

2010 AP® CALCULUS BC FREE-RESPONSE QUESTIONS

3. A particle is moving along a curve so that its position at time t is $(x(t), y(t))$, where $x(t) = t^2 - 4t + 8$ and $y(t)$ is not explicitly given. Both x and y are measured in meters, and t is measured in seconds. It is known that $\frac{dy}{dt} = te^{t-3} - 1$.
- (a) Find the speed of the particle at time $t = 3$ seconds.
- (b) Find the total distance traveled by the particle for $0 \leq t \leq 4$ seconds.
- (c) Find the time t , $0 \leq t \leq 4$, when the line tangent to the path of the particle is horizontal. Is the direction of motion of the particle toward the left or toward the right at that time? Give a reason for your answer.
- (d) There is a point with x -coordinate 5 through which the particle passes twice. Find each of the following.
- (i) The two values of t when that occurs
- (ii) The slopes of the lines tangent to the particle's path at that point
- (iii) The y -coordinate of that point, given $y(2) = 3 + \frac{1}{e}$
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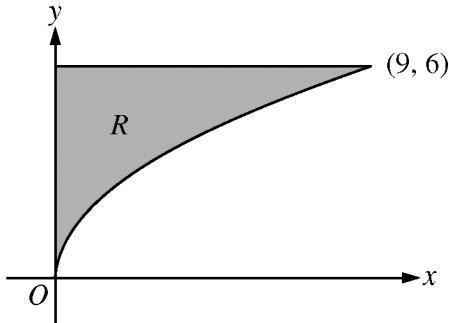
WRITE ALL WORK IN THE PINK EXAM BOOKLET.

END OF PART A OF SECTION II

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**CALCULUS BC
SECTION II, Part B
Time—45 minutes
Number of problems—3**

No calculator is allowed for these problems.



4. Let R be the region in the first quadrant bounded by the graph of $y = 2\sqrt{x}$, the horizontal line $y = 6$, and the y -axis, as shown in the figure above.
- Find the area of R .
 - Write, but do not evaluate, an integral expression that gives the volume of the solid generated when R is rotated about the horizontal line $y = 7$.
 - Region R is the base of a solid. For each y , where $0 \leq y \leq 6$, the cross section of the solid taken perpendicular to the y -axis is a rectangle whose height is 3 times the length of its base in region R . Write, but do not evaluate, an integral expression that gives the volume of the solid.
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