Name ________________________________ **Problem Set 6**

"Problem sets are probably one of the best things to get you ready for the AP test. As the year went on, I tended to save them until Sunday night which was not a good idea. I would put in the effort to try to do them but I wouldn't know how to and at that point it was too late to do anything about it. Once I got them back I never really went back to look at how to do them…that was a huge mistake. One things I would recommend is spending a little time on it throughout the week." A 2019 Nerd

FR1. 2019 Practice Exam **(No Calculator)**

An airplane takes off along a straight runway. For $0 \le t \le 20$, the plane's velocity is given by a differentiable function v. Selected values of $v(t)$, where t is measure in seconds and $v(t)$ is measured in meters per second, are given in the table below.

t (secs)	0	4	10	15	19	19.9	19.99	19.999	19.9999
v(t) (m/s)	0	50	75	87	93	94.85	94.985	94.9984	94.9997

a) Use the data in the table to estimate $\lim\limits_{t \to 20^-} v(t)$, that is the velocity of the airplane at takeoff.

b) Use the data in the table to estimate the value of $v'(6)$. Using correct units, interpret the meaning of the value in the context of the problem.

c) Approximate the value of the definite integral $0 \le t \le 15$ using a right Riemann sum with three subintervals indicated in the table. Using correct units, explain the meaning of the definite integral in the context of the problem.

d) Given the velocity of a second airplane can be modeled by $f(t) = 29\ln(t+1)$ for $0 \le t \le 20$ seconds, find the acceleration of the plane at the time it reaches a velocity of $58\,m/s$.

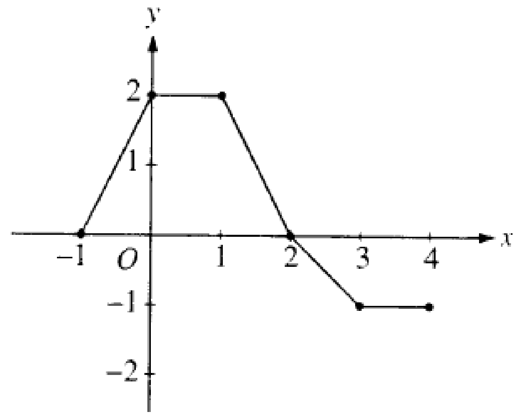
FR2. 2000 – AB 2 **(Calculator)**

Two runners, A and B, ran on a straight racetrack for $0 \le t \le 10$ seconds. The velocity, in meters per second, of Runner A and Runner B are shown below:

Runner A: $v(t) = \begin{cases} 3t & 0 \le t \le 3 \\ 9 & 3 < t \le 10 \end{cases}$ Runner B: $v(t) = \dfrac{20t}{2t+3}$

a) Find the velocity of Runner A and the velocity of Runner B at $t = 2$. Indicate units of measure.
b) Find the acceleration of Runner A and the acceleration of Runner B at $t = 2$. Indicate units of measure.
c) Find the total distance run by Runner A and the total distance run by Runner B of the time interval $0 \le t \le 10$ seconds. Indicate units of measure.

MC1.



The graph of a piecewise-linear function f, for $-1 \le x \le 4$, is shown above. What is the value of $\int_{-1}^{4} f(x)dx$?

(A) 2.5 (B) 4 (C) 5.5 (D) 8

MC2. If $\int_{a}^{b} f(x)dx = a + 2b$, then $\int_{a}^{b} (f(x)+5)dx =$

(A) $a + 2b + 5$ (B) $5b - 5a$ (C) $7b - 4a$ (D) $7b - 6a$

MC3. A function f is continuous on the closed interval $[2, 5]$ with $f(2) = 17$ and $f(5) = 17$. Which of the following additional conditions guarantees that there is a number c in the open interval $(2, 5)$ such that $f'(c) = 0$?

(A) No additional conditions are necessary.

(B) f has a relative extremum on the open interval $(2, 5)$.

(C) f is differentiable on the open interval $(2, 5)$.

(D) $\int_2^5 f(x)\, dx$ exists.

MC4. CA The second derivative of a function g is given by $g''(x) = 2^{-x^2} + \cos x + x$. For $-5 < x < 5$, on what open intervals is the graph of g concave up?

(A) $-5 < x < -1.016$ only

(B) $-1.016 < x < 5$ only

(C) $0.463 < x < 2.100$ only

(D) $-5 < x < 0.463$ and $2.100 < x < 5$