The rate of consumption of cola in the United States is given by $S(t) = Ce^{kt}$ where S is measured in billions of gallons per year and t is measured in years from the begining of 1980.

(d) Using correct units, explain the meaning of $\int_5^7 S(t)dt$ in terms of cola consumption.

A particle moves along the x-axis so that its velocity at time t is given by

$$v(t) = -(t+1)\sin\left(\frac{t^2}{2}\right).$$

At time $t = 0$, the particle is at position $x = 1$.

(a) Find the acceleration of the particle at time $t = 2$. Is the speed of the particle increasing at $t = 2$? Why or why not?

(b) Find all times t in the open interval $0 < t < 3$ when the particle changes direction. Justify your answer.

(c) Find the total distance traveled by the particle from time $t = 0$ until time $t = 3$.

(d) During the time interval $0 \le t \le 3$, what is the greatest distance between the particle and the origin? Show the work that leads to your answer.

AB Calculus Review Sheet #4

5. The rate of consumption of oil in the United States during the 1980s (in billions of barrels per 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 United States from January 1, 1980 to January 1, 1990.

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6. The rate at which your home consumes electricity is measured in kilowatts. If your home consumes electricity at the rate of 1 kilowatts per 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 $C(t) = 3.9 - 2.4\sin\left(\frac{\pi t}{12}\right)$ where $C(t)$ is measured in kilowatts and t is the number of hours past midnight. Find the amount of electricity in kilowatt-hours consumed in your home on an average day.

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7. Population density measures the number of people per square mile inhabiting a given living area. Washerton's population density, which decreases as you move away from the city's center, can be approximated by the function $D(r) = 10{,}000(2 - r)$ at a distance r miles from the city's center.

   a. If the population density approaches zero at the edge of the city, what is the city's radius?

   b. A thin ring around the center of the city has thickness Δr and radius r. If you straighten the ring out, it suggests a rectangular strip. Approximately what is the area of the ring?

   c. Explain why the population of the ring in part (b) is approximately $P(r) = 10{,}000(2 - r)2\pi r\Delta r$.

   d. Estimate the total population of Washerton by setting up and evaluating a definite integral. Note: Population = $\sum$ Density × Change in Area.