

Ch 2 HW Assignment: Answers & HW Hints (Pt. 1)

Part 1: Velocity as a Derivative

Pg. 31 #14a-d, 15, 16, 17a-e
(Pt. 2 is directly after Pt. 1)

Answers

14a. $t=0\text{s}$

b. $x=4\text{m}$

c. $t=0.816\text{s}$

d. $t=-0.816\text{s}$

15a. -6m/s

b. neg

c. 6m/s

d. Decreasing, because...

e. $t=2\text{s}$

f. No, because...

16. 5.89m

17a. 28.5cm/s

b. 18cm/s

c. 40.5cm/s

d. 28.125cm/s

e. 30.33cm/s

Ch 2 #16

You need to begin by finding dx/dt so that you know a function for velocity. To do this derivative, remember 2 things...

1. The product rule.
2. If $f=e^u$, then $df/dt = (du/dt) \cdot (e^u)$

Once you've found the derivative, the problem's almost done.

Ch 2 #17e

You've got to start by finding the position halfway between $x_{t=2}$ and $x_{t=3}$. Be creative and I'm sure you'll find a way to get $x_{\text{halfway}} = 36\text{m}$. Once you've found that, then you need to use the original position function to find the time when the object reaches the halfway location. Lastly, find the object's velocity at that time.

Ch 2 HW Assignment: Answers & HW Hints (Pt. 2)

Part 2: Acceleration as a Derivative

Pg. 31 #18a-c, 20, 21a-c

Answers

18a. $\pm 1.155s$

b. $0s$

c. Positives, because...

20a. $54m$

b. $18m/s$

c. $-12m/s^2$

e. $4s$

d. $64m$

20g. $2s$

f. $24m/s$

h. $-24m/s^2$

i. $18m/s$

21a. m/s^2

b. m/s^3

c. $1s$

Ch 2 #20

As indicated on the answer page, it makes sense to do part e before d, and part g before f.

On part i, keep in mind that it's not really fair to find the arithmetic average of the two velocities (like adding up and dividing by 2), because the acceleration is constant. So you actually need to do it without calculus, just going back to $v_{\text{avg}} = \Delta x / \Delta t$.

Ch 2 #21

Part a and b are kind of weird. But the idea is that the function is a position function, so each term in the function must be a position value. So each term must have units of meters, meaning the coefficients a and b must multiply by their t^2 or t^3 to arrive at meters.

On part c, you're looking for time when it reaches max position, so you'll look for times when $v=0$. However, there are two non-negative times when this occurs. Just plug and chug to see which one actually corresponds to the maximum position.

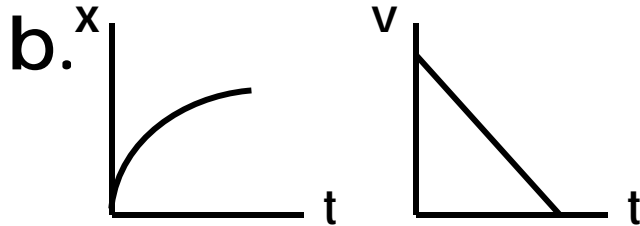
Ch 2 HW Assignment: Answers & HW Hints (Pt. 3)

Part 3: Kinematic Formulas

Pg. 32-33 #24-25, 26ab, 27, 29, 31,
34ab, 35, 41, 43

Answers

24a. 0.1m



25a. 35.4 days

b. $4.59E^{13}m$

26a. 5s

b. 61.5m

27. $1.62E^{15}m/s^2$

29a. 30s

b. 300m

31a. 10.59m

b. 41.66s

34a. 56.57s

b. 31.82m/s

35a. $4m/s^2$

b. Positive

41. $0.903m/s^2$

43a. 15m apart

b. 26.2m/s

Ch 2 #31

On part B, just recognize that you're calculating total time for a few different motions. The elevator speeds up for some distance (calculated in A), then moves at constant speed, and then slows down. It's definitely helpful if you realize that the 'speed up' and 'slow down' motions are symmetric with each other, and therefore take the same amount of time and distance.

Ch 2 #35

There are two different ways to approach part A. One way is to just figure out the equation for this parabolic function, based on the three data points you have and on your understanding of parabolas. The other way is to take the 2nd and 3rd data points and plug them into the formula $x = v_0 t + \frac{1}{2} a t^2$. You'll wind up with a system of 2 equations, and then you can solve for "a". (If you do the 2nd method, be careful of what you plug in for "x" in the 2 equations, since we've chosen to make it mean displacement rather than position.)

Ch 2 #41

The idea on this one is to set up 2 equations relating the position of each object to time, and then to set the 2 equations equal at the time they cross each other on the graph, since both cars are at the same position at that time. For the green car, its equation should obviously be linear. For the red car, you want to relate x to t for an accelerating object, knowing only its initial speed, so this should lead you to the appropriate kinematic equation. (You do need to factor in its initial position, though.)

Ch 2 #43

For part A, just figure out how far the police car moves in that time, and also how far you move during that same time. On part B, you need to do something similar to #41, where you find equations for each motion, and then set them equal for the moment they hit. It's up to you whether to think of this part in terms of the entire motion or whether you want to think of just the part after part A. Either way, solve for the time when the cars are both at the same position (which is 0.833 seconds or 3.283 seconds, depending on your strategy), and then find your speed at that time.

Ch 2 HW Assignment: Answers & HW Hints (Pt. 4)

Part 4: Free-fall

Pg. 33-34 #44, 46, 47ab, 49, 50a, 51, 53, 62

Answers

44a. 182.5m/s

b. Nope.

46a. 1.54s

b. 27.1m/s

47a. 31.3m/s

b. 6.39s

49a. 5.45s

b. 41.4m/s

50a. 0.46s

51. 3.96m/s

53a. 19.6m

b. 58.8m

62a. -8m/s^2

b. 20m/s

Ch 2 #49

Just be careful with your positives and negatives, and then don't forget how to use the quadratic formula.

Ch 2 #50a

Think of it in terms of how much time it takes to get to the 80% mark, and then how much time it takes to fall the whole distance. The difference between those two times must be how long it spends in the last 20% of its fall.

Ch 2 #51

Two things happen at the same time: a key falls down 45 meters (while accelerating), and a boat moves forward (at a constant velocity). Find the time for the one thing to occur, and then how far the boat moves in that time.

Ch 2 #53

For part A, notice that the maximum height will happen when the velocity equals zero, which is at 4s, which is 2s after the object breaks free.

For part B, you can calculate the height of the break-free point with kinematics and the fact that it fell from $t=2s$ to $t=8s$.

Ch 2 #62

For part A, you need to pull data from the graph to then use in a kinematic. Since all of the kinematics include v_0 , then you need to somehow use a portion of the motion for which you know the initial speed. Since you don't know the initial speed at $t=0s$, you can think about the motion as starting at $t=2.5s$, where you do know the speed.

Ch 2 HW Assignment: Answers & HW Hints (Pt. 5)

Part 5: Integrals in Physics

Pg. 33-34 #66, 67, 89, 70, 98

Answers

66. 5m/s

67. 100m

89. 47m/s

70. 15.59m/s

98a. 18.2m/s

b. 28.8m

Ch 2 #70

Because you have two different objects, you need to set their two velocity functions equal to one another, and then solve for the time at which they are equal.

But before you can set the velocities equal, you need to find the function for the second velocity by using integration ideas, including solving for the constant C. (You should wind up with $v = -4t^2 + 20$ for this second v function.)

Ch 2 #98

When you're looking for v_{\max} , you obviously need to solve for the time at which $a=0$, which should be easy. But then you need to plug this time into the velocity function, which you don't know yet. So use integration ideas to find $v(t)$, and then plug in that v_{\max} time.

On part B, just integrate the velocity function to find the position function, and then plug in 6s. One note is that you weren't really asked for position, but were instead asked for distance moved, so you shouldn't add in the initial position of 7.3m