Distance/Velocity/Acceleration Review

1. A particle moves along the x-axis so that at any time *t* its position is given by $x(t) = t^3 - 6t^2 + 9t + 11$. For what values of *t* is the particle at rest?

2. The position of a particle moving along the x-axis is $x(t) = \sin(3t) - \cos(2t)$ for $t \geq 0$. When $t = \frac{\pi}{2}$, the acceleration of the particle is?

3. The acceleration of a particle moving along the x-axis at time *t* is given by $a(t) = 6t - 18$. If the velocity is 24 when $t = 0$ and the position is 20 when $t = 1$, then $x(t) = ?$

4. A particle moves along a line so that at time *t* its position is given by $s(t) = -5\sin t - \frac{t^2}{2} + 10$. What is the velocity when the acceleration is zero?

5. A particle moves in a straight line with velocity $v(t) = 2t^2 + 1$. How far does the particle move between time $t=1$ and $t = 3$?

6. The acceleration of a body moving in a straight line is given by $a(t) = 6 - 8t$. If the velocity is 20 at $t = 2$, what is $s(4) - s(1)$?

7. A points moves in a straight line so that its distance $x(t) = 9t - 3t^2$. What is the total distance covered by the point between $t = 1$ and $t = 2$?

8. At $t = 0$ a particle starts at rest and moves along a line in such a way that at time *t*, $a(t) = 48t^2$ ft/sec^2. Through how many feet does the particle move during the first 3 seconds?

9. The acceleration of a particle moving along the x-axis at time $t > 0$ is $a(t) = 2t + 3$ ft/sec^2. If the velocity is 5 ft/sec at $t = 1$ sec and $x(0) = 1$, then $x(2)$ is?

10. A particle moves along the x-axis so that at any time $t \geq 0$ its position is given by $x(t) = (t-1)(t-3)^3$. For what values of t is the velocity increasing?

11. A particle starts at time $t = 0$ and moves along a number line so that its position, at time $t \geq 0$, is given by $x(t) = (t-1)^3(t-5)$. The particle is moving to the right for??

12. A point moves so that x, it's distance from the origin at time t, $t \geq 0$, *is given by* $x(t) = \cos^5 t$. The first time interval in which the point is moving to the right is?

13. An object moves along the x-axis so that at any time $t > 0$ its position is given by $x(t) = t^4 + t^3 - 9t^2 + 16t$. At the instant when the acceleration becomes 0, the velocity is?

14. A point moves on the x-axis so that its distance from the origin at time t is given by $x(t) = 10t - 3t^2$. What is the total distance covered by the point between $t = 1$ and $t = 2$?

15. At $t = 0$, a particle starts at the origin with a velocity of 4 ft/sec and moves along the x-axis so that $a(t)=24t^2$ ft/sec^2. Through how many feet does the particle move during the first 2 seconds?

16. The acceleration of a body moving along a straight line is given by $a(t) = 8 - 6t$. If the velocity is 10 at $t = 0$, what is $s(4) - s(1)$?

17. A particle moves along the x-axis with velocity given by $v(t) = t + 3\sin t$. If the particle is at the origin when $t = 0$, its position when $v(t) = 6$ is x = ??

18. A particle's position is $x(t) = \frac{t^3}{3} - 4t^2 + 15t - 20$. For what times is the particle moving left?

19. 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 $t = 2$.
    a. Write a polynomial expression for the position of the particle at any time $t \geq 0$.
    b. For what values of t, $0 \leq t \leq 3$, is the particle's instantaneous velocity the same as its average velocity on the closed interval [0, 3]?
    c. Find the total distance traveled by the particle from time $t = 0$ until $t = 3$.

20. A particle moves along the y-axis with velocity given by $v(t) = t\sin(t^2)$, for $t \geq 0$.
    a. In which direction (up or down) is the particle moving at time $t = 1.5$? Why?
    b. Find the acceleration of the particle at time $t = 1.5$. If the velocity of the particle increasing at $t = 1.5$? Why or why not?
    c. Given that $y(t)$ is the position of the particle at time t and that $y(0) = 3$, find $y(2)$.
    d. Find the total distance traveled by the particle from $t = 0$ until $t = 2$.

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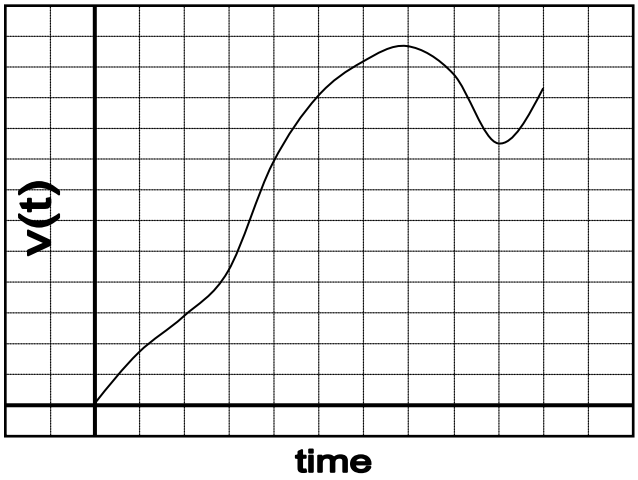
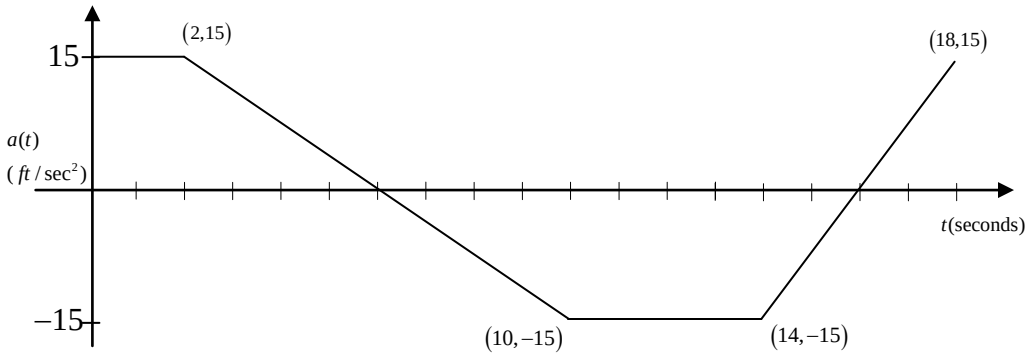
t (seconds)	v(t) (feet per second)
0	0
5	12
10	20
15	30
20	55
25	70
30	78
35	81
40	75
45	60
50	72



21. The graph of velocity $v(t)$, in ft/sec of a car traveling on a straight road for $0 \leq t \leq 50$, is shown above. A table of values for $v(t)$, at 5 second intervals of time is shown to the left of the graph.
    a. During what time intervals is the acceleration of the car positive?
    b. Find the average acceleration of the car in ft/sec² over the interval $0 \leq t \leq 50$.
    c. Find one approximation for the acceleration of the car in ft/sec² at $t = 40$. Show the computations used to arrive at your answer.
    d. Approximate $\int_0^{50} v(t)dt$ with a Riemann sum, using the midpoints of the five subintervals of equal length. Using correct units, explain the meaning of this integral.



22. A car is traveling on a straight road with velocity 55 ft/sec at time t = 0. For $0 \le t \le 18$ seconds, the car's acceleration, in ft/sec², is the piecewise linear function defined by the graph above.
    a. Is the velocity of the car increasing at t = 2 seconds? Why or why not?
    b. At what time in the interval $0 \le t \le 18$ seconds, other than t = 0, is the velocity of the car 44 ft/sec? Why?
    c. On the time interval $0 \le t \le 18$, what is the car's absolute maximum velocity, in ft/sec, and at what time does it occur? Justify your answer.
    d. At what time in the interval $0 \le t \le 18$, if any, is the car's velocity equal to zero? Justify your answer.

Distance/Velocity/Acceleration Review

1) t = 1, 3
2) 5
3) $x(t) = t^3 - 9t^2 + 24t + 4$
4) -5.100
5) 58/3
6) 33
7) 1.5
8) 324 ft.
9) 35/3
10) [0,2) U (3, infinity)
11) t > 4
12) interval from (π, 3 π/2)
13) 5
14) 1.6666….
15) 40 ft.
16) 27
17) 19.304
18) Interval from (3, 5)
19) A) $x(t) = t^3 - t^2 - t + 3$ B) 1.786 C) 17
20) A) moving UP since velocity is positive and it's on the y-axis B) V(t) is decreasing C) 3.828 D) 1.173
21) A) (0, 35) U (45, 50) B) 36/25 (ft/s²) C) -6/5 (ft/s²) D) 2530 ft