AP Calculus AB Final Exam Review #2 **(Calculator Active)**

1. The function f is continuous for $-2 \le x \le 1$ and differentiable for -2 < x < 1. If $f(-2) = -5$ and $f(1) = 4$, which of the following statements could be false?

(A) There exists c, where -2 < c < 1, such that $f(c) = 0$.
(B) There exists c, where -2 < c < 1, such that $f'(c) = 0$.
(C) There exists c, where -2 < c < 1, such that $f(c) = 3$.
(D) There exists c, where -2 < c < 1, such that $f'(c) = 3$.
(E) There exists c, where $-2 \le x \le 1$, such that $f(c) \ge f(x)$ for all x on the closed interval $-2 \le x \le 1$.

2. The function f is continuous for $-2 \le x \le 2$ and $f(-2) = f(2) = 0$. If there is no c, where -2 < c < 2, for which $f'(c) = 0$, which of the following statements must be true?

(A) For -2 < k < 2, $f'(k) > 0$.
(B) For -2 < k < 2, $f'(k) < 0$.
(C) For -2 < k < 2, $f'(k)$ exists.
(D) For -2 < k < 2, $f'(k)$ exists, but f' is not continuous.
(E) For some k, where -2 < k < 2, $f'(k)$ does not exist.

3. The base of a solid is the region bounded by the x-axis and the graph of $y = \sqrt{1 - x^2}$. For the solid, each cross section perpendicular to the x-axis is a square. What is the volume of the solid?

4. If $f(x) = (x+2)\sin\left(\sqrt{x+2}\right)$, what is the average value of f on the closed interval [0, 6]?

5. The rate at which motor oil is leaking from an automobile is modeled by the function L defined by $L(t) = 1 + \sin(t^2)$ for time $t \ge 0$. $L(t)$ is measured in liters per hour, and t is measured in hours. How much oil leaks out of the automobile during the first half hour?

6. What is the solution to the differential equation $\frac{dy}{dx} = 3\cos x$ with the initial condition $y\left(\frac{\pi}{2}\right) = 5$.

7. The graph of $y = e^{\sin x} - 2$ crosses the x-axis at one point in the interval [0, 1]. What is the slope of the graph at this point?

8. Suppose $\int_0^2 g(t)dt = 5$. Use substitution to calculate the following:

a. $\int_0^4 g\left(\frac{t}{2}\right)dt$ b. $\int_0^1 5g(2t)dt$ c. $\int_0^2 g(2-t)\,dt$

9. The graph of the function $y' = x^3 + 6x^2 + 7x - 2\cos x$ is concave down on the interval _____.

10. The acceleration of a particle given by $a(t) = -40t^3 + 18t + 8$. If $v(0) = 0$ what is $v(2)$?

t (hours)	0	1	3	6	8
$R(t)$ (liters / hour)	1340	1190	950	740	700

11. Water is pumped into a tank at a rate modeled by $W(t) = 2000e^{-t^2/20}$ liters per hour for $0 \le t \le 8$, where t is measured in hours. Water is removed from the tank at a rate modeled by $R(t)$ liters per hour, where R is differentiable and decreasing on $0 \le t \le 8$. Selected values of $R(t)$ are shown in the table above. At time $t = 0$, there are 50,000 lites of water in the tank.

a. Estimate $R'(2)$. Show the work that leads to your answer. Indicate units of measure.

b. Use a left Riemann sum with four subintervals indicated by the table to estimate the total amount of water removed from the tank during the 8 hours. Is this an overestimate or an underestimate of the total amount of water removed? Give a reason for your answer.

c. To the nearest liter, how much water is **pumped into** the tank on $0 \le t \le 8$?

d. Use your answers from part (b) and (c) to find an estimate of the total amount of water in the tank, to the nearest liter, at the end of 8 hours.