

Chapter 2

Motion in One Dimension

1. The average and instantaneous velocities are always the same when acceleration is:

- a. $5t$
- b. 0
- c. $t^2 + 3$
- d. g
- e. t^3

ANS: b ✓

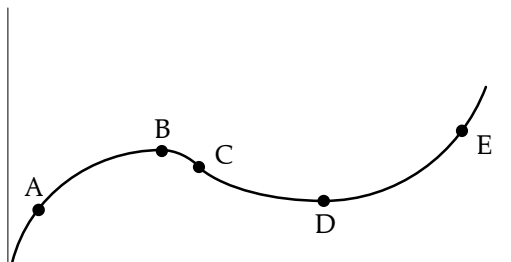
2. The average velocity of a body is zero in the interval $-2 \text{ s} \leq t \leq 2 \text{ s}$ where $v = t^3 - t$. Is the instantaneous velocity zero at any instant in this interval?

- a. yes
- b. no
- c. only if a is constant
- d. only if a is proportional to g
- e. only if a is proportional to t

ANS: a ✓

3. At which point on the velocity-time graph is the acceleration negative?

- a. A
- b. B
- c. C
- d. D
- e. E

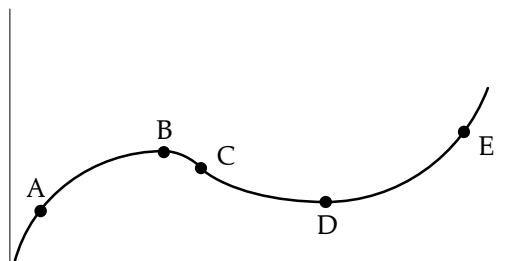


ANS: e ✗

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4. At which point on the velocity-time graph is the acceleration zero?

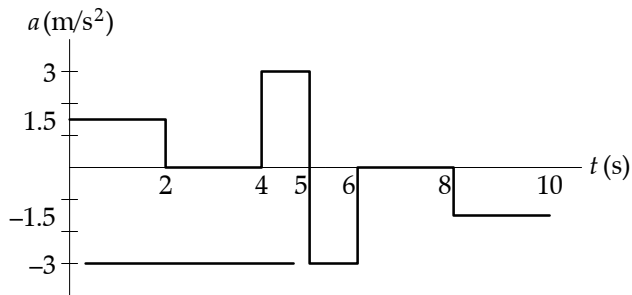
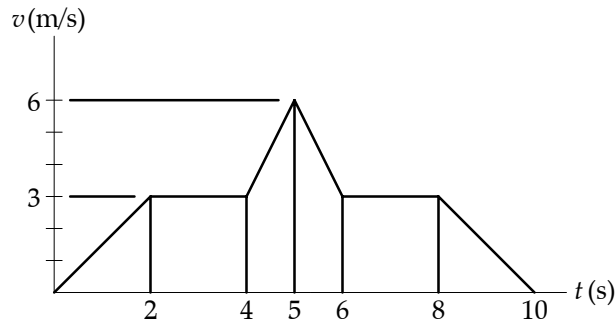
- a. A
- b. B
- c. C
- d. D
- e. E



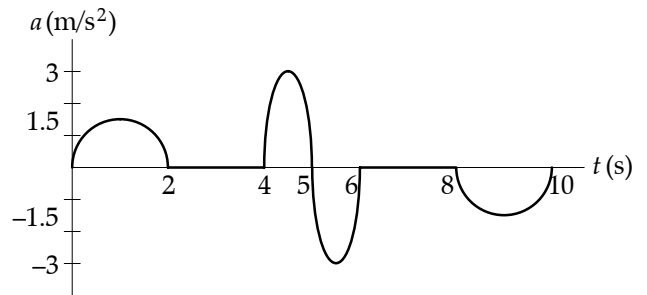
ANS: c



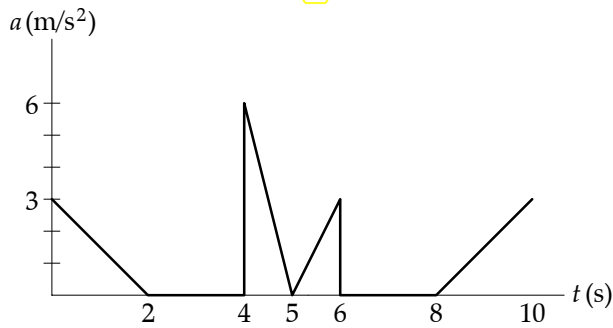
5. Which of the graphs in (a) through (e) correctly describes the acceleration versus time relationship of the body whose velocity versus time graph is plotted below?



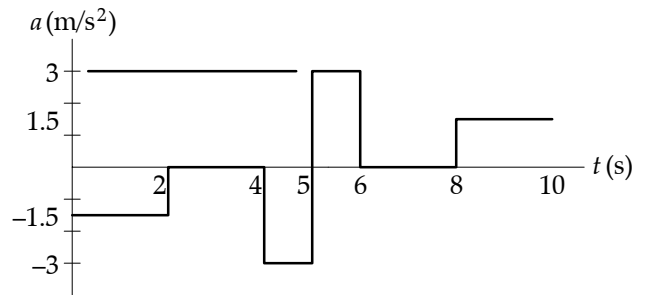
a.



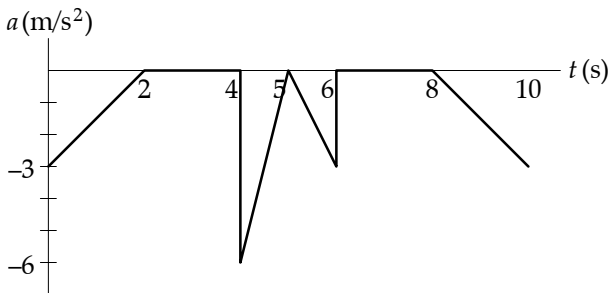
b.



c.



d.



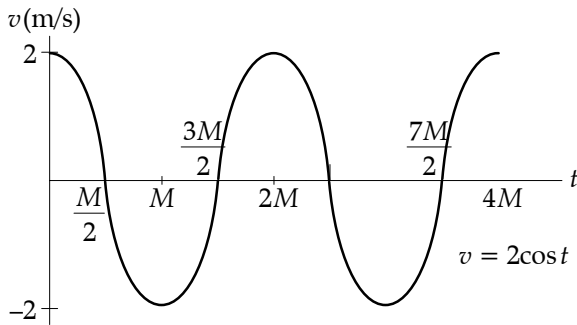
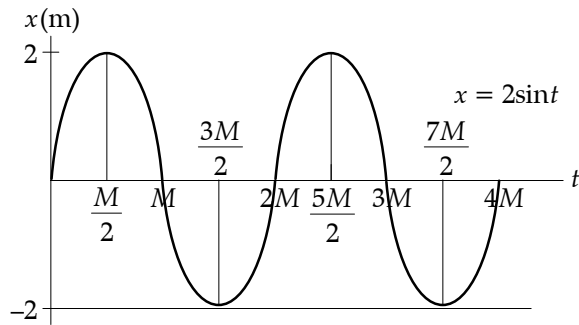
e.

ANS: a

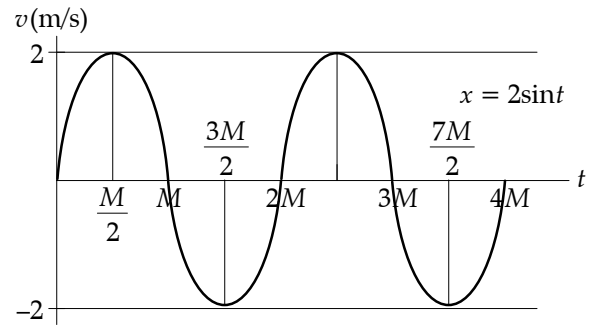


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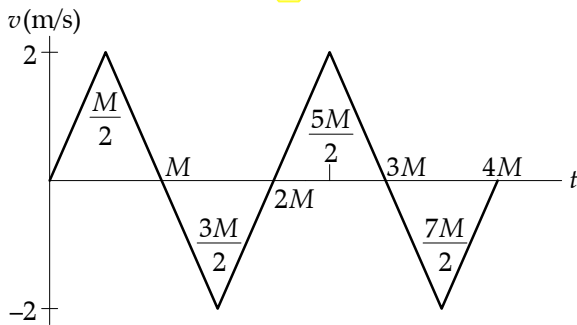
6. Which of the graphs in (a) through (e) correctly describes the velocity versus time relationship of the body whose distance versus time graph is plotted below?



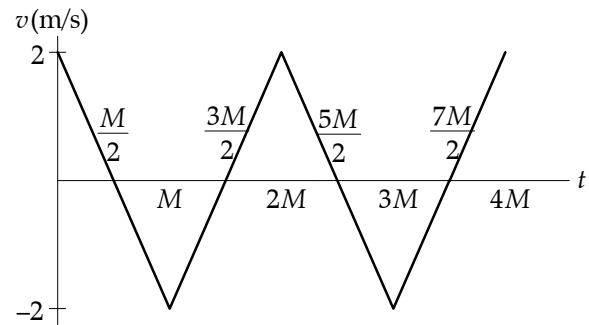
a.



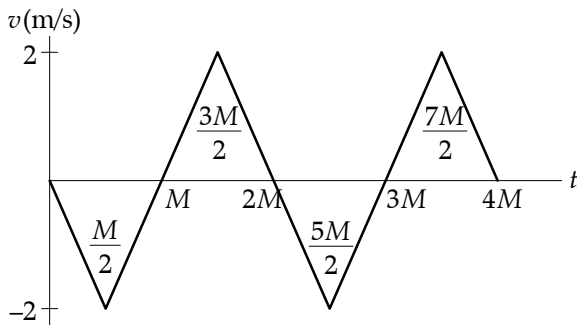
b.



c.



d.



e.

ANS: a ✓

7. An object is thrown vertically upward at the Earth's surface. Take the upward direction as positive. The velocity and acceleration at maximum height are:

- a. 0, 0
- b. $+gt, 0$
- c. 0, $+g$
- d. 0, $-g$
- e. $-gt, 0$

ANS: d ✓

8. Two balls are thrown from a height of 20 m. Ball one is thrown upward with a speed of 2 m/s. Ball two is thrown downward with a speed of 2 m/s. What is the ratio of the speed of ball one with the speed of ball two when each hits the ground?

- a. 1:2
- b. 1:1
- c. 2:1
- d. 20:1
- e. 1:20

ANS: b ✓

9. A car is traveling eastward at a speed of 40 m/s when the brakes are applied. What is the direction of the acceleration if the only forces on the car are frictional and there is no wind?

- a. E
- b. W
- c. NW
- d. NE
- e. S

ANS: b ✓

10. Two cars (A and B) are moving in the same direction in parallel lanes. Car A's initial speed is 10 m/s. After 20 s, its speed is 30 m/s. Car B's initial speed is 5 m/s. After 20 s its speed is 25 m/s. Their accelerations are constant. Which car, if either, has the greater acceleration?

- a. Car A
- b. Car B
- c. They both have the same acceleration.
- d. Car B has greater acceleration during the first 5 seconds.
- e. Car A has greater acceleration during the first 5 seconds.

ANS: c ✓

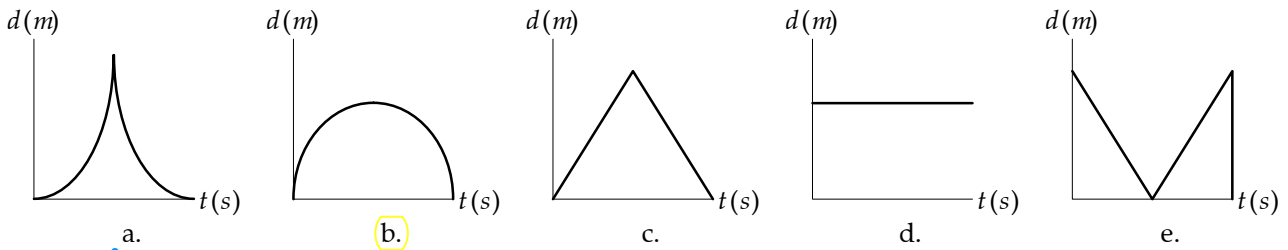
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11. The average velocity of a car that travels along a straight road for 30 s is 0 m/s. If the acceleration of the car is constant throughout this time period and not zero, which of the following statements is correct? (v_o is the initial velocity; v_f is the velocity at $t = 30$ s)

- a. $v_o = v_f \neq 0$
- b. $v_o = v_f = 0$
- c. $v_o = -v_f = 0$
- d. $v_o = -v_f \neq 0$
- e. $v_o - v_f = 0$

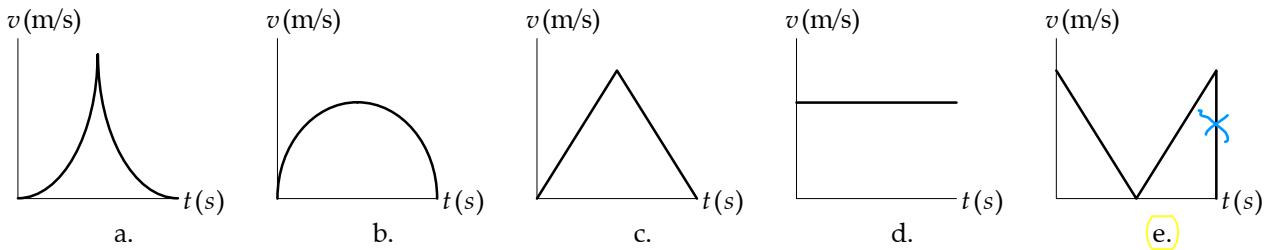
ANS: d ✓

12. A ball is thrown vertically upward from Earth's surface and falls back to Earth. Which graph plots displacement vs. time correctly?



ANS: b ✓

13. A ball is thrown vertically upward from Earth's surface and falls back to Earth. Which graph plots speed vs. time correctly?



ANS: e

14. When they simultaneously pass a radar check at a point along a straight road, car A has velocity $v = +20$ m/s, E, car B has velocity $v = +30$ m/s, E. Car A is later observed to pass car B. Which of the statement(s) below is(are) correct?

- a. Car A has a positive acceleration; car B has no acceleration.
- b. Car B has a negative acceleration; car A has no acceleration.
- c. Car A has a negative acceleration; car B has no acceleration.
- d. Either (a) or (b) may be correct.
- e. Either (b) or (c) may be correct.

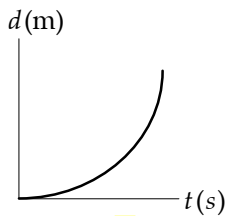
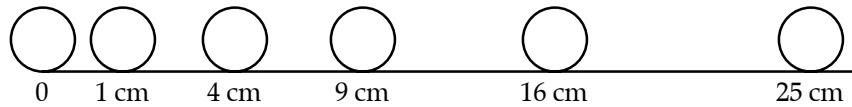
ANS: d ✓

15. Assuming approximately 4×10^7 m as the circumference of the earth, how long in seconds would it take a snail to travel around the circumference if it can crawl 20 cm in one minute?

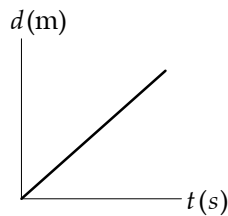
- a. 10^8
- b. 10^9
- c. 10^{10}
- d. 10^{11}
- e. 10^{12}

ANS: c

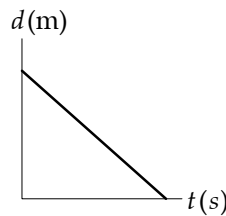
16. A series of photographs, taken 1 second apart by a camera fixed in space, are superposed to show the successive positions of a ball rolling horizontally. Which of the graphs describes the ball's motion correctly?



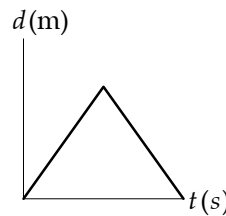
a.



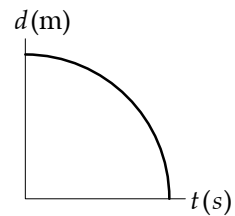
b.



c.



d.



e.

ANS: a

17. A person walks north for 20 minutes at a speed of 1.2 m/s. She then has lunch, while resting for 10 minutes. She continues to walk north for another 30 minutes at 1.2 m/s. What is her average speed in m/s during this hour?

- a. 1.4
- b. 1.0
- c. 0.5
- d. 0.7
- e. 1.5

ANS: b

18. A jogger runs west for 5.0 minutes at a speed of 6 m/s and continues for another 10 minutes at a speed of 4 m/s. What is his displacement in m west after 15 minutes?

- a. 4200
- b. 4000
- c. 3800
- d. 4600
- e. 4400

ANS: a

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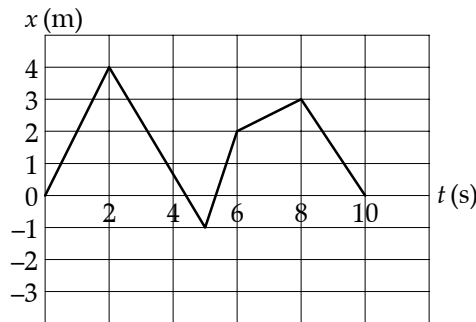
19. A dolphin maintains a constant speed of 2.0 m/s for 24 s while swimming in a straight line. It then reverses direction and returns to its starting point in 8 s. Its average speed and average velocity for the entire trip are:

- a. 3 m/s; 0 m/s.
- b. 4 m/s; 0 m/s.
- c. 3 m/s; 3 m/s in the original direction.
- d. 4 m/s; 4 m/s in the original direction.
- e. 3 m/s; 3 m/s in the return direction.

ANS: a ✓

20. A body moves along the x -axis as shown in the x vs. t graph. What is its average velocity from 0 to 2 s in m/s?

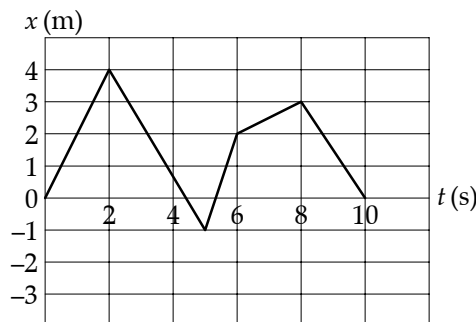
- a. 1
- b. 2
- c. 3
- d. -4
- e. 5



ANS: b ✓

21. A body moves along the x -axis as shown in the x vs. t graph. What is its average velocity from 2.0 s to 5.0 s in m/s?

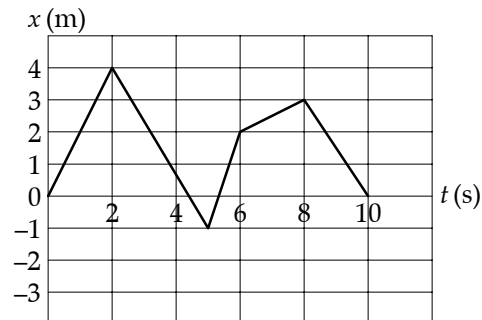
- a. -0.60
- b. -1.7
- c. 3.4
- d. 2.4
- e. -3.4



ANS: b ✓

22. A body moves along the x -axis as shown in the x vs. t graph. What is its average velocity from 0 to 6.0 s in m/s?

- a. -3.0
- b. -0.33
- c. 0
- d. 0.33
- e. 3.0



ANS: d ✓

23. At $t = 2.0$ s, a particle moving with constant velocity is at $x = 6.6$ m. What is its position in m at $t = 2.7$ s if it starts at the origin at $t = 0$?

- a. 7.8
- b. 8.9
- c. 9.0
- d. 9.3
- e. 9.9

ANS: b ✓

24. At $t = 1.8$ s, a particle moving with constant velocity is at $x = 5.2$ m. At $t = 3.2$ s, the particle is at $x = 8.1$ m. What is its speed in m/s?

- a. 1.4
- b. 1.5
- c. 2.1
- d. 3.2
- e. 4.2

ANS: c ✓

25. A skier reaches the bottom of a slope at a speed of 40 m/s. She then heads due north on level ground. Her speed decreases to 20 m/s in 5.0 s. Her acceleration relative to north in m/s^2 is:

- a. $+4$
- b. -4
- c. $+8$
- d. -8
- e. -20

ANS: b ✓

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26. Joan releases her grip on her stuffed panda while leaning out of her second floor dorm window. Compare the instantaneous velocity, v_{inst} , at $t = 1.0$ s with the average velocity, v_{avg} , of the panda during its first second of fall.

a. $v_{inst} < v_{avg}$

b. $v_{inst} = v_{avg}$

c. $v_{inst} > v_{avg}$

d. $v_{inst} \leq v_{avg}$

e. $|v_{inst}| < |v_{avg}|$

ANS: c



27. A car is moving with a speed of 3.2 m/s when brakes are applied. If the car stops after it has moved 1.8 m, what was its average acceleration in m/s^2 ?

a. -2.7

b. -2.8

c. -2.9

d. -3.0

e. -3.1

ANS: b

28. A particle's position on the x -axis is given by the equation $x = 1 + 2t - t^2$. What is its velocity in m/s at $t = 2$ s if x is measured in m and t in s?

a. -2

b. -1

c. 0

d. 0.5

e. 1

ANS: a

29. A particle's motion along the x -axis is governed by the equation $x = 2 + 5t + 3t^2$. What is its acceleration at $t = 1$ s in m/s^2 if t is measured in s and x in m?

a. 2

b. 3

c. 4

d. 5

e. 6

ANS: e

30. A particle moves in the x direction with a constant acceleration of 10 m/s^2 . If its initial position is $x = 1.5 \text{ m}$ and its initial speed is 2.5 m/s , what is its position in m after 3 s?

- a. 36
- b. 45
- c. 54
- d. 63
- e. 72

ANS: c

31. A particle moves in the x direction with a constant acceleration of 3.0 m/s^2 . If its initial position is $x = 1.2 \text{ m}$ and its initial speed is 2.1 m/s , what is its speed in m/s at 2.6 s?

- a. 7.8
- b. 9.1
- c. 8.8
- d. 9.9
- e. 11.6

ANS: d

32. A passenger plane lands with a speed of 98 m/s and accelerates at -7.0 m/s^2 . After how many s does it come to rest?

- a. 10
- b. 11
- c. 12
- d. 13
- e. 14

ANS: e

33. A train moving at 32.0 m/s brakes to a stop in 22.0 s . How far in m did it move while coming to a stop?

- a. 424
- b. 352
- c. 280
- d. 176
- e. 188

ANS: b

34. How long in s does it take a rock to hit the ground if it is thrown down at 2.00 m/s and it falls a distance of 25.8 m ?

- a. 2.07
- b. 2.10
- c. 2.25
- d. 2.32
- e. 2.41

ANS: b

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35. A bicycle racer travels a distance of 16.9 m when accelerating from rest at -7 m/s^2 . If you start a stopwatch at the instant when she starts, what time (in seconds) does it show when she reaches the 16.9 m position?

- a. 1.03
- b. 1.05
- c. 2.62
- d. 3.21
- e. 3.25



ANS: e

36. A car accelerates from rest at 8.3 m/s^2 for 50 m, then brakes with an acceleration of -9.2 m/s^2 and comes to a stop. What was the total distance traveled in m?

- a. 85
- b. 90
- c. 95
- d. 100
- e. 105

ANS: c

37. A hot air balloon rises with a constant speed of 5 m/s. When it is 30 m above the ground a rock is dropped from the balloon. How long in s does it take the rock to hit the ground?

- a. 3
- b. 4
- c. 5
- d. 6
- e. 7

ANS: a

38. A rock is thrown upward with a speed of 23 m/s. What maximum height in m does it reach before falling back to earth?

- a. 26
- b. 27
- c. 28
- d. 29
- e. 30

ANS: b

39. A rock is dropped from a height of 15.2 m. What is its speed in m/s when it is half way to the ground if its initial speed is zero?

- a. 7.60
- b. 8.63
- c. 12.2
- d. 74.5
- e. 149

ANS: c

40. The position of a particle moving along the x -axis is given by $x = (21 + 22t - 6t^2)$ m, where t is in s. What is the average velocity in m/s during the time interval $t = 1$ s to $t = 3$ s?

- a. -6.0
- b. -4.0
- c. -2.0
- d. -8.0
- e. 8.0

ANS: c

41. A bullet is fired through a board, 14 cm thick, with its line of motion perpendicular to the face of the board. If it enters with a speed of 450 m/s and emerges with a speed of 220 m/s, what is the magnitude of the bullet's acceleration in km/s^2 as it passes through the board?

- a. 500
- b. 550
- c. 360
- d. 520
- e. 275

ANS: b

42. The position of a particle moving along the x -axis is given by $x = 2t^3 - 6t^2 + 4$, where x is measured in m and t is measured in s. What is the average acceleration of the particle in m/s^2 during the time interval $1 \text{ s} < t < 3 \text{ s}$?

- a. 18
- b. 14
- c. 16
- d. 12
- e. 24

ANS: d

43. The position of a particle moving along the x axis is given by $x(t) = 6t^2 - t^3$, where x is in meters and t in seconds. What is the position of the particle in m when it achieves its maximum speed in the positive x direction?

- a. 24
- b. 12
- c. 32
- d. 16
- e. 2

ANS: d

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44. The velocity of a particle moving along the x axis is given for $t > 0$ by $v_x = (t) = (32t - 2t^3)$ m/s, where t is in s. What is the acceleration of the particle in m/s^2 when (after $t = 0$) it achieves its maximum displacement in the positive x direction?

- a. -64
- b. zero
- c. 128
- d. 32
- e. -32

ANS: a ✓

45. The position of a particle as it moves along the x axis is given for $t > 0$ by $x(t) = (t^3 - 3t^2 + 6t)$ m, where t is in s. Where is the particle in m when it achieves its minimum speed (after $t = 0$)?

- a. 3
- b. 4
- c. 8
- d. 2
- e. 7

ANS: b ✓

46. The position of a particle as it moves along the x axis is given by $x(t) = (4 + 12t - t^3)$ m, where t is in s. What is the acceleration in m/s^2 when it achieves its maximum speed in the positive x direction?

- a. zero
- b. -12
- c. +12
- d. +9
- e. -9

ANS: a ✓

47. A body is moving in the x direction such that $x = 3t^2$. What is its speed in m/s at time $t = 4$ s?

- a. 3
- b. 6
- c. 12
- d. 18
- e. 24

ANS: e ✓

48. A body is moving in the x direction such that $x = 2t^3$. What is its speed in m/s at time $t = 2$ s?

- a. 3
- b. 6
- c. 12
- d. 18
- e. 24

ANS: e ✓

49. A car is traveling east moving at 20 m/s. The brakes are applied. What is the direction of the acceleration?

- a. East
- b. West
- c. North
- d. South
- e. left

ANS: b

50. Convert the acceleration of gravity, which is 9.8 m/s^2 , to km/h^2 .

- a. 7.6×10^{-4}
- b. 0.0027
- c. 2.7
- d. 35
- e. 1.3×10^5

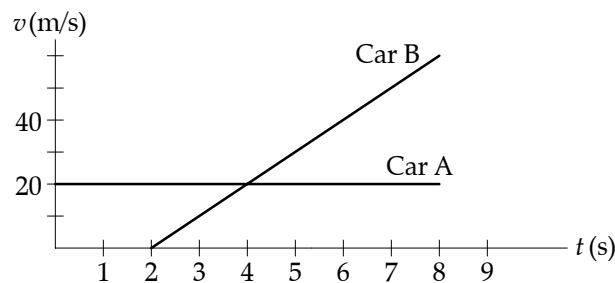
ANS: e

51. A woman pulls a sled with a constant acceleration of 1.1 m/s^2 . How fast is the sled moving in m/s after five seconds, if the sled starts with a speed of 0 m/s?

- a. 1.1
- b. 2.2
- c. 3.3
- d. 4.4
- e. 5.5

ANS: e

52. Driver A is cruising along enjoying the fall colors. Driver B starts her car at the instant he passes her. Their velocities are shown as functions of time in the graph below. At what instants in time are drivers A and B side by side?

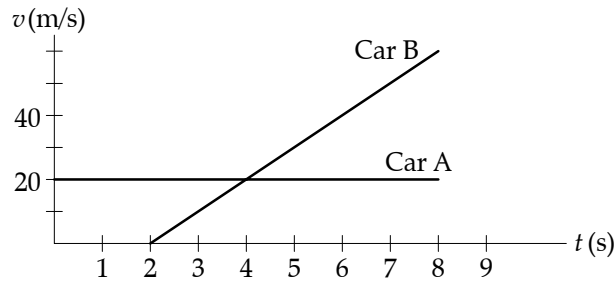


- a. 0 s, 2 s
- b. 0 s, 4 s
- c. 2 s, 4 s
- d. 2 s, 6 s
- e. 4 s, 6 s

ANS: d

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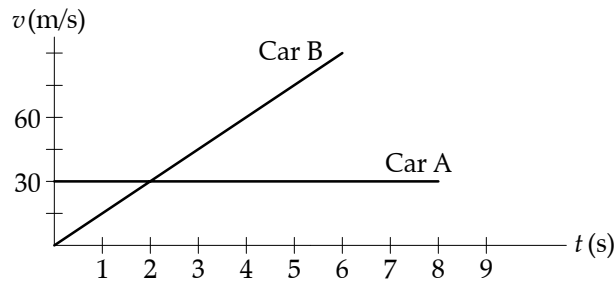
53. Driver A is cruising along enjoying the fall colors. Driver B starts her car at the instant he passes her. Their velocities are shown as functions of time in the graph below. At what instant(s) listed below does(do) drivers A and B have the same acceleration?



- a. 2 s
- b. 4 s
- c. 2 s, 4 s
- d. 1 s
- e. 1 s, 4 s

ANS: d ✓

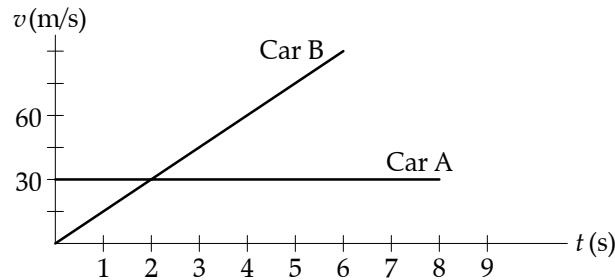
54. Driver A is cruising along enjoying the fall colors. Driver B starts her car at the instant he passes her. Their velocities are shown as functions of time in the graph below. At what instants in time are drivers A and B side by side?



- a. 0 s
- b. 2 s
- c. 0 s, 2 s
- d. 0 s, 4 s
- e. 2 s, 4 s

ANS: d ✓

55. Driver A is cruising along enjoying the fall colors. Driver B starts her car at the instant he passes her. Their velocities are shown as functions of time in the graph below. At what instant(s) listed below does(do) drivers A and B have the same acceleration?



- a. 0 s
- b. 2 s
- c. 0 s, 2 s
- d. 2 s, 4 s
- e. They do not have the same acceleration at any time shown on the graph.

ANS: e

56. Cart A, of mass m , starts from rest and travels in a straight line with acceleration a . It traverses a distance x in time t . Cart B, of mass $4m$, starts from rest and travels in a straight line with acceleration $\frac{a}{2}$. At time t it has traversed the distance:

- a. $\frac{x}{4}$
- b. $\frac{x}{2}$
- c. x
- d. $2x$
- e. $4x$

ANS: b

57. Cart A, of mass m , starts from rest and travels in a straight line with acceleration a . It reaches velocity v in time t . Cart B, of mass $4m$, starts from rest and travels in a straight line with acceleration $\frac{a}{2}$. At time t it has reached velocity:

- a. $+\frac{v}{4}$
- b. $+\frac{v}{2}$
- c. $+v$
- d. $+2v$
- e. $+4v$

ANS: b

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58. Sue, starting at rest, drives with an acceleration of 4 m/s^2 for 5 seconds. Then she drives with an acceleration of -4 m/s^2 for 5 seconds. Her initial acceleration is in the $+x$ or \hat{i} direction. At the end of 10 seconds her displacement is:

- a. 0 m
- b. $20\hat{i}$ m
- c. $40\hat{i}$ m
- d. $50\hat{i}$ m
- e. $100\hat{i}$ m

ANS: e

59. Craig, a window washer, is 29.4 m high on a scaffold rising at a speed of 4.9 m/s when he drops a squeegee. Ignoring air resistance, the time it takes the squeegee to reach the ground is:

- a. 1 s
- b. 2 s
- c. 2.5 s
- d. 3 s
- e. 6 s

ANS: d

60. Craig, a window washer, is 29.4 m high on a scaffold when he drops a squeegee. Ignoring air resistance, the time it takes the squeegee to reach the ground is:

- a. 1 s
- b. 2 s
- c. 2.5 s
- d. 3 s
- e. 6 s

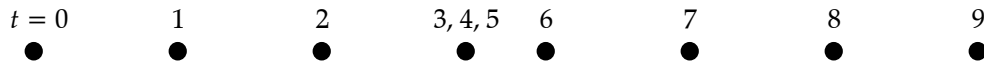
ANS: c

61. John tosses a ball out of a window 78.4 m above ground level after checking to see that no one on the ground might be hit by the ball. If the ball exits the window with a horizontal velocity of 20 m/s, how far from the point below the window does it land?

- a. 20 m
- b. 40 m
- c. 80 m
- d. 160 m
- e. 320 m

ANS: c

62. The small circles in the diagram below represent the positions along the x -axis of a body at equal time intervals. Assume the body moves in a straight line.



This diagram is most likely to describe

- a swimmer swimming laps.
- an exercise on a rowing machine.
- a person on a treadmill.
- a tennis ball during a volley.
- a runner who tripped, fell, rose, and continued running.

ANS: e ✓

63. The number of cut threads sticking up out of a 27 in by 42 in bath towel is of the order of

- 10^4
- 10^6
- 10^8
- 10^{10}
- 10^{12}

ANS: b ✓

64. Two cars are initially moving in the same direction in parallel lanes. Car A's initial velocity is 20 m/s, S. After 10 s, its velocity is 40 m/s, S. Car B's initial velocity is 5 m/s, S. After 10 s, its velocity is 15 m/s, N. Which car, if either, has the average acceleration of greater magnitude?

- Car A
- Car B
- They both have the same average acceleration.
- Car A does at first, but then is overtaken by car B.
- Car B does at first, but then is overtaken by car A.



ANS: c

65. Two cars are initially moving in the same direction in parallel lanes. Car A's initial velocity is 20 m/s, S. After 10 s, its velocity is 40 m/s, S. Car B's initial velocity is 5 m/s, S. After 10 s, its velocity is 5 m/s, N. Which car, if either, has the average acceleration of greater magnitude?

- Car A
- Car B
- They both have the same average acceleration.
- Car A does at first, but then is overtaken by car B.
- Car B does at first, but then is overtaken by car A.

ANS: b ✗

40 Motion in One Dimension

66. A particle starts at position x_1 on the x -axis at $t = 0$, and ends at position x_2 at $t = t_f$. If $v_x \neq 0$ for the whole time interval, the largest value of the x -coordinate, x_{\max} , may occur at

- a. $t = 0$.
- b. $t = t_f$.
- c. $t_i \leq t < t_f$.
- d. $t_i < t \leq t_f$.
- e. $t_i \leq t \leq t_f$.



ANS: e

67. The position of a particle at time t is given by

- a. its x -coordinate at time t .
- b. the distance it traverses between $t = 0$ and $t = t$.
- c. the magnitude of the nearest integer value of the x -coordinate.
- d. the total distance it has traveled between $t = 0$ and $t = t$.
- e. a, b or d above.

ANS: a

68. a particle starts at $x = 2.5$ m at $t = 0$ and ends at $x = -3.2$ m 28 seconds later. Which statement is true?

- a. The distance it traveled is 5.7 m, but its displacement is unknown.
- b. Its displacement is +5.7 m, but the distance it traveled is unknown.
- c. Its displacement is -5.7 m, but the distance it traveled is unknown.
- d. Its displacement is +5.7 m, and the distance it traveled is +5.7 m.
- e. Its displacement is -5.7 m, and the distance it traveled is +5.7 m.

ANS: c

69. A car starts at the 208 km marker on a national highway in Canada. An hour later it is at the 195 km marker. We can be certain that

- a. the distance it traveled was +13 km, but its displacement is unknown.
- b. its displacement was +13 km, but the distance it traveled is unknown.
- c. its displacement was -13 km, but the distance it traveled is unknown.
- d. its displacement was +13 km, and the distance it traveled is +13 km.
- e. its displacement was -13 km, and the distance it traveled is +13 km.

ANS: c

70. We are told that a particle starts at $x = 2.00$ m at $t = 0$ s, is at $x = 5.00$ m at $t = 3.25$ s, and is again at $x = 2.00$ m at $t = 5.30$ s. We can safely conclude that

- a. the average speed during the 5.30 second time interval was 0 m/s.
- b. the average velocity during the 5.30 second time interval was 0 m/s.
- c. both the average speed and average velocity during the 5.30 second time interval were 0 m/s.
- d. the average acceleration was 0 m/s.
- e. the total distance traveled was 0 m.

ANS: b

71. A particle starts at $x = 2.00$ m at $t = 0$ s with $v_x = 3.00$ m/s. It is again at $x = 2.00$ m at $t = 5.30$ s. We can safely conclude that

- a. the average acceleration was -1.13 m/s².
- b. the average velocity was 0 m/s.
- c. the total distance traveled was 15.9 m.
- d. the velocity at $t = 5.30$ s is $v_x = -3.00$ m/s.
- e. we don't have enough information to determine whether or not any of the answers above is correct.

ANS: e

72. The magnitude of the acceleration of gravity at the surface of the moon is one sixth its value at the surface of the Earth. If you can throw a baseball to a height of 45.9 meters on Earth, you can toss it to height of ____ on the moon.

- a. 7.65 m
- b. 45.9 m
- c. 138 m
- d. 275 m
- e. 1650 m

ANS: d

73. The magnitude of the acceleration of gravity at the surface of the moon is one sixth of its value at the surface of the Earth. If you throw a baseball vertically upwards with a speed of 30 m/s on both the Earth and the moon, the time it takes to return on the moon, t_M , compared to the time it takes to return on Earth, t_E , is

- a. $t_M = \frac{1}{6} t_E$.
- b. $t_M = \frac{1}{\sqrt{6}} t_E$.
- c. $t_M = t_E$.
- d. $t_M = \sqrt{6} t_E$.
- e. $t_M = 6 t_E$.

ANS: d

74. The magnitude of the acceleration of gravity at the surface of the moon is one sixth of its value at the surface of the Earth. If you throw a baseball vertically upwards with a speed of 30 m/s on the moon, at the highest point its velocity and acceleration are

- a. 5.0 m/s, 0 m/s².
- b. 30 m/s, 0 m/s².
- c. 0 m/s, 1.6 m/s².
- d. 0 m/s, 9.8 m/s².
- e. 30 m/s, 1.6 m/s².

ANS: c

42 *Motion in One Dimension*

75. The average velocity in the time interval Δt has magnitude $|\vec{v}_{avg}| \neq 0$. Based on this information alone, at any instant in this time interval, the instantaneous velocity

- a. can never have a zero value.
- b. must always have a zero value at one instant.
- c. may have, but does not necessarily have, a zero value.
- d. may have a zero value only if the object reverses direction.
- e. may have a zero value only if the object comes to rest at the end of the time interval.

ANS: c

