AP Calculus *name\_* Position/Velocity/Acceleration Review (from Demana Waits p. 371) Calculators are allowed

## In Exercises 1-5, the function v(t) is the velocity in m/sec of a particle moving long the x-axis.

- a) Determine when the particle is moving to the right, to the left, and stopped.
- *b)* Find the particle's displacement for the given time interval.
- *c) Find the total distance traveled by the particle.*
- $1 \quad v(t) = 5\cos t, \quad 0 \le t \le 2\pi$
- 2.  $v(t) = 6t^2 18t + 12$ ,  $0 \le t \le 2$
- 3.  $v(t) = e^{\sin t} \cos t$ ,  $0 \le t \le 2\pi$
- 4. An automobile accelerates from rest at  $1+3\sqrt{t}$  mph/sec for 9 seconds.
  - a) What is its velocity after 9 seconds?
  - b) How far does it travel in those 9 seconds?
- 5. A particle travels with velocity  $v(t) = (t-2) \sin t$  m/sec for  $0 \le t \le 4$  sec.
  - a) What is the particle's displacement?
  - b) What is the total distance traveled?
- 6. The rate of consumption of oil in the U.S. during the 1980s (in billions of barrels/year) is modeled by the function  $C = 27.08e^{t/25}$ , where *t* is the number of years after January 1, 1980. Find the total consumption of oil in the U.S. from January 1, 1980 to January 1, 1990.
- 7. The rate at which your home consumes electricity is measured in kilowatts. If your home consumes electricity at the rate of 1 kilowatt for 1 hour, you will be charged for 1 "kilowatt-hour" of electricity. Suppose that the average consumption rate for a certain home is modeled by the function  $C(t) = 3.9 2.4 \sin(\pi t/12)$ , where C(t) is measured in kilowatts and t is the number of hours past midnight. Find the average hourly consumption for this home, measured in kilowatt-hours.

 $p_{-}$ 

For exercises 8-12, a particle moves along the x-axis (units in cm). Its initial position at t = 0 sec is x(0) = 15. The figure shows the graph of the particle's velocity v(t). The numbers are the *areas* of the enclosed region.



- 8. What is the particle's displacement between t = 0 and t = c?
- 9. What is the total distance traveled by the particle in the same time period?
- 10. Give the positions of the particle at times a, b, and c.
- 11. Where does the particle achieve its greatest positive acceleration on the interval [0, b]?
- 12. Where does the particle achieve its greatest positive acceleration on the interval [0, c]?

In exercises 13-16, the graph of the velocity of a particle moving on the x-axis is given. The particle starts at x = 2 when t = 0.

- a) Find where the particle is at the end of the trip.
- b) Find the total distance traveled by the particle.





16.



<u>Key</u>

1. a) right: 
$$\left(0,\frac{\pi}{2}\right)_{and}\left(\frac{3\pi}{2},2\pi\right)_{left:}\left(\frac{\pi}{2},\frac{3\pi}{2}\right)$$
 b) 0 m c) 20 m  
2. a) right: (0, 1) left: (1, 2) b) 4 m c) 6 m

3. a) right:  $\left(0,\frac{\pi}{2}\right)_{\text{and}}\left(\frac{3\pi}{2},2\pi\right)_{\text{left}}\left(\frac{\pi}{2},\frac{3\pi}{2}\right)$ b) 0 m c) 4.701 m 4.  $v(t) = \int a(t)dt = \int (1+3t^{1/2})dt = t+2t^{3/2}+C, \ C=0, \ v(t) = t+2t^{3/2}$  $\int_{0}^{0.0025} |v(t)| dt = 0.06525 \mathrm{m}$ b) a) v(9) = 63 mph 5. a)  $\int_{0}^{4} [(t-2)\sin t] dt = -1.450$  m b)  $\int_{0}^{4} |v(t)| dt = 1.913$ m 6. Total Consumption =  $\int_{0}^{10} C(t)dt = \int_{0}^{10} 27.08e^{t/25}dt = 332.965$ billion barrels 7. Average Daily Consumption =  $\frac{1}{24-0} \int_{0}^{24} C(t) dt = \frac{1}{24} \int_{0}^{24} \left[ 3.9 - 2.4 \sin\left(\frac{\pi t}{12}\right) \right] dt = 3.9$ kilowatt-hours 8. -4 + 5 - 24 = -23 cm 9. 4 + 5 + 24 = 33 cm 10. at t = a, x(a) = x(0) - 4 = 15 - 4 = 11 cm at t = b, x(b) = x(0) - 4 + 5 = 15 + 1 = 16 cm at t = c, x(c) = x(0) - 4 + 5 - 24 = 15 - 23 = -8 cm 11. at t = a12. at t = c13. a) x(0) + Area = 2 + 4 = 614. a) x(0) + Area = 2 + 1 - 1 + 1 - 1 = 2b) Area = 4 mb) Area = 4 m15. a) x(0) + Area = 2 - 1 + 5 - 1 = 516. a) x(0) + Area = 2 + 3 - 12 + 4.5 = -2.5b) Area = 7 mb) Area = 19.5 m