AP® Calculus BC
2000 Scoring Commentary

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Question 1

General Commentary

This problem required the student to use definite integrals in computing the area of a region R and the volumes of two solids with known cross sections. One solid was obtained by revolving the region R about the x-axis (a solid of revolution having circular cross sections) and the other solid had base R with square cross sections perpendicular to the x-axis. The student needed to use a calculator equation-solver (numerical or graphical) to determine the intersection of two curves that bound the region. The calculator was also needed to compute all three definite integrals arising in this problem.

Question 2

General Commentary

This problem presented the student with the velocity functions for two runners, Runner A and Runner B. Runner A's velocity was represented graphically, while Runner B's velocity was represented analytically as an algebraic function. The three parts of the problem asked the student to answer parallel questions for both runners – (a) velocity at a given time, (b) acceleration at a given time, and (c) distance traveled over a given time interval – all with appropriate units of measurement. This problem required students to demonstrate their understanding of basic differential and integral calculus concepts in multiple representations, a relatively new emphasis in the AP Calculus Course Description.

Question 3

General Commentary

This problem presented the student with the values of a function f and all of its derivatives at $x = 5$. From this information, the student needed to find the third-degree Taylor polynomial for f and determine the radius of convergence for the Taylor series for f about $x = 5$. The problem concluded by asking the student to show that the sixth-degree Taylor polynomial for f about $x = 5$ could be used to approximate $f(6)$ with error less than 1/1000. Since the resulting Taylor series is a convergent alternating series when $x = 6$, the seventh-degree term can be used to find a suitable bound on this error.

Question 4

General Commentary

This problem presented the student with a velocity vector for a particle moving in the plane, along with its position at the specific time $t = 1$. The first parts of the problem asked the student to find the acceleration vector and the position of the particle at time $t = 3$. These parts required the student to perform both some simple differentiation and antidifferentiation without the use of a calculator. The remaining parts of the problem turned to the geometry of the particle's path. The student had to find the time at which the slope of the path attains a given value, as well as the limiting value of the slope as t approaches infinity.

Question 5

General Commentary

This problem was relatively straightforward and presented the student with a curve described by a relation in terms of x and y. The first part of the problem asked for a verification of an algebraic expression for dy/dx found by implicit differentiation. The student then had to make use of this derivative expression and the original relation in determining the equations and locations of various tangent lines to the curve. Note that this problem required the student to solve some simple algebraic equations without the use of a calculator.

Question 6

General Commentary

This problem presented the student with a separable differential equation. The use of slope fields, a relatively new topic in the AP Calculus BC Course Description, was prominent in the first two parts of this problem. The student had to sketch a slope field for the differential equation using a given lattice of points in the coordinate plane. The student was then asked to use this slope field to mathematically "disqualify" a particular curve as a solution to the differential equation. The next part of the problem asked for a solution that satisfied a given initial condition. In solving this differential equation, the student needed to perform some simple antidifferentiations without the use of a calculator and correctly handle the constants of integration that arose in order to find a solution that satisfied the initial condition. The concluding part of the problem asked for the range of this particular solution. Note that the slope field found earlier in the problem could be used to help a student check the reasonableness of a solution and its range. Parts (c) and (d) of this problem contributed to the Calculus AB subscore grade.