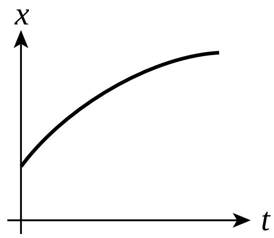
This print-out should have 32 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

X vs T

001 10.0 points

A train car moves along a long straight track. The graph shows the position as a function of time for this train.



The graph shows that the train

1. moves at a constant velocity.

2. slows down all the time. **correct**

3. speeds up part of the time and slows down part of the time.

4. speeds up all the time.

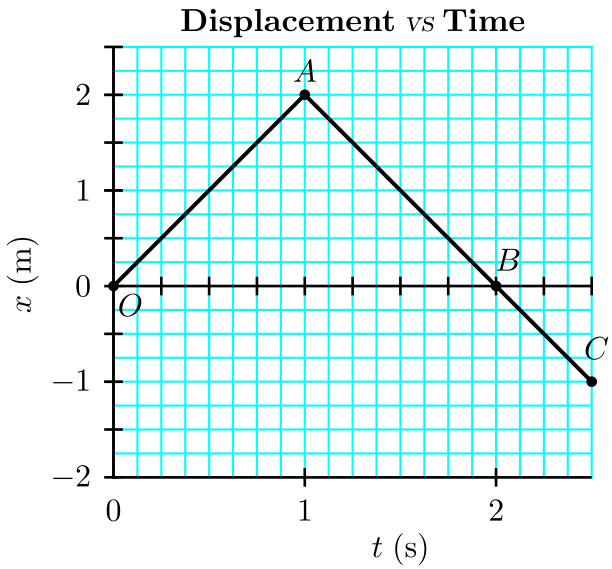
Explanation:

The slope of the curve diminishes as time increases, hence the train slows down all the time.

Displacement vs Time 02

002 (part 1 of 5) 10.0 points

Consider the displacement curve $OABC$



What is the average velocity from point O to A?

1. $\overline{v}_{OA} = +2$ m/s **correct**

2. $\overline{v}_{OA} = +\sqrt{3}$ m/s

3. $\overline{v}_{OA} = -2$ m/s

4. $\overline{v}_{OA} = 0$ m/s

5. $\overline{v}_{OA} = -\sqrt{3}$ m/s

Explanation:

The displacement x is on the vertical axis and the time t is on the horizontal axis. Velocity requires net displacement:

$$\overline{v}_{OA} = \frac{x_A - x_O}{t_A - t_O} = \frac{2-0}{1-0} = +2 \text{ m/s}.$$

---

003 (part 2 of 5) 10.0 points

What is the average velocity for the motion from point O to point B?

1. $\overline{v}_{OB} = -2$ m/s

2. $\overline{v}_{OB} = 0$ m/s **correct**

3. $\overline{v}_{OB} = +\sqrt{3}$ m/s

4. $\overline{v}_{OB} = +2$ m/s

5. $\overline{v}_{OB} = -\sqrt{3}$ m/s

Explanation:

$$\overline{v}_{OB} = \frac{x_B - x_O}{t_B - t_O} = \frac{0-0}{2-0} = 0 \text{ m/s}\,.$$

---

004 (part 3 of 5) 10.0 points

What is the average speed for the motion from point O to point B?

1. $\overline{s}_{OB} = +\sqrt{3}$ m/s

2. $\overline{s}_{OB} = 0$ m/s

3. $\overline{s}_{OB} = -2$ m/s

4. $\overline{s}_{OB} = +2$ m/s **correct**

5. $\overline{s}_{OB} = -\sqrt{3}$ m/s

Explanation:

$$\overline{s}_{OB} = \frac{|x_A - x_O| + |x_B - x_A|}{t_B - t_O} = \frac{2+2}{2-0} = +2 \text{ m/s}\,.$$

---

005 (part 4 of 5) 10.0 points

What is the instantaneous velocity at point B?

1. $v_B = +2$ m/s

2. $v_B = -\sqrt{3}$ m/s

3. $v_B = -2$ m/s **correct**

4. $v_B = 0$ m/s

5. $v_B = +\sqrt{3}$ m/s

Explanation:

The instantaneous velocity at point B can be obtained by first finding an expression for the position of the moving object and taking its derivative evaluated at time t_B. Since the graph near B is linear, it is simpler to calculate the slope of the line over the interval from A to B. The result correctly describes the instantaneous velocity at B because the derivative of a straight line is constant at all points on the line and can be obtained for our case by

$$v_B = \frac{x_B - x_A}{t_B - t_A} = \frac{0-2}{2-1} = -2 \text{ m/s}\,.$$

---

006 (part 5 of 5) 10.0 points

What is the instantaneous speed at point B?

1. $s_B = 0$

2. $s_B = -\sqrt{3}$ m/s

3. $s_B = +\sqrt{3}$ m/s

4. $s_B = +2$ m/s **correct**

5. $s_B = -2$ m/s

Explanation:

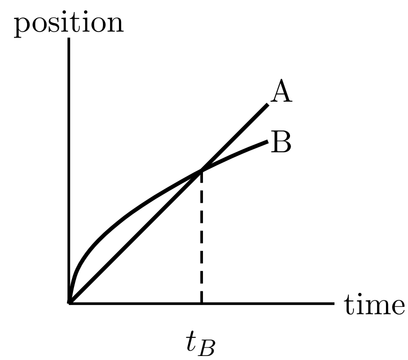
Instantaneous speed is simply the magnitude of the velocity:

$$s_B = |v_B| = |-2| = +2 \text{ m/s}\,.$$

Kinematics2

007 10.0 points

The graph shows position as a function of time for two trains running on parallel tracks.



Which is true?

1. Both trains speed up all the time.

2. Both trains have the same velocity at some time before t_B. **correct**

3. At time t_B, both trains have the same velocity.

4. Somewhere on the graph, both trains have the same acceleration.

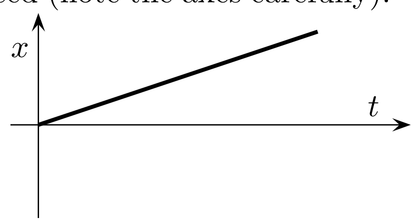
Explanation:

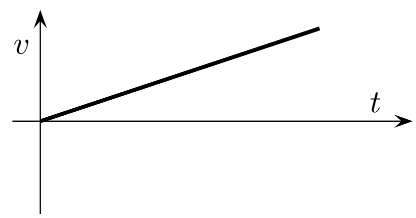
The slope of the curve B is the same with the slope of line A at some point $t < t_B$. Choice 1 is wrong because at time t_B, train A has a bigger velocity; choice 3 is wrong because train A has a constant velocity; choice 4 is wrong because train A has a zero acceleration while train B has a changing velocity and hence a nonzero acceleration.

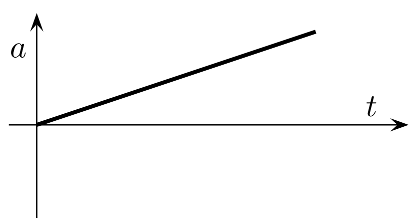
Graphical Analysis

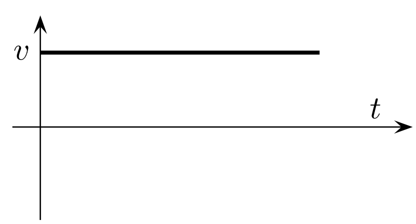
008 10.0 points

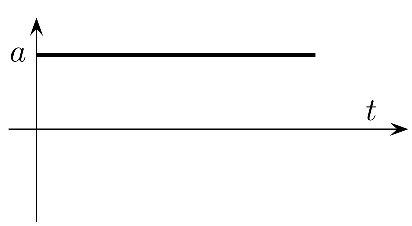
Identify all graphs that represent motion at constant speed (note the axes carefully).

a) 

b) 

c) 

d) 

e) 

1. a), b), and e)

2. None of these

3. a), b), and d)

4. a), b), and c)

5. a) only

6. e) only

7. d) only

8. c) only

9. a) and c)

10. a) and d) **correct**

Explanation:

For constant speed, $a = 0$.

a) $x = k\,t,\ k > 0$, increases at a constant rate, so it has a constant velocity.

b) $v = k\,t,\ k > 0$, increases at a constant rate, so it has a constant acceleration.

c) $a = k\,t,\ k > 0$, increases at a constant rate.

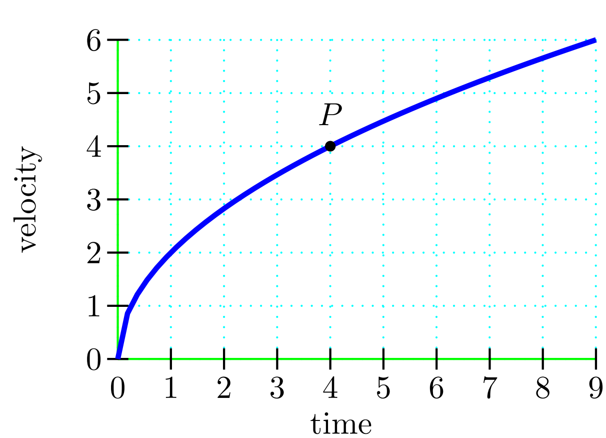
d) $v = k,\ k > 0$, represents a constant velocity.

e) $a = k,\ k > 0$, represents a constant, nonzero acceleration.

Velocity vs Time 09

009 10.0 points

A car moves along a straight line. The graph below shows its velocity as a function of time.



Which of the following statements correctly describes the car's motion at point P on the graph?

1. The car is accelerating forward. **correct**

2. The car's direction is about 30° off the x axis.

3. The car has zero acceleration.

4. The car is climbing a hill.

5. The car is decelerating.

6. The car is stationary.

Explanation:

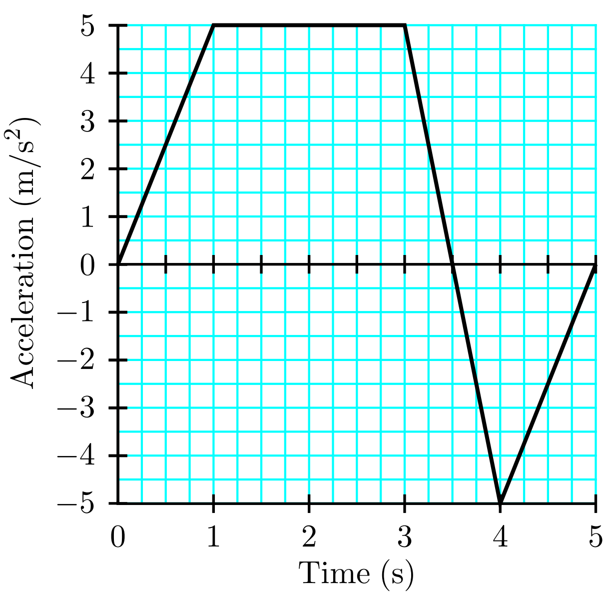
Note: The graph depicts the velocity $v(t)$ as a function of time and not the position $x(t)$.

At point P on the graph, the velocity is positive (indeed, $v \geq 0$ at all times depicted on the graph) and the curve $v(t)$ slopes upward — which means positive derivative $\frac{d\,v}{dt} > 0$. In other words, the car has positive acceleration $a = \frac{d\,v}{dt} > 0$. Since $v > 0$, this means the car is *accelerating*.

Acceleration vs Time 03

010 10.0 points

Consider the acceleration of an object starting from rest.



Other than at $t = 0$, when is the velocity of the object zero?

1. 5.0 s

2. At no other time on this graph **correct**

3. 3.5 s

4. 4.0 s

5. During the interval from 1.0 s to 3.0 s

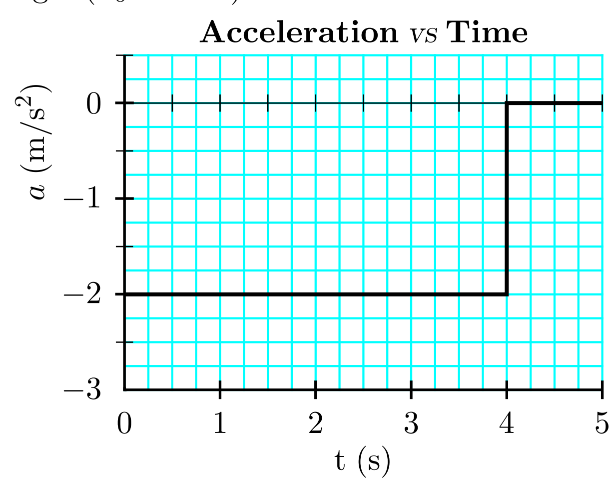
Explanation:

$v_t = \int_0^t a\,dt$ is the area between the acceleration curve and the t axis during the time period from 0 to t. If the area is above the horizontal axis, it is positive; otherwise, it is negative. In order for the velocity to be zero at any given time t, there would have to be equal amounts of positive and negative area between 0 and t. According to the graph, this condition is never satisfied.

Time Dependent Acceleration 02

011 (part 1 of 2) 10.0 points

An acceleration (in m/s^2) has the time dependence shown on the graph below. The particle starts from rest ($v_0 = 0$ m/s) at the origin ($x_0 = 0$ m).



Find the velocity at $t = 5$ s.

1. $v_{t=5} = -1$ m/s

2. $v_{t=5} = -2$ m/s

3. $v_{t=5} = -6$ m/s

4. $v_{t=5} = -8$ m/s **correct**

5. $v_{t=5} = -4$ m/s

6. $v_{t=5} = -3$ m/s

Explanation:

$$\begin{aligned} \text{Let}: \quad t_0 &= 0 \text{ s}, \\ t_4 &= 4 \text{ s}, \\ t_5 &= 5 \text{ s}, \\ a_{0\to4} &= -2 \text{ m/s}^2, \quad \text{and} \\ a_{4\to5} &= 0 \text{ m/s}^2. \end{aligned}$$

If the particle has a negative acceleration, its velocity will decrease from zero at the beginning to a negative value. When the acceleration is zero, the velocity of the particle will be constant. Thus, the velocity of the particle is

$$\begin{aligned} v_4 &= v_0 + a_{0\to4}(t_4 - t_0) \\ &= 0 \text{ m/s} + (-2 \text{ m/s}^2)(4 \text{ s} - 0 \text{ s}) \\ &= -8 \text{ m/s}, \quad \text{so} \\ v_5 &= v_4 + a_{4\to5}(t_5 - t_4) \\ &= (-8 \text{ m/s}) + (0 \text{ m/s}^2)(5 \text{ s} - 4 \text{ s}) \\ &= \boxed{-8 \text{ m/s}}. \end{aligned}$$

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012 (part 2 of 2) 10.0 points

Find the position at $t = 5$ s.

1. $x_{t=5} = -8$ m

2. $x_{t=5} = -4.5$ m

3. $x_{t=5} = -21$ m

4. $x_{t=5} = -9$ m

5. $x_{t=5} = -24$ m **correct**

6. $x_{t=5} = -12$ m

Explanation:

The particle will move in a negative direction from rest at a negative acceleration. When its acceleration is zero, it will continue to move at a constant velocity, so

$$\begin{aligned} x_4 &= x_0 + v_0(t_4 - t_0) + \frac{1}{2}a_{0\to4}(t_4 - t_0)^2 \\ &= 0 \text{ m} + (0 \text{ m/s})(4 \text{ s} - 0 \text{ s}) \\ &\qquad + \frac{1}{2}(-2 \text{ m/s}^2)(4 \text{ s} - 0 \text{ s})^2 \\ &= -16 \text{ m}, \quad \text{and} \\ x_5 &= x_4 + v_4(t_5 - t_4) + \frac{1}{2}a_{4\to5}(t_5 - t_4)^2 \\ &= (-16 \text{ m}) + (-8 \text{ m/s})(5 \text{ s} - 4 \text{ s}) \\ &\qquad + \frac{1}{2}(0 \text{ m/s}^2)(5 \text{ s} - 4 \text{ s})^2 \\ &= (-16 \text{ m}) + (-8 \text{ m}) \\ &= \boxed{-24 \text{ m}}. \end{aligned}$$

Accelerating Object

013 10.0 points

If the acceleration of an object is zero at some instant in time, what can be said about its velocity at that time?

1. It is zero.

2. It is not changing at that time. **correct**

3. It is positive.

4. It is negative.

5. Unable to determine.

Explanation:

The acceleration

$$a = \frac{\Delta v}{\Delta t} = 0$$
$$\Delta v = 0.$$

Sliding Hockey Puck

014 (part 1 of 3) 10.0 points

A hockey puck sliding on a frozen lake comes to rest after traveling 111 m.

If its initial velocity is 4.6 m/s, what is its acceleration if that acceleration is assumed constant?

Correct answer: -0.0953153 m/s^2.

Explanation:

$$\begin{aligned}\text{Givne}: \quad v_0 &= 4.6 \text{ m/s}\,,\\ x &= 111 \text{ m}\,, \quad \text{and}\\ v &= 0 \text{ m/s}\,.\end{aligned}$$

$$v^2 = v_0^2 + 2\,a\,x$$

with $v = 0$ m/s, so

$$\begin{aligned}a &= \frac{-v_0^2}{2x} = \frac{-(4.6 \text{ m/s})^2}{2(111 \text{ m})}\\ &= \boxed{-0.0953153 \text{ m/s}^2}.\end{aligned}$$

---

015 (part 2 of 3) 10.0 points

How long is it in motion?

Correct answer: 48.2609 s.

Explanation:

$$v = v_0 + at,$$

where again $v = 0$ m/s, so

$$\begin{aligned}t &= \frac{-v_0}{a} = \frac{-4.6 \text{ m/s}}{-0.0953153 \text{ m/s}^2}\\ &= \boxed{48.2609 \text{ s}}.\end{aligned}$$

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016 (part 3 of 3) 10.0 points

What is its speed after traveling 57 m?

Correct answer: 3.20843 m/s.

Explanation:

$$\text{Given}: \quad x = 57 \text{ m}\,.$$

$$\begin{aligned}v^2 &= v_0^2 + 2\,a\,x\\ &= (4.6 \text{ m/s})^2\\ &\quad + 2(-0.0953153 \text{ m/s}^2)(57 \text{ m})\\ &= 10.2941 \text{ m}^2/\text{s}^2\,,\end{aligned}$$

so that

$$\boxed{v = 48.2609 \text{ s}}.$$

Tipler PSE5 02 104

017 10.0 points

An automobile accelerates from rest at 0.2 m/s^2 for 30 s. The speed is then held constant for 11 s, after which there is an acceleration of -4.5 m/s^2 until the automobile stops.

What is the total distance traveled?

Correct answer: 0.16 km.

Explanation:

$$\begin{aligned}\text{Let}: \quad a_1 &= 0.2 \text{ m/s}^2\,,\\ a_2 &= 0\,,\\ a_3 &= -4.5 \text{ m/s}^2\,,\\ t_1 &= 30 \text{ s}\,,\\ t_2 &= 11 \text{ s}\,,\\ v_0 &= 0\,, \quad \text{and}\\ v_f &= 0\,.\end{aligned}$$

The first displacement is

$$s_1 = v_0\,t_0 + \frac{1}{2}\,a_1\,t_1^2 = \frac{1}{2}\,a_1\,t_1^2\,,$$

reaching a speed of

$$v_1 = v_0 + a\,t_1 = a_1\,t_1\,.$$

The second displacement is

$$s_2 = v_1\,t_2 = a_1\,t_1\,t_2\,,$$

maintaining a speed of $v_2 = v_1$.

During the braking interval

$$\begin{aligned}v_3^2 &= v_2^2 + 2\,a_3\,s_3 = 0\\ s_3 &= \frac{-v_2^2}{2\,a_3} = \frac{-(a_1\,t_1)^2}{2\,a_3}\,, \text{ so}\end{aligned}$$

$$\begin{aligned}s &= s_1 + s_2 + s_3\\ &= \frac{1}{2}\,a_1\,t_1^2 + a_1\,t_1\,t_2 - \frac{(a_1\,t)^2}{2\,a_3}\\ &= \frac{1}{2}\,(0.2 \text{ m/s}^2)\,(30 \text{ s})^2\\ &\quad + (0.2 \text{ m/s}^2)\,(30 \text{ s})\,(11 \text{ s})\\ &\quad - \frac{[(0.2 \text{ m/s}^2)\,(30 \text{ s})]^2}{2\,(-4.5 \text{ m/s}^2)}\\ &= 160 \text{ m}\\ &= \boxed{0.16 \text{ km}}.\end{aligned}$$

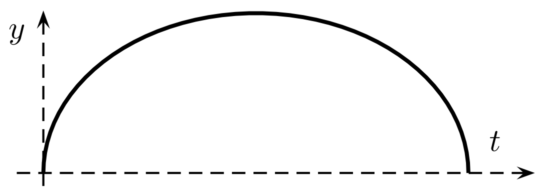
Displacement Curves

018 10.0 points

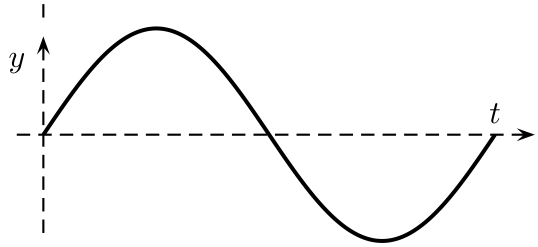
An object is thrown upward from the origin along the positive y direction and caught.

Which graph correctly describes the y coordinate of the **vertical** motion while the object is in the air?

1.

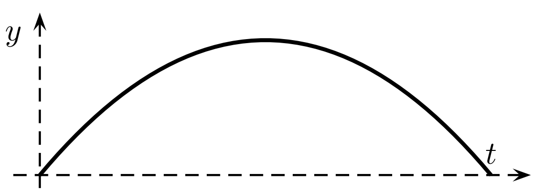


2.



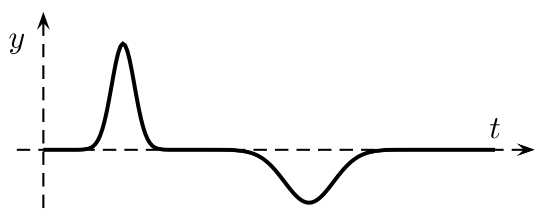
3. None of these graphs are correct.

4.



correct

5.



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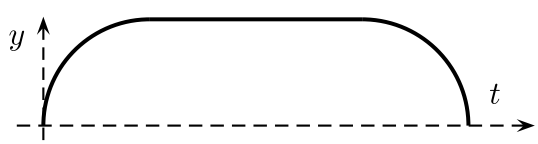

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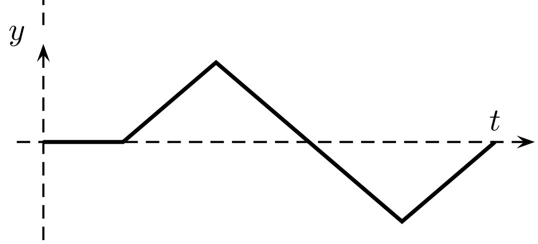

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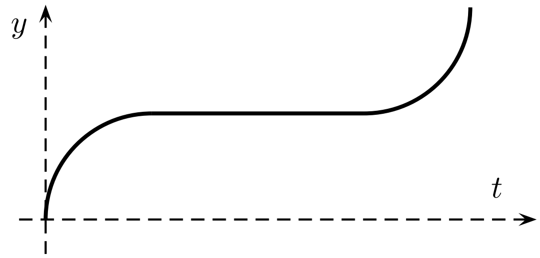

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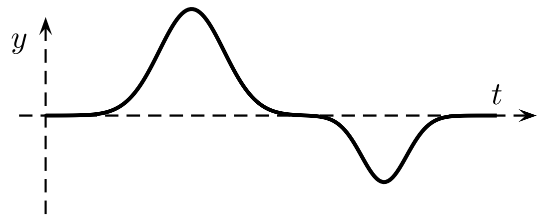
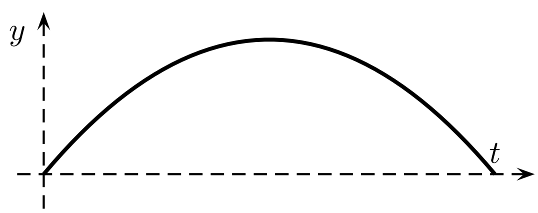


Explanation:

The vertical motion should be represented by the parabola

$$y = v_0\, t - \frac{1}{2}\, g\, t^2\,, \quad \text{as shown}$$



Calc Practice 05

019 (part 1 of 3) 10.0 points

A particle moves along the x-axis so that its velocity at any time $t \geq 0$ is given by $v(t) = 3t^2 - 2t - 1$. The position $x(t)$ is 5 for $t = 2$.

Find a polynomial expression for the position of the particle at any time $t \geq 0$.

1. $t^3 + t^2 + 6t + 3$

2. $t^3 + t^2 - 3t + 3$

3. $2t^3 - t^2 - t - 3$

4. $t^3 - t^2 - t + 3$ **correct**

5. $3t^3 - 2t^2 - t + 3$

Explanation:

$$x(t) = \int v(t)\, dt = \int (3t^2 - 2t - 1)\, dt$$
$$= t^3 - t^2 - t + C$$

$x(2) = 8 - 4 - 2 + C = 5$

$C = 3$ and

$$x(t) = t^3 - t^2 - t + 3\,.$$

---

020 (part 2 of 3) 10.0 points

For what values of t, $0 \le t \le 3$, is the particle's instantaneous velocity the same as its average velocity on the closed interval $[0, 3]$?

1. 1.786 **correct**

2. 3.798

3. 2.813

4. 2.917

5. 3.296

Explanation:

The average velocity is

$$\overline{v} = \frac{x(3) - x(0)}{3 - 0} = \frac{18 - 3}{3} = 5\,, \quad \text{so}$$

$$v(t) = 3t^2 - 2t - 1 = 5$$

$$t = \frac{1 + \sqrt{19}}{3} \approx 1.786$$

---

021 (part 3 of 3) 10.0 points

Find the total distance traveled by the particle from time $t = 0$ until time $t = 3$.

1. 17 **correct**

2. 15

3. 16

4. 14

5. 18

Explanation:

$$d = \int_0^3 |v(t)|\,dt = \int_0^3 |3t^2 - 2t - 1|\,dt$$

$$= t^3 - t^2 - t\Big|_0^3 = 17$$

Calc Practice 02

022 (part 1 of 3) 10.0 points

A particle moves on the x-axis so that its position at any time $t \ge 0$ is given by

$$x(t) = 2\,t\,e^{-t}.$$

Find the acceleration of the particle at $t = 0$.

1. -4 **correct**

2. -2

3. 0

4. -8

5. 4

Explanation:

$x(t) = 2\,t\,e^{-t}$

$v(t) = x'(t) = 2\,e^{-t} - 2\,t\,e^{-t}$

$a(t) = v(t) = -2\,e^{-t} - 2\,e^{-t} + 2\,t\,e^{-t}\,, \quad$ so

$$a(0) = -2e^0 - 2e^0 + 0 = -4\,.$$

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023 (part 2 of 3) 10.0 points

Find the velocity of the particle when its acceleration is 0.

1. $\dfrac{-4}{e^2}$

2. $\dfrac{4}{e^2}$

3. $-\dfrac{2}{e^2}$ **correct**

4. $\dfrac{2}{e^2}$

5. $\dfrac{2}{e}$

6. $-\dfrac{2}{e}$

Explanation:

$$x''(t) = -2\,e^{-t}\,(2-t) = 0$$
$$t = 2$$

since $e^{-t} > 0$, so

$$x'(2) = v(2) = 2\,e^{-2} - 4\,e^{-2} = \frac{-2}{e^2}\,.$$

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024 (part 3 of 3) 10.0 points

Find the total distance traveled by the particle from $t = 0$ to $t = 5$.

1. $\frac{2}{e} - \frac{8}{e^5}$

2. $\frac{2}{e} - \frac{10}{e^5}$

3. $\frac{4}{e} - \frac{10}{e^5}$ **correct**

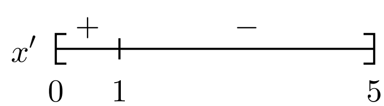
4. $\frac{2}{e} + \frac{8}{e^5}$

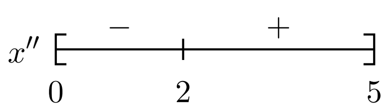
5. $\frac{2}{e} + \frac{10}{e^5}$

Explanation:

The particle stops when

$$x'(t) = v(t) = 2\,e^{-t}\,(1-t) = 0$$
$$t = 1$$





$$x(0) = 0 \quad x(1) = \frac{2}{e} \quad x(5) = \frac{10}{e^5}\,,$$

so the distance traveled is

$$[x(1) - x(0)] + [x(1) - x(5)]$$
$$= \left(\frac{2}{e} - 0\right) + \left(\frac{2}{e} - \frac{10}{e^5}\right)$$
$$= \frac{4}{e} - \frac{10}{e^5}\,.$$

Bullet Fired Down 02

025 (part 1 of 2) 10.0 points

A bullet is fired straight down from the top of a high cliff.

What is the acceleration of the bullet?

1. Equal to 9.8 m/s^2. **correct**

2. First faster than 9.8 m/s^2, then slower.

3. First slower than 9.8 m/s^2, then faster.

4. Not enough information to answer.

5. More than 9.8 m/s^2.

6. Less than 9.8 m/s^2.

Explanation:

Regardless of whether the bullet is dropped, fired straight up, or fired straight down, it is under the influence of gravitational acceleration $g = 9.8\,\mathrm{m/s^2}$.

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026 (part 2 of 2) 10.0 points

What conclusion can be reached about the speed of the bullet?

1. Always slower than its initial speed.

2. Equal to zero.

3. First slower than its initial speed, then faster.

4. Not enough information to answer.

5. Always faster than its initial speed. **correct**

6. Equal to its initial speed.

7. First faster than its initial speed, then slower.

8. Equal to 9.8 m/s.

9. Equal to 9.8 m/s^2.

Explanation:

Gravity will continue to accelerate it faster than its initial speed.

Rock Thrown Straight Up

027 10.0 points

A rock thrown straight up with a velocity of 28 m/s from the edge of a building just misses the building as it comes down. The rock is moving at 53 m/s when it strikes the ground.

The acceleration of gravity is 9.8 m/s^2 .

How tall was the building?

Correct answer: 103.316 m.

Explanation:

$$v_f^2 = v_i^2 - 2g(y_f - y_0)$$
$$y_f - y_0 = \frac{v_f^2 - v_i^2}{-2g}$$

so the height is

$$\begin{aligned} H &= y_0 - y_f \\ &= \frac{v_f^2 - v_i^2}{2g} \\ &= \frac{(53 \text{ m/s})^2 - (28 \text{ m/s})^2}{2\,(9.8 \text{ m/s}^2)} \\ &= 103.316 \text{ m.} \end{aligned}$$

Dropping a Mail Bag 02

028 (part 1 of 3) 10.0 points

A small mail bag is released from a helicopter that is descending steadily at 5.79 m/s.

The acceleration of gravity is 9.8 m/s^2 .

After 4.72 s, what is the speed of the mailbag?

Correct answer: 52.046 m/s.

Explanation:

Let us take the down as positive. Since the helicopter is descending at a constant speed, u, the initial speed of the mailbag is also u. Hence, at 4.72 s, the speed of the mailbag is

$$\begin{aligned} v &= u + gt \\ &= 5.79 \text{ m/s} + (9.8 \text{ m/s}^2)(4.72 \text{ s}) = 52.046 \text{ m/s} \end{aligned}$$

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029 (part 2 of 3) 10.0 points

After the mailbag is dropped, the helicopter continues descending for 1 s but then stops.

How far is the mailbag below the helicopter at 4.72 s?

Correct answer: 130.703 m.

Explanation:

The mailbag has fallen a distance

$$\begin{aligned} y &= ut + \frac{1}{2}gt^2 \\ &= (5.79 \text{ m/s})(4.72 \text{ s}) + \frac{1}{2}(9.8 \text{ m/s}^2)(4.72 \text{ s})^2 \\ &= 136.493 \text{ m} \end{aligned}$$

However, during the time interval of 1 second, the helicopter has also descended a distance

$$\begin{aligned} d = ut &= (5.79 \text{ m/s})(1 \text{ s}) \\ &= 5.79 \text{ m/s} \end{aligned}$$

Then the mailbag is a distance

$$\begin{aligned} \ell = y - d &= 136.493 \text{ m} - 5.79 \text{ m} \\ &= 130.703 \text{ m} \end{aligned}$$

below the helicopter.

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030 (part 3 of 3) 10.0 points

What is your answer to part 1 if the helicopter is rising steadily at $u = 5.79$ m/s ? (Take down as positive.)

Correct answer: 40.466 m/s.

Explanation:

If the helicopter is ascending at speed u then the initial velocity of the mailbag is -5.79 m/s (following our convention that down is positive). Hence the speed of the bag at 4.72 s is

$$\begin{aligned} v &= -u + gt \\ &= -5.79 \text{ m/s} + (9.8 \text{ m/s}^2)(4.72 \text{ s}) \\ &= 40.466 \text{ m/s} \end{aligned}$$

Dropped vs Thrown Stones

031 (part 1 of 2) 10.0 points

A stone falls from rest from the top of a cliff. A second stone is thrown downward from the same height 3.6 s later with an initial speed of 70.56 m/s. They hit the ground at the same time.

The acceleration of gravity is 9.8 m/s^2.

How long does it take the first stone to hit the ground?

Correct answer: 5.4 s.

Explanation:

For stone 1:

$$y_1 = \frac{1}{2}\, g\, t_1^2$$

For stone 2:

$$y_2 = v_0\, t_2 + \frac{g\, t_2^2}{2}$$

Stone 2 is thrown Δt seconds after stone 1 and they hit the ground at the same time, so

$$t_1 = t_2 + \Delta t\,.$$

Since the height of the cliff is the same for both of the stones,

$$y_1 = y_2$$

$$\frac{g\, t_1^2}{2} = v_0\,(t_1 - \Delta t) + \frac{g}{2}\,(t_1 - \Delta t)^2$$

$$(v_0 - g\,\Delta t)\, t_1 = v_0\,\Delta t - \frac{g}{2}\,\Delta t^2$$

$$\begin{aligned} t_1 &= \frac{v_0\,\Delta t - \frac{g}{2}\,\Delta t^2}{v_0 - g\,\Delta t} \\ &= \frac{(70.56\text{ m/s})\,(3.6\text{ s})}{(70.56\text{ m/s}) - (9.8\text{ m/s}^2)\,(3.6\text{ s})} \\ &\quad - \frac{\frac{(9.8\text{ m/s}^2)}{2}\,(3.6\text{ s})^2}{(70.56\text{ m/s}) - (9.8\text{ m/s}^2)\,(3.6\text{ s})} \\ &= 5.4\text{ s}\,. \end{aligned}$$

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032 (part 2 of 2) 10.0 points

How high is the cliff?

Correct answer: 142.884 m.

Explanation:

Once t_1 is known, the height of the cliff is given by

$$\begin{aligned} y &= \frac{g\, t_1^2}{2} \\ &= \frac{(9.8\text{ m/s}^2)\,(5.4\text{ s})^2}{2} \\ &= 142.884\text{ m}\,. \end{aligned}$$