - 0] + (50\ \text{m/s})(t - 15\ \text{s})$ or $\boxed{x_2 = (50\ \text{m/s})t - 375\ \text{m}}$

(iii) For $40\ \text{s} \le t \le 50\ \text{s}$,

$$x_3 = \begin{pmatrix}\text{area under } v \text{ vs } t \\ \text{from } t = 0 \text{ to } 40\ \text{s}\end{pmatrix} + \frac{1}{2}a_3(t - 40\ \text{s})^2 + (50\ \text{m/s})(t - 40\ \text{s})$$

or

$$x_3 = 375\ \text{m} + 1\,250\ \text{m} + \frac{1}{2}(-5.0\ \text{m/s}^2)(t - 40\ \text{s})^2 + (50\ \text{m/s})(t - 40\ \text{s})$$

which reduces to

$$\boxed{x_3 = (250\ \text{m/s})t - (2.5\ \text{m/s}^2)t^2 - 4\,375\ \text{m}}.$$

(e) $\bar{v} = \dfrac{\text{total displacement}}{\text{total elapsed time}} = \dfrac{1\,875\ \text{m}}{50\ \text{s}} = \boxed{37.5\ \text{m/s}}$

***P2.24** (a) For the first car the speed as a function of time is $v = v_i + at = -3.5\ \text{cm/s} + 2.4\ \text{cm/s}^2\ t$.

For the second car, the speed is $+5.5\text{ cm/s} + 0$. Setting the two expressions equal gives

$-3.5\text{ cm/s} + 2.4\text{ cm/s}^2\,t = 5.5\text{ cm/s}$ so $t = (9\text{ cm/s})/(2.4\text{ cm/s}^2) = \boxed{3.75\text{ s}}$.

(b) The first car then has speed $-3.5\text{ cm/s} + (2.4\text{ cm/s}^2)(3.75\text{ s}) = \boxed{5.50\text{ cm/s}}$, and this is the constant speed of the second car also.

(c) For the first car the position as a function of time is
$x_i + v_i t + (1/2)at^2 = 15\text{ cm} - (3.5\text{ cm/s})t + (0.5)(2.4\text{ cm/s}^2)\,t^2$.
For the second car, the position is $10\text{ cm} + (5.5\text{ cm/s})t + 0$.

At passing, the positions are equal: $15\text{ cm} - (3.5\text{ cm/s})t + (1.2\text{ cm/s}^2)\,t^2 = 10\text{ cm} + (5.5\text{ cm/s})t$
$(1.2\text{ cm/s}^2)\,t^2 - (9\text{ cm/s})\,t + 5\text{ cm} = 0$.

We solve with the quadratic formula:

$$t = \frac{9 \pm \sqrt{9^2 - 4(1.2)(5)}}{2(1.2)} = \frac{9+\sqrt{57}}{2.4} \text{ and } \frac{9-\sqrt{57}}{2.4} = \boxed{6.90\text{ s and }0.604\text{ s}}$$

(d) At 0.604 s, the second and also the first car's position is $10\text{ cm} + (5.5\text{ cm/s})0.604\text{ s} = \boxed{13.3\text{ cm}}$.

At 6.90 s, both are at position $10\text{ cm} + (5.5\text{ cm/s})6.90\text{ s} = \boxed{47.9\text{ cm}}$.

(e) The cars are initially moving toward each other, so they soon share the same position x when their speeds are quite different, giving one answer to (c) that is not an answer to (a). The first car slows down in its motion to the left, turns around, and starts to move toward the right, slowly at first and gaining speed steadily. At a particular moment its speed will be equal to the constant rightward speed of the second car. The distance between them will at that moment be staying constant at its maximum value. The distance between the cars will be far from zero, as the accelerating car will be far to the left of the steadily moving car. Thus the answer to (a) is not an answer to (c). Eventually the accelerating car will catch up to the steadily-coasting car, whizzing past at higher speed than it has ever had before, and giving another answer to (c) that is not an answer to (a). A graph of x versus t for the two cars shows a parabola originally sloping down and then curving upward, intersecting twice with an upward-sloping straight line. The parabola and straight line are running parallel, with equal slopes, at just one point in between their intersections.

P2.26 Take any two of the standard four equations, such as $\left\{\begin{aligned} v_{xf} &= v_{xi} + a_x t \\ x_f - x_i &= \frac{1}{2}\left(v_{xi} + v_{xf}\right)t \end{aligned}\right\}$.

Solve one for v_{xi}, and substitute into the other: $v_{xi} = v_{xf} - a_x t$

$$x_f - x_i = \frac{1}{2}\left(v_{xf} - a_x t + v_{xf}\right)t\,.$$

Thus

$$\boxed{x_f - x_i = v_{xf}t - \frac{1}{2}a_x t^2}.$$

We note that the equation is dimensionally correct. The units are units of length in each term. Like the standard equation $x_f - x_i = v_{xi}t + \frac{1}{2}a_x t^2$, this equation represents that displacement is a quadratic function of time.

Our newly derived equation gives us for the situation back in problem 25,

$$62.4 \text{ m} = v_{xf}(4.20 \text{ s}) - \frac{1}{2}(-5.60 \text{ m/s}^2)(4.20 \text{ s})^2$$

$$v_{xf} = \frac{62.4 \text{ m} - 49.4 \text{ m}}{4.20 \text{ s}} = \boxed{3.10 \text{ m/s}}.$$

P2.28 (a) Compare the position equation $x = 2.00 + 3.00t - 4.00t^2$ to the general form

$$x_f = x_i + v_i t + \frac{1}{2}at^2$$

to recognize that $x_i = 2.00 \text{ m}$, $v_i = 3.00 \text{ m/s}$, and $a = -8.00 \text{ m/s}^2$. The velocity equation, $v_f = v_i + at$, is then

$$v_f = 3.00 \text{ m/s} - (8.00 \text{ m/s}^2)t.$$

The particle changes direction when $v_f = 0$, which occurs at $t = \frac{3}{8}$ s. The position at this time is

$$x = 2.00 \text{ m} + (3.00 \text{ m/s})\left(\frac{3}{8} \text{ s}\right) - (4.00 \text{ m/s}^2)\left(\frac{3}{8} \text{ s}\right)^2 = \boxed{2.56 \text{ m}}.$$

(b) From $x_f = x_i + v_i t + \frac{1}{2}at^2$, observe that when $x_f = x_i$, the time is given by $t = -\frac{2v_i}{a}$. Thus, when the particle returns to its initial position, the time is

$$t = \frac{-2(3.00 \text{ m/s})}{-8.00 \text{ m/s}^2} = \frac{3}{4} \text{ s}$$

and the velocity is $v_f = 3.00 \text{ m/s} - (8.00 \text{ m/s}^2)\left(\frac{3}{4} \text{ s}\right) = \boxed{-3.00 \text{ m/s}}$.

P2.32 Take the original point to be when Sue notices the van. Choose the origin of the x-axis at Sue's car. For her we have $x_{is} = 0$, $v_{is} = 30.0 \text{ m/s}$, $a_s = -2.00 \text{ m/s}^2$ so her position is given by

$$x_s(t) = x_{is} + v_{is}t + \frac{1}{2}a_s t^2 = (30.0 \text{ m/s})t + \frac{1}{2}(-2.00 \text{ m/s}^2)t^2.$$

For the van, $x_{iv} = 155 \text{ m}$, $v_{iv} = 5.00 \text{ m/s}$, $a_v = 0$ and

$$x_v(t) = x_{iv} + v_{iv}t + \frac{1}{2}a_v t^2 = 155 + (5.00 \text{ m/s})t + 0 .$$

To test for a collision, we look for an instant t_c when both are at the same place:

$$30.0t_c - t_c^2 = 155 + 5.00t_c$$
$$0 = t_c^2 - 25.0t_c + 155.$$

From the quadratic formula

$$t_c = \frac{25.0 \pm \sqrt{(25.0)^2 - 4(155)}}{2} = 13.6 \text{ s or } \boxed{11.4 \text{ s}} .$$

The roots are real, not imaginary, so there is a collision. The smaller value is the collision time. (The larger value tells when the van would pull ahead again if the vehicles could move through each other). The wreck happens at position

$$155 \text{ m} + (5.00 \text{ m/s})(11.4 \text{ s}) = \boxed{212 \text{ m}} .$$

P2.38 We have $y_f = -\frac{1}{2}gt^2 + v_i t + y_i$

$$0 = -(4.90 \text{ m/s}^2)t^2 - (8.00 \text{ m/s})t + 30.0 \text{ m} .$$

Solving for t,

$$t = \frac{8.00 \pm \sqrt{64.0 + 588}}{-9.80} .$$

Using only the positive value for t, we find that $t = \boxed{1.79 \text{ s}}$.

P2.40 The bill starts from rest $v_i = 0$ and falls with a downward acceleration of 9.80 m/s^2 (due to gravity). Thus, in 0.20 s it will fall a distance of

$$\Delta y = v_i t - \frac{1}{2}gt^2 = 0 - (4.90 \text{ m/s}^2)(0.20 \text{ s})^2 = -0.20 \text{ m} .$$

This distance is about twice the distance between the center of the bill and its top edge $(\approx 8 \text{ cm})$.

Thus, David will be unsuccessful.

***P2.42** We can solve (a) and (b) at the same time by assuming the rock passes the top of the wall and finding its speed there. If the speed comes out imaginary, the rock will not reach this elevation.

$$v_f^2 = v_i^2 + 2a(x_f - x_i) = (7.4 \text{ m/s})^2 - 2(9.8 \text{ m/s}^2)(3.65 \text{ m} - 1.55 \text{ m}) = 13.6 \text{ m}^2/\text{s}^2$$

so the rock does reach the top of the wall with $v_f = 3.69$ m/s.

(c) We find the final speed, just before impact, of the rock thrown down:

$v_f^2 = v_i^2 + 2a(x_f - x_i) = (-7.4 \text{ m/s})^2 - 2(9.8 \text{ m/s}^2)(1.55 \text{ m} - 3.65 \text{ m}) = 95.9 \text{ m}^2/\text{s}^2$

$v_f = -9.79$ m/s. The change in speed of the rock thrown down is $|9.79 - 7.4| = \boxed{2.39 \text{ m/s}}$

(d) The magnitude of the speed change of the rock thrown up is $|7.4 - 3.69| = 3.71$ m/s. This does not agree with 2.39 m/s.

The upward-moving rock spends more time in flight, so the planet has more time to change its speed.

$$\boxed{a^2 = a_i^2 + 2J(v - v_i)}.$$

P2.48 (a) $a = \dfrac{dv}{dt} = \dfrac{d}{dt}\left[-5.00\times10^7 t^2 + 3.00\times10^5 t\right]$

$$\boxed{a = -(10.0\times10^7 \text{ m/s}^3)t + 3.00\times10^5 \text{ m/s}^2}$$

Take $x_i = 0$ at $t = 0$. Then $v = \dfrac{dx}{dt}$

$$x - 0 = \int_0^t v\,dt = \int_0^t \left(-5.00\times10^7 t^2 + 3.00\times10^5 t\right)dt$$

$$x = -5.00\times10^7 \frac{t^3}{3} + 3.00\times10^5 \frac{t^2}{2}$$

$$\boxed{x = -(1.67\times10^7 \text{ m/s}^3)t^3 + (1.50\times10^5 \text{ m/s}^2)t^2}.$$

(b) The bullet escapes when $a = 0$, at $-(10.0\times10^7 \text{ m/s}^3)t + 3.00\times10^5 \text{ m/s}^2 = 0$

$$t = \frac{3.00\times10^5 \text{ s}}{10.0\times10^7} = \boxed{3.00\times10^{-3} \text{ s}}.$$

(c) New $v = (-5.00\times10^7)(3.00\times10^{-3})^2 + (3.00\times10^5)(3.00\times10^{-3})$

$$v = -450 \text{ m/s} + 900 \text{ m/s} = \boxed{450 \text{ m/s}}.$$

(d) $x = -(1.67\times10^7)(3.00\times10^{-3})^3 + (1.50\times10^5)(3.00\times10^{-3})^2$

$x = -0.450 \text{ m} + 1.35 \text{ m} = \boxed{0.900 \text{ m}}$

P2.50 (a) As we see from the graph, from about -50 s to 50 s Acela is cruising at a constant positive velocity in the $+x$ direction. From 50 s to 200 s, Acela accelerates in the $+x$ direction reaching a top speed of about 170 mi/h. Around 200 s, the engineer applies the brakes, and the train, still traveling in the $+x$ direction, slows down and then stops at 350 s. Just after 350 s, Acela reverses direction (v becomes negative) and steadily gains speed in the $-x$ direction.

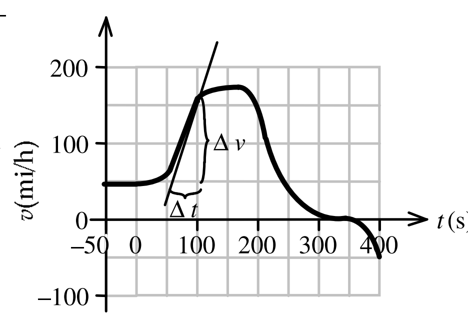


FIG. P2.50(a)

(b) The peak acceleration between 45 and 170 mi/h is given by the slope of the steepest tangent to the v versus t curve in this interval. From the tangent line shown, we find

$$a = \text{slope} = \frac{\Delta v}{\Delta t} = \frac{(155-45)\ \text{mi/h}}{(100-50)\ \text{s}} = \boxed{2.2\ (\text{mi/h})/\text{s}} = 0.98\ \text{m/s}^2 .$$

(c) Let us use the fact that the area under the v versus t curve equals the displacement. The train's displacement between 0 and 200 s is equal to the area of the gray shaded region, which we have approximated with a series of triangles and rectangles.

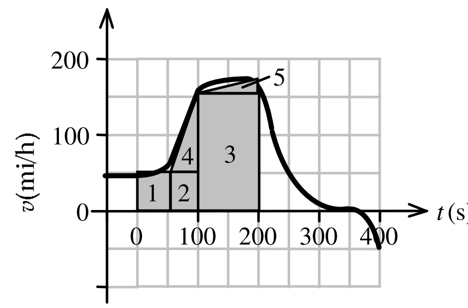


FIG. P2.50(c)

$$\begin{aligned}\Delta x_{0\to 200\ \text{s}} &= \text{area}_1 + \text{area}_2 + \text{area}_3 + \text{area}_4 + \text{area}_5\\ &\approx (50\ \text{mi/h})(50\ \text{s}) + (50\ \text{mi/h})(50\ \text{s})\\ &\quad + (160\ \text{mi/h})(100\ \text{s})\\ &\quad + \frac{1}{2}(50\ \text{s})(100\ \text{mi/h})\\ &\quad + \frac{1}{2}(100\ \text{s})(170\ \text{mi/h} - 160\ \text{mi/h})\\ &= 24\,000(\text{mi/h})(\text{s})\end{aligned}$$

Now, at the end of our calculation, we can find the displacement in miles by converting hours to seconds. As $1\ \text{h} = 3\,600\ \text{s}$,

$$\Delta x_{0\to 200\ \text{s}} \approx \left(\frac{24\,000\ \text{mi}}{3\,600\ \text{s}}\right)(\text{s}) = \boxed{6.7\ \text{mi}} .$$

P2.52 Area A_1 is a rectangle. Thus, $A_1 = hw = v_{xi}t$.

Area A_2 is triangular. Therefore $A_2 = \frac{1}{2}bh = \frac{1}{2}t(v_x - v_{xi})$.

The total area under the curve is

$$A = A_1 + A_2 = v_{xi}t + \frac{(v_x - v_{xi})t}{2}$$

and since $v_x - v_{xi} = a_x t$

$$\boxed{A = v_{xi}t + \tfrac{1}{2}a_x t^2} .$$

The displacement given by the equation is: $x = v_{xi}t + \frac{1}{2}a_x t^2$, the same result as above for the total area.

P2.60 (a)

$$d = \frac{1}{2}(9.80)t_1^2 \qquad d = 336t_2$$

$$t_1 + t_2 = 2.40 \qquad 336t_2 = 4.90(2.40 - t_2)^2$$

$$4.90t_2^2 - 359.5t_2 + 28.22 = 0 \qquad t_2 = \frac{359.5 \pm \sqrt{359.5^2 - 4(4.90)(28.22)}}{9.80}$$

$$t_2 = \frac{359.5 \pm 358.75}{9.80} = 0.076\,5 \text{ s} \qquad \text{so} \qquad d = 336t_2 = \boxed{26.4 \text{ m}}$$

(b) Ignoring the sound travel time, $d = \frac{1}{2}(9.80)(2.40)^2 = 28.2 \text{ m}$, an error of $\boxed{6.82\%}$.

P2.62

Time t (s)	Height h (m)	Δh (m)	Δt (s)	$\bar{v}$ (m/s)	midpt time t (s)
0.00	5.00				
		0.75	0.25	3.00	0.13
0.25	5.75				
		0.65	0.25	2.60	0.38
0.50	6.40				
		0.54	0.25	2.16	0.63
0.75	6.94				
		0.44	0.25	1.76	0.88
1.00	7.38				
		0.34	0.25	1.36	1.13
1.25	7.72				
		0.24	0.25	0.96	1.38
1.50	7.96				
		0.14	0.25	0.56	1.63
1.75	8.10				
		0.03	0.25	0.12	1.88
2.00	8.13				
		–0.06	0.25	–0.24	2.13
2.25	8.07				
		–0.17	0.25	–0.68	2.38
2.50	7.90				
		–0.28	0.25	–1.12	2.63
2.75	7.62				
		–0.37	0.25	–1.48	2.88
3.00	7.25				
		–0.48	0.25	–1.92	3.13
3.25	6.77				
		–0.57	0.25	–2.28	3.38
3.50	6.20				
		–0.68	0.25	–2.72	3.63
3.75	5.52				
		–0.79	0.25	–3.16	3.88
4.00	4.73				
		–0.88	0.25	–3.52	4.13
4.25	3.85				
		–0.99	0.25	–3.96	4.38
4.50	2.86				
		–1.09	0.25	–4.36	4.63
4.75	1.77				
		–1.19	0.25	–4.76	4.88
5.00	0.58				

TABLE P2.62

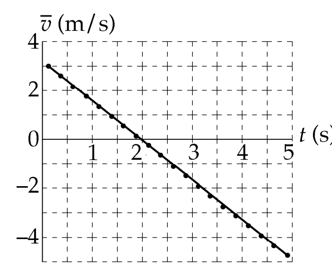


FIG. P2.62

The very convincing fit of a single straight line to the points in the graph of velocity versus time indicates that the rock does fall with constant acceleration. The acceleration is the slope of line:

$$a_{avg} = -1.63\ \text{m/s}^2 = \boxed{1.63\ \text{m/s}^2\ \text{downward}}$$