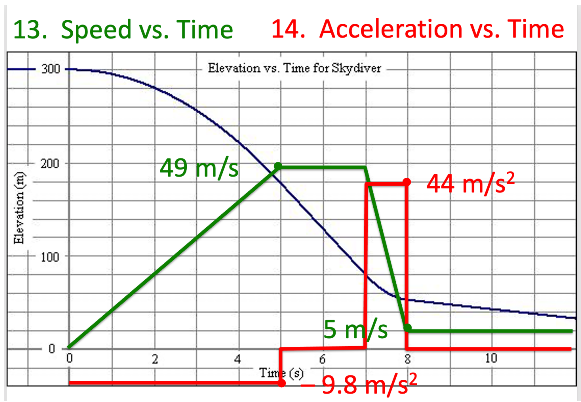
AP Physics C – Kinematics, Complete Answers

1. a. 775 mi, N of K-town
   b. 655 mi, S
   c. 105 mi, S of K-town
   d. 1105 mi
2. Suppose a car is owned and used for several years and then returned to the dealer. The odometer shows thousands of miles distance traveled but displacement is zero because net change in position is zero, having returned to its starting point.
3. a. 6$\underline{0}$ km, W
   b. 7$\underline{0}$ km
   c. 120 km/h, W
   d. 140 km/h
   e. Distance and average speed are greater because the car did not travel a straight path of roadway.
4. a. 46 m, 439 m,
   3.84×10^8 m
   b. 69 yrs, 7.24 yrs,
   4.36 min
5. a. Biker A by 19 s
   b. 11 m/s
   c. 0 m/s
6. a. Because speed is proportional to distance per time and distance is the same, the ratio of speeds is equal to the inverse of the ratio of the times.
   b. This would not work if either car is accelerating.
7. 4.68 s
8. a. Only if motion is linear in one direction is avg. speed equal to magnitude of average velocity.
   b. If path is curved or object reverses direction then distance will be greater than displacement.
   c. As the interval of time approaches zero any curvature of the path becomes insignificant.
9. a. $d = \Delta t \dfrac{v_1 v_2}{v_1 - v_2}$
   b. 1.7 km (about 1 mi)
   c. 4$\underline{0}$ km (about 25 mi)
10. a. 8.6 m/s^2
    b. 3.5 m/s^2
    c. 1.7 m/s^2
    d. As the speed of the car increases the acceleration of the car decreases.
11. 3.8 s

12. a. 22 m/s, down
b. 20 m/s
c. 49 m/s
d. Skydiver has terminal speeds from 5 to 7 sec and from 8 to 12 sec as shown by linear portions of the graph.
e. $t = 18.5$ s,
$v = 5.0$ m/s

13. graph

14. graph

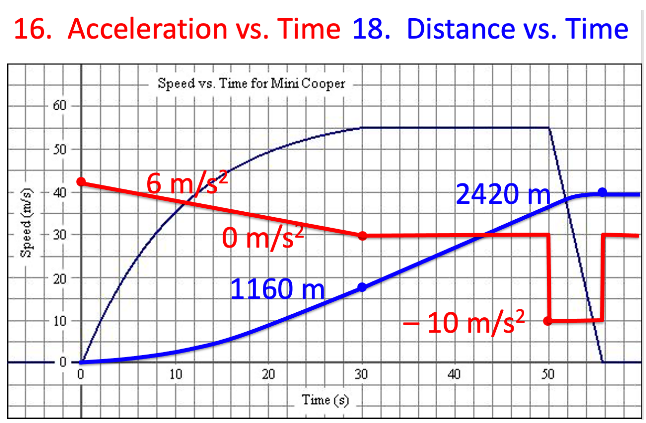


15. a. 4.1 m/s², S
b. 3.1 m/s², S
c. 0.85 m/s², S
d. 0
e. 9.6 m/s², N
f. 5.4 m/s²

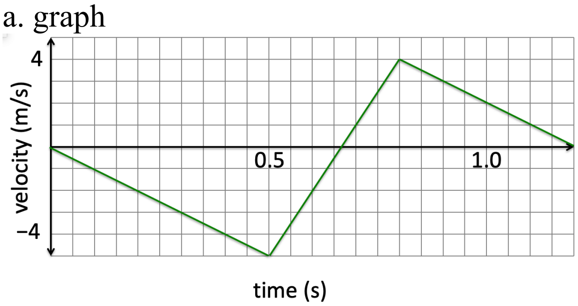
16. graph

17. a. 1160 m
b. 1100 m
c. 157 m

18. graph



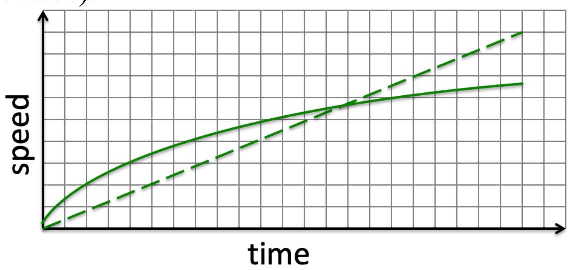
19. a. graph



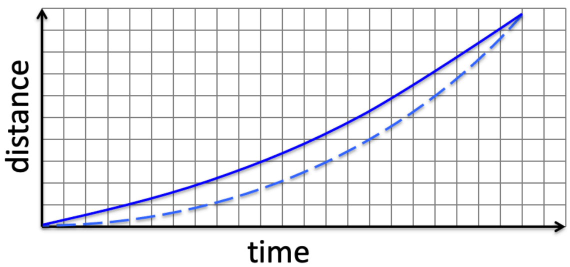
b. 1.25 m
c. 0.38 m
d. If the graph has the form shown here, with a constant acceleration $0.5 < t < 0.8$ s, then the person would leave the trampoline at a lower position that hitting it, which seems unlikely!

20. a. 25 m
b. 75 m

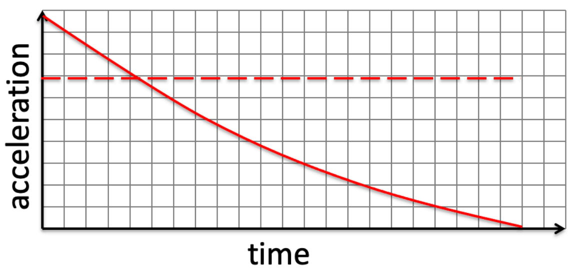
21. a. 179.7 m/s
    b. 40.14 m/s^2
22. a. The calculated speed would be correct ONLY IF the car had constant acceleration (must not have).
    b.



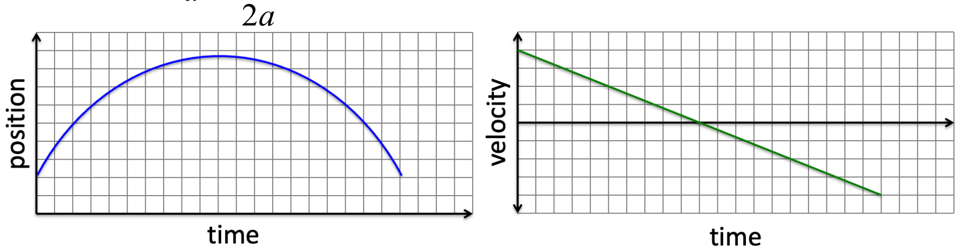
    c.



    d.

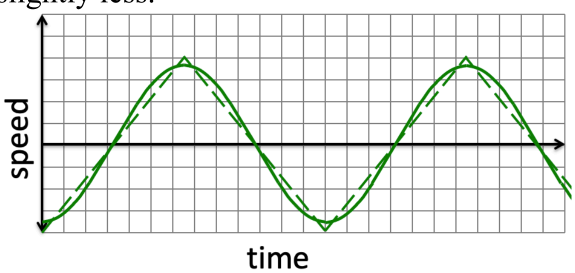


23. a. 760 km/s^2
    (80,000 *g*'s!)
    b. 0.54 ms
24. a. 50.0 m
    b. 42.4 m/s
25. a. 9.00 m/s^2, 8.91 m/s^2
    b. 112 m
26. 11.6 m/s
27. 25 m/s
28. a. in each case: $d = \frac{v^2}{2a}$
    b.



29. a. 0.15 m
    b. 0.23 m uphill of starting point

30. a. 5.45 m/s^2
    b. 12.1 %
    c. 21.3 %
31. a. 7.6 m/s
    b. 95 m/s^2
    c. The likely maximum speed would probably be less than calculated above. As shown in the graph the actual values of speed would likely produce a smooth wave-like curve. In order for area under the curve to equal the given data the max speed of the curved plot would be slightly less.



32. a. $t = \sqrt{2d\left(\frac{1}{a_1} + \frac{1}{a_2}\right)}$
    b. $t = 9.43$ s
33. a. $11\underline{0}$ m, 6.00 m/s upward
    b. 98 m
34. a. 1400 m/s
    b. 12700 m/s
    c. The change in speed for the asteroid would be much less than an object falling from rest because the time to travel the distance 100 km would be much less. For a given rate of acceleration the amount of change is proportional to the amount of time. Because the asteroid's speed changes only a relatively small amount while passing through the atmosphere it may turn out to have a negligible effect.
35. a. 7.7 m
    b. 12 m/s, up
36. a. 12.0 m/s
    b. 5.3 m
37. a. 11 mph
    b. 1.0 s
38. 24 ft
39. a. 3.1 m/s
    b. 0.39 s
40. a. $a = g\frac{h}{y}$
    b. 2900 m/s^2
41. a. $\frac{gt}{2}$
    b. $\frac{v^2}{2g} - \frac{gt^2}{8}$