For $0 \leq t \leq 6$, a particle is moving along the x-axis. The particle's position, $x(t)$, is not explicitly given. The velocity of the particle is given by $v(t) = 2\sin\left(e^{t/4}\right) + 1$. The acceleration of the particle is given by $a(t) = \frac{1}{2} e^{t/4} \cos\left(e^{t/4}\right)$ and $x(0) = 2$.

a. Is the speed of the particle increasing or decreasing at time $t = 5.5$? Give a reason for the your answer

b. Find the average velocity of the particle for the time period $0 \leq t \leq 6$.

c. Find the total distance traveled by the particle from time $t = 0$ to $t = 6$.

d. For $0 \leq t \leq 6$, the particle changes direction exactly once. Find the position of the particle at that time.

At time t, a particle moving in the xy-plane is at position (x(t), y(t)), where x(t) and y(t) are not explicitly given. For $t \geq 0$, $\frac{dx}{dt} = 4t + 1$ and $\frac{dy}{dt} = \sin t^2$. At time t = 0, x(0) = 0 and y(0) = -4.

a. Find the speed of the particle at time t = 3 seconds, and find the acceleration vector of the particle at time t = 3.

b. Find the slope of the line tangent to the path of the particle at time t = 3.

c. Find the position of the particle at time t = 3.

d. Find the total distance traveled by the particle over the time interval $0 \leq t \leq 3$.

t (minutes)	0	2	5	9	10
H(t) (˚C) (degrees Celsius)	66	60	52	44	43

As a pot of tea cools, the temperature of the tea is modeled by a differentiable function H for $0 \le t \le 10$, where time t is measured in minutes and temperature H(t) is measured in degrees Celsius. Values of H(t) at selected values of time are shown in the table above.

a. Use the data in the table to approximate the rate at which the temperature of the tea is changing at time t = 3.5. Show the computations that lead to your answer.

b. Using correct units, explain the meaning of $\frac{1}{10}\int_0^{10} H(t)\,dt$ in the correct context of this problem.

Use a trapezoidal sum with the four subintervals indicated by the table to estimate $\frac{1}{10}\int_0^{10} H(t)\,dt$

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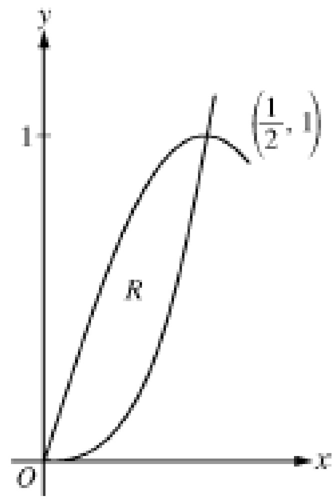
c. Evaluate $\int_0^{10} H'(t)\,dt$. Using correct units, explain the meaning of the expression in the context of this problem.

d. At time t = 0, biscuits with temperature 100˚C were removed from an oven. The temperature of the biscuits at time t is modeled by a differentiable function B for which it is known that $B'(t) = -13.84e^{-0.173t}$. Using the given models, at time t = 10, how much cooler are the biscuits than the tea?



Let R be the region in the first quadrant enclosed by the graphs of $f(x) = 8x^3$ and $g(x) = \sin(\pi x)$, as shown in the figure above.

a.	Write an equation for the line tangent to the graph of f at $x = \frac{1}{2}$.
b.	Find the area of R.
c.	Write, but do not evaluate, an integral expression for the volume of the solid generated when R is rotated about the horizontal line y = 1.