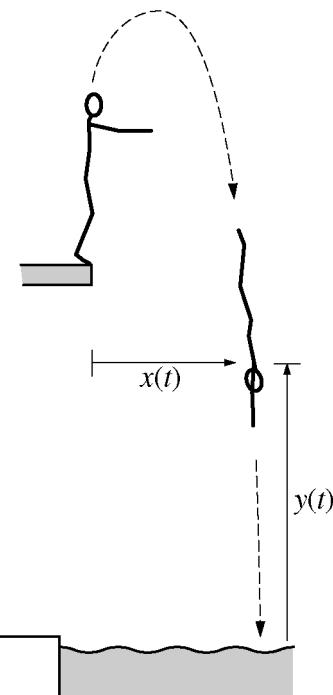


2009 AP[®] CALCULUS BC FREE-RESPONSE QUESTIONS



Note: Figure not drawn to scale.

3. A diver leaps from the edge of a diving platform into a pool below. The figure above shows the initial position of the diver and her position at a later time. At time t seconds after she leaps, the horizontal distance from the front edge of the platform to the diver's shoulders is given by $x(t)$, and the vertical distance from the water surface to her shoulders is given by $y(t)$, where $x(t)$ and $y(t)$ are measured in meters. Suppose that the diver's shoulders are 11.4 meters above the water when she makes her leap and that

$$\frac{dx}{dt} = 0.8 \text{ and } \frac{dy}{dt} = 3.6 - 9.8t,$$

for $0 \leq t \leq A$, where A is the time that the diver's shoulders enter the water.

- (a) Find the maximum vertical distance from the water surface to the diver's shoulders.
- (b) Find A , the time that the diver's shoulders enter the water.
- (c) Find the total distance traveled by the diver's shoulders from the time she leaps from the platform until the time her shoulders enter the water.
- (d) Find the angle θ , $0 < \theta < \frac{\pi}{2}$, between the path of the diver and the water at the instant the diver's shoulders enter the water.

WRITE ALL WORK IN THE PINK EXAM BOOKLET.

END OF PART A OF SECTION II

2009 AP® CALCULUS BC FREE-RESPONSE QUESTIONS

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

No calculator is allowed for these problems.

4. Consider the differential equation $\frac{dy}{dx} = 6x^2 - x^2y$. Let $y = f(x)$ be a particular solution to this differential equation with the initial condition $f(-1) = 2$.
- (a) Use Euler's method with two steps of equal size, starting at $x = -1$, to approximate $f(0)$. Show the work that leads to your answer.
- (b) At the point $(-1, 2)$, the value of $\frac{d^2y}{dx^2}$ is -12 . Find the second-degree Taylor polynomial for f about $x = -1$.
- (c) Find the particular solution $y = f(x)$ to the given differential equation with the initial condition $f(-1) = 2$.
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WRITE ALL WORK IN THE PINK EXAM BOOKLET.