Ch 4 HW Assignment: Answers & HW Hints (Pt. 1)

Part 1: Using Unit Vectors

Pg. 77-78 #1, 5-6, 11-13, 15-19

Answers

Note: It's understood that all "i", "j", and "k" should have 'hats' to indicate unit vector notation.

1. (-2i+6j-10k)m
5. (-0.7i+1.4j-0.4k)m/s
6a. (3i-8tj)m/s
  b. (3i-16j)m/s
  c. 16.28m/s
  d. -79.4°
11a. (8tj+1k)m/s
  b. 8j m/s²
12a. (-1.5i+0.5k)m/s²
  b. 1.58m/s²
  c. 161.6°

13a. (6i-106j)m
  b. (19i-224j)m/s
  c. (24i-336j)m/s²
  d. -85.15°
15. 32i m/s
16a. 15.84m/s
  b. 42.5°
17a. -1.5j m/s
  b. (4.5i-2.25j)m

18a. -18i
  b. 0.75s
  c. Never, since…
  d. 2.19s
19a. (72i+90.67j)m
  b. 49.5°

Ch 4 #12

On part C, don’t get freaked out that you’re finding an angle in the x-z plane. You’re still just trying to see how many degrees you had to rotate from the +x-axis to get to the angle of the vector you’re dealing with. Using $\tan^{-1}$ just like when it’s the x-y plane will work just fine. (If you had to find an angle in 3D space, that would require some different strategies. But since this is still just in 2 dimensions, everything’s ‘normal’.)

Ch 4 #13

On parts A,B,C, you're finding those vectors at t=2s. On part D, read carefully. You should be able to decipher that it's really asking for the angle of the velocity vector at that moment.

Ch 4 #18

On part D, set up the Pythagorean theorem as $10^2 = (6t-4t^2)^2 + 8^2$. To solve, you DON'T need to multiply out the binomial. Just subtract 64 from both sides, take the square root of both sides, and then solve. (There are several possible answers, but it should become clear that only 1 really makes sense.)

Ch 4 #19

On part A, you'll need to use integrals, remembering to solve for constant terms each time. On part B, read the question carefully. You should realize that it's really just asking for the direction of the velocity at that moment.

Ch 4 HW Assignment: Answers (Pt. 2)

Part 2: Horizontally-Launched Projectiles

Pg. 78-80 #21, 24, 25, 29, 40

Answers

21a. 3.03s

b. 757.6m

c. -29.69m/s

24a. 0.495s

b. 3.07m/s

25a. -0.177m

b. 1.9m

29a. 1.6m

b. 6.864m

c. 2.857m

40a. 0.205s

b. 0.205s

c. -0.206m

d. -0.618m

e. Because it’s moving faster (vertically) during the second half of its motion.

Ch 4 HW Assignment: Answers (Pt. 3)

Part 3: Angle-Launched Projectiles

Pg. 78-81 #26, 27, 23, 30ab, 37a, 39, 42, 47, 54

Answers

26a. 51.83m

b. 27.36m/s

c. 67.49m

27a. 10.03s

b. 896.95m

23. 43.1m/s

30a. 21.45m/s

b. 24.94m/s

37a. 11.0m

39. 4.84cm

42a. 95m

b. 30.6m

47a. Yes, it does clear it, because…

b. 2.53m

54a. 20m/s

b. 36.3m/s

c. 74.08m

Ch 4 #23

As you start to set up your horizontal equation, you'll notice that you're missing both v_o and t, and you can't solve for either one (directly) if you're missing 2 variables. However, it's entirely possible for you to set up a vertical equation that's missing the same exact 2 variables, which means that you have a system of equations that now can be solved through substitution. (One additional hint: When you've got the vertical equation $0=v_o\sin 12t-4.9t^2$, you can make your life way easier by dividing all terms by t.)

Ch 4 #30b

To find the speed at ½ of the max height, you need to start by finding the max height. Don't forget that your final answer needs to involve both components of its speed.

Ch 4 #39

You need to think of this problem as if it had asked you to solve for the <u>angle</u> at which to aim, and then do one last step to turn that angle into a distance above the target. To solve for the angle, you need to use a system of equations (similar to #23), but things are more complex since one of your unknowns is θ. If you get everything set up and substituted (like #23), you can solve with the aid of a trig identity that says $2\sin\theta\cos\theta=\sin2\theta$.

Ch 4 #42

This one is just a little weird because you have to pull info off of the graph. The 2 important moments to note of on the graph are the moment the ball hits its max height (and therefore has zero vertical velocity), and also the moment the ball was launched.

Ch 4 #47

Use the info about what the ball's horizontal range *should* be to help you work backwards and determine its launch speed. (This does involve a system of equations, similar to #23.) Then once you know the launch speed, see how high the ball really is when it has moved a horizontal distance of 97.5m. Is this enough height to clear the fence? By how much does it clear?

Ch 4 HW Assignment: Answers (Pt. 4)

Part 4: Uniform Circular Motion

Pg. 81 #57, 59, 61, 63-67

Answers

57a. 12s

b. 4.11m/s^2

c. Downward

59a. 125,664m/s

b. 789,568m/s

c. Both increase.

61a. 7.32m

b. West

c. North

63. (3i + 6j)m/s^2

64a. 8.82m

b. 6m

65. 2.92m

66a. 4m

b. 6m

67. 163.3m/s^2

Ch 4 #61

On part B&C, make sure you understand what it's asking. On B, for instance, at a moment when acceleration is pointing due east, the object must be located west of the center of rotation. (Because centripetal acceleration always points toward the center of the path.) The question asks for the direction of the r-vector, which points from the center to the location.

Ch 4 #63

If you think about it, the wallet and purse must have the same period, but not the same speed. With a quick little derivation, you can show that the relationship between acceleration and radius for two objects with the same period is $a_c=(4\pi^2 r)/(T^2)$. So if the wallet's radius is 1.5x the purse's radius, then its a_c must also be 1.5x greater.

Ch 4 #64

It's probably best to start with a drawing of the xy coordinate plane, including the v and a vectors. The drawing should help you figure out how far around the circle the object has moved during the 6s, which allows you to figure out its period. Once you know the period, calculating radius is easy, and then answering the question should also be easy.

Ch 4 #65-66

These are both pretty similar to #64, so do all of that stuff again.

Ch 4 #67

This one combines two of your favorite topics: circular motion and projectiles. Work the problem backwards by using projectile ideas to calculate the object's 'launch' speed. Then realize that this speed is the same as the object's speed during its circular motion.