Chapter 2 – Problem Day

13. You drive on I-10 from San Antonio to Houston, half the *time* at 55 km/h and the other half at 90 km/h. Going back you travel half the *distance* at 55 km/h and the other half at 90 km/h. What is your average speed (a) from San Antonio to Houston, (b) from Houston back to San Antonio, and (c) for the entire trip? (d) What is your average velocity for the entire trip?

15. (a) If a particle's position is given by $x = 4 - 12t + 3t^2$ (where t is in seconds and x is in meters), what is its velocity at $t = 1$ s? (b) Is it moving in the positive or negative direction of x just then? (c) What is its speed just then? (d) Is the speed increasing or decreasing just then? (Try answering the next two questions without further calculation.) (e) Is there ever an instant when the velocity is zero? If so, give the time t; if not, answer no. (f) Is there a time after $t = 3$ s when the particle is moving in the negative direction of x? If so, give the time t; if not, answer no.

21. The position of a particle moving along the x-axis depends on the time according to the equation $x = ct^2 - bt^3$, where x is in meters and t in seconds. What are the units of (a) constant c and (b) constant b? Let their numerical values be 3.0 and 2.0, respectively. (c) At what time does the particle reach its maximum positive x position? From $t = 0$ s to $t = 4$ s, (d) what distance does the particle move and (e) what is its displacement?

43. You are on your cell phone while trailing a police car by 25 m; both your car and the police car are traveling at 110 km/h. Your call distracts you for 2.0 s. At the beginning of that 2.0 s, the police officer begins braking suddenly at 5.0 m/s^2. (a) What is the separation between the two cars when your attention finally returns? Suppose that you take another 0.40 s to realize your danger and begin braking. (b) If you too brake at 5.0 m/s^2, what is your speed when you hit the police car?

50. A bolt is dropped from a bridge under construction, falling 90 m to the valley below the bridge. (a) In how much time does it pass through the last 20% of its fall? What is its speed (b) when it begins that last 20% of its fall and (c) when it reaches the valley beneath the bridge?

58. A rock is thrown vertically upward from ground level at time $t = 0$ s. At $t = 1.5$ s it passes the top of a tall tower, and 1.0 s later it reaches its maximum height. What is the height of the tower?

70. Two particles move along an x-axis. The position of particle 1 is given by $x = 6.00t^2 + 3.00t + 2.00$ (in meters and seconds); the acceleration of particle 2 is given by $a = -8.00t$ (in meters per seconds squared and seconds) and, at $t = 0$ s, its velocity is 20 m/s. When the velocities of the particles match, what is their velocity?

71. At the instant the traffic light turns green, an car starts with a constant acceleration of 2.2 m/s^2. At the same instant a truck, traveling with a constant speed of 9.5 m/s, overtakes and passes the automobile. (a) How far beyond the traffic signal will the automobile overtake the truck? (b) How fast will the automobile be traveling at that instant?

Chapter 2 Answers

13a) 73 km/hr
13b) 68 km/hr
13c) 70 km/hr
13d) zero

15a) – 6 m/s
15b) negative
15c) 6 m/s
15d) decreasing
15e) Yes, t = 1 s
15f) No

21a) m/s^2
21b) m/s^3
21c) 1 s
21d) 82 m
21e) – 80 m

43a) 15 m
43b) 26 m/s

50a) 0.45 s
50b) 38 m/s
50c) 42 m/s

58) 26 m

70) 15.6 m/s

71a) 82 m
71b) 19 m/s