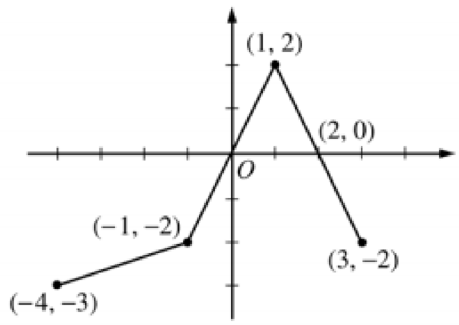
AP Calculus Final Exam Review #1 **(Non-Calculator)**

1. Find the derivative of each function:
   a. $y = x\cos x$
   b. $f(x) = \dfrac{x^3}{x+1}$
   c. $h(x) = 8x - 4 + 2\ln x$
   d. $g(x) = \tan(x^2 + e^{3x})$
   e. $j(x) = \left(x^4 - 3\sin x\right)^5$
   f. $y = \ln(3x^4 + 5x)$
2. Write the equation of the line tangent to $h(x) = 8x - 4 + 2\ln x$ at $x = 1$.
3. Let f be the function given by $f(x) = 27x - x^3$. On what intervals does f increase?
4. Find all critical points and local extrema for $f(x) = \dfrac{x}{x^2+1}$.
5. Find all critical points and local extrema for $g(x) = xe^{-3x}$.
6. Find all critical points and inflection points for $f(x) = x^3 - 9x^2 + 24x + 5$.
7. Let $f(x) = \begin{cases} \dfrac{x^2-4}{x-2}, & x \neq 2 \\ k, & x = 2 \end{cases}$. What value of k will make f continuous at $x = 2$?
8. A car comes to a stop five seconds after the driver applies the brakes. While the brakes are on, the velocities in the table are recorded.

Time (in sec)	0	1	2	3	4	5
Velocity (ft/sec)	88	60	40	25	10	0

   a. Use a Left Hand Sum to approximate the distance traveled.
   b. Use a Right Hand Sum to approximate the distance traveled.
   c. Which of these is an overestimate? Explain.
9. A particle moves along the x-axis. The velocity of the particle at time t is $8t - t^2$. What is the total distance traveled by the particle from time $t = 0$ to $t = 2$?
10. Find the antiderivative of each function:
   a. $\int \csc x \cot x\, dx$
   b. $\int \sin x\, dx$
   c. $\int e^x\, dx$
   d. $\int e^{x/3}\, dx$
   e. $\int \sec x \tan x\, dx$
   f. $\int \dfrac{1}{2x}\, dx$
   g. $\int \dfrac{12x^3+5}{3x^4+5x}\, dx$
   h. $\int e^{\sin x} \cos x\, dx$
11. Evaluate each definite integral:
   a. $\int_3^9 e^{x/3}\, dx$
   b. $\int_{\pi/3}^{\pi} \sin x$
   c. $\int_1^e \dfrac{1}{2x}\, dx$
12. Pollution is removed from a lake on day t at a rate of $f(t)$ kg/day.
   a. Explain the meaning of the statement $f(12) = 500$.
   b. If $\int_5^{15} f(t)dt = 4000$, give the units of the 5, the 15, and the 4000.
   c. Give the meaning of $\int_5^{15} f(t)dt = 4000$.



Graph of f

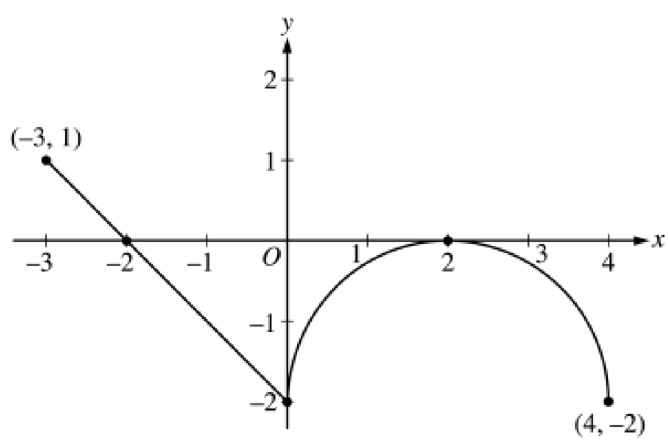
4. The graph of the function f above consists of three line segments.

(a) Let g be the function given by $g(x) = \int_{-4}^{x} f(t)\,dt$. For each of $g(-1)$, $g'(-1)$, and $g''(-1)$, find the value or state that it does not exist.

(b) For the function g defined in part (a), find the x-coordinate of each point of inflection of the graph of g on the open interval $-4 < x < 3$. Explain your reasoning.

(c) Let h be the function given by $h(x) = \int_{x}^{3} f(t)\,dt$. Find all values of x in the closed interval $-4 \le x \le 3$ for which $h(x) = 0$.

(d) For the function h defined in part (c), find all intervals on which h is decreasing. Explain your reasoning.



Graph of f'

4. Let f be a function defined on the closed interval $-3 \le x \le 4$ with $f(0) = 3$. The graph of f', the derivative of f, consists of one line segment and a semicircle, as shown above.

(a) On what intervals, if any, is f increasing? Justify your answer.

(b) Find the x-coordinate of each point of inflection of the graph of f on the open interval $-3 < x < 4$. Justify your answer.

(c) Find an equation for the line tangent to the graph of f at the point $(0, 3)$.

(d) Find $f(-3)$ and $f(4)$. Show the work that leads to your answers.