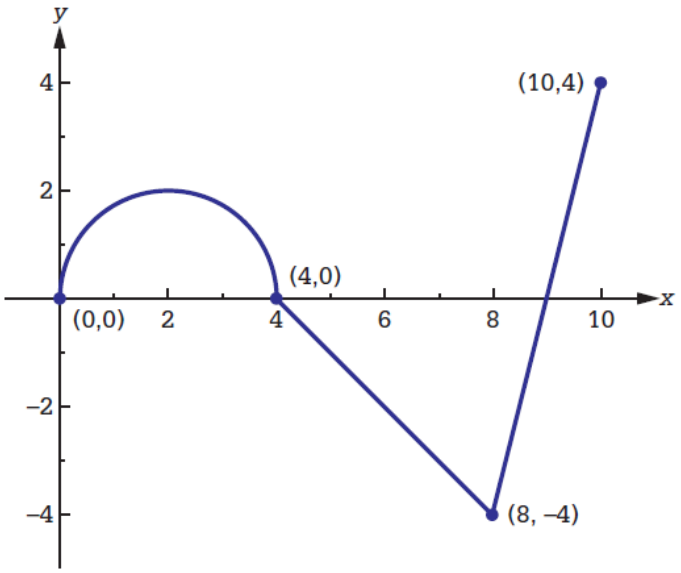
Name _____ **Problem Set 9**

"During the year, the problem sets may seem annoying but looking back at them after taking the AP test, you can see how helpful they were in preparing you and making sure you remember concepts." A 2019 Nerd

FR1. 2019 Practice Free Responses **(No Calculator)**

The function f is defined on the closed interval $[0,10]$. The graph of f consists of a semicircle and two line segments and is shown in the figure.



a) Find $\int_4^2 f(x)\,dx$.

b) Find the average value of f over $[0,8]$.

c) Find $\int_8^{10}\left[e^{3x} - f(x)\right]dx$.

d) Find $\int_0^3 x\, f\left(x^2\right)dx$.

FR2. 2017 Practice Test **(Calculator)**

t (minutes)	0	3	5	6	9
$r(t)$ (rotations per minute)	72	95	112	77	50

Rochelle rode a stationary bicycle. The number of rotations per minute of the wheel of the stationary bicycle at time t minutes during Rochelle's ride is modeled by a differentiable function r for $0 \le t \le 9$ minutes. Values of $r(t)$ for selected values of t are shown in the table above.

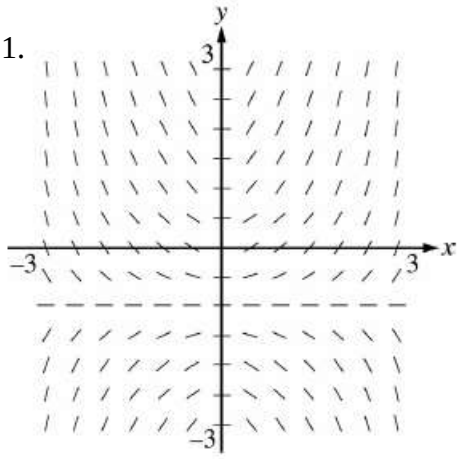
(A) Estimate $r'(4)$. Show the computations that lead to your answer. Indicate units of measure.

(B) Is there a time t, for $3 \le t \le 5$, at which $r(t)$ is 106 rotations per minute? Justify your answer.

(C) Use a left Riemann sum with the four subintervals indicated by the data in the table to approximate $\int_0^9 r(t)\,dt$. Using correct units, explain the meaning of $\int_0^9 r(t)\,dt$ in the context of the problem.

(D) Sarah also rode a stationary bicycle. The number of rotations per minute of the wheel of the stationary bicycle at time t minutes during Sarah's ride is modeled by the function s, defined by $s(t) = 40 + 20\pi \sin\left(\frac{\pi t}{18}\right)$ for $0 \le t \le 9$ minutes. Find the average number of rotations per minute of the wheel of the stationary bicycle for $0 \le t \le 9$ minutes.

MC1.



Shown above is a slope field for which of the following differential equations?

(A) $\frac{dy}{dx} = xy + x$

(B) $\frac{dy}{dx} = xy + y$

(C) $\frac{dy}{dx} = y + 1$

(D) $\frac{dy}{dx} = (x+1)^2$

MC2. CA The derivative of the function f is given by $f'(x) = -\frac{x}{3} + \cos\left(x^2\right)$. At what values of x does f have a relative minimum on the interval $0 < x < 3$?

(A) 1.094 and 2.608

(B) 1.798

(C) 2.372

(D) 2.493

MC3. If $\frac{dy}{dx} = 2y^2$ and if $y = -1$ when $x = 1$, then when $x = 2$, $y =$

(A) $-\frac{2}{3}$ (B) $-\frac{1}{3}$ (C) 0 (D) $\frac{1}{3}$

MC4. At time t, a population of bacteria grows at the rate of $5e^{0.2t} + 4t$ grams per day, where t is measured in days. By how many grams has the population grown from time $t = 0$ days to $t = 10$ days?

(A) $5e^2 + 40$

(B) $5e^2 + 195$

(C) $25e^2 + 175$

(D) $25e^2 + 375$