Physics 53 Exam 1 Dr. Alward February 1, 2009

1. An object moving at 25 m/s is passing through coordinate x = 12 m at time t = 0. At that instant, the object begins to uniformly accelerate at a rate of 4 m/s^2. At what time (in seconds) will the object's x-coordinate be 44 m?

(a) 2.31
(b) 1.17
(c) 2.46
(d) 3.09
(e) none of these

2. An object moving at 122 m/s begins to slow down at a rate of -5.4 m/s^2. When the object's velocity has been reduced to 45 m/s, about how far has it traveled, in meters, since it began to slow down?

(a) 1191
(b) 2167
(c) 786
(d) 1347

3. An automobile moving at 45 mph increases its speed uniformly to 80 mph in 16 seconds. About how many meters did the automobile travel during this time?

(a) 1186
(b) 1388
(c) 967
(d) 447
(e) none of these

4. A speeding SUV traveling at 45 m/s passes a California Highway Patrol car parked at the side of the road. Three seconds later the patrolman begins chase, accelerating from rest at a rate of 2.6 m/s^2. How far (in meters) down the road will the SUV be before the CHP car catches up with it?

(a) 1817
(b) 2398
(c) 1029
(d) 4521
(e) none of these

5. A car travels for two and a half hours at 50 mph, then 25 minutes at 70 mph. What was the car's average speed in mph during this period?

(a) 61.43
(b) 58.34
(c) 55.09
(d) 52.86
(e) none of these

6. What is the angle in degrees between the vectors A = <-3, 2, 0> and B = <-2, -1,4>?

(a) 65.74
(b) 77.21
(c) 70.09
(d) 44.56
(e) none of these

7. What is the length (magnitude) of the vector that is the cross-product of the two vectors A = 2i -3j + k and B = -4i + 2j + 5k?

(a) 26.54
(b) 23.43
(c) 19.98
(d) 15.54
(e) none of these

8. A ball is revolving in a circular path at the end of a string 2.1 meters long. How many revolutions must it make per minute in order that the ball's acceleration be 20 m/s^2?

(a) 29.47
(b) 11.53
(c) 16.76
(d) 22.50
(e) none of these

9. An arrow is fired upward. Its speed four seconds after being fired is 50 m/s. What will its average speed (in m/s) be in the last three seconds before it strikes the ground?

(a) 69.80
(b) 71.45
(c) 79.70
(d) 74.50
(e) none of these

10. An object accelerating at 4.0 m/s^2 reaches a speed of 140 m/s while traveling 1300 m. What was the object's initial speed, in m/s?

(a) 95.92
(b) 111.23
(c) 78.90
(d) 42.24
(e) none of these

11. An object moving along the x-axis has a velocity given by $v(t) = 3 + 6t^2 - 2t^3$, in m/s, and t is in seconds. What is the displacement (in meters) of the object during the time period beginning at t = 3.2 s and ending at t = 4.1 s?

(a) 15.43
(b) -13.85
(c) -32.09
(d) 44.32
(e) none of these

12. At time t = 0, the velocity of an object is 17.50 m/s. At that instant, it begins accelerating according to the equation, $a(t) = 5t^2e^{3t}$, where a(t) is in m/s^2, and t is in seconds. What will be the object's velocity at time t = 0.98 seconds?

(a) 33.82
(b) 77.58
(c) 88.22
(d) 92.90
(e) none of these

13. The position of an object on the x-axis is given by the function, $x(t) = 12 + 13t^2 e^{0.2t}$, where x(t) is in meters, and t is in seconds. What is the velocity of the object (in m/s) at t = 1.35 s?

(a) 52.19
(b) 43.12
(c) 16.78
(d) 33.58
(e) none of these

14. Given A = <4, -1> and B = <-3,2>. Let C = A - B. What angle (in degrees) does C make with respect to the positive x-axis?

(a) 24.56
(b) - 23.20
(c) -17.80
(d) -19.84
(e) none of these

15. The position of a particle moving along the x-axis is a function of time given by the equation, $x(t) = 14t + 2t^3 - t^4$, where x(t) is in meters, and t is in seconds. At what time (in seconds) will the particle reverse its direction of motion?
(a) 3.17
(b) 2.30
(c) 2.09
(d) 2.21
(e) none of these

16. An object moving with constant acceleration travels moves 180 meters during a 4.3 second time period, at the end of which the velocity of the object is 24 m/s. What was the object's velocity (in m/s) at the beginning of the time period?

(a) 44.23
(b) 32.15
(c) 49.89
(d) 59.72
(e) none of these

17. At time t = 0, an object is at x = 200 m, and its velocity is 22 m/s. The acceleration function of the object is $a(t) = -10 + 9t$, where a(t) is in m/s^2 and t is in seconds. What is the position (in meters) of the object at t = 4.3 s?

(a) -45.67
(b) 112.45
(c) 321.41
(d) 412.12
(e) none of these

18. A jet flying horizontally at 200 m/s at an altitude of 1000 meters drops a bomb over level terrain. How far (in meters) horizontally from its point of release does the bomb strike the ground?

(a) 1345
(b) 2857
(c) 1976
(d) 4213
(e) none of these

19. At what angle (in degrees) above the horizontal must a projectile fired at 180 m/s be aimed over level ground in order to reach a height of 500 m after 4.2 seconds?

(a) 34.89
(b) 40.89
(c) 58.02
(d) 50.87
(e) none of these

20. Relative to the ground, air is moving at 33 m/s on a heading of 234º. An airplane's nose is pointing along a heading of 48º, and it is flying level at a speed of 90 m/s relative to the air. Inside the airplane a bullet is fired perpendicularly toward the right side of the plane at a speed of 100 m/s relative to the plane. Which of the numbers below is the closest to the actual heading of the bullet relative to the ground, in degrees? Hint: drawing a picture and estimating might be quicker than other methods.

(a) 70
(b) 110
(c) 140
(d) 170
(e) 205