

AP Calculus AB Practice: Implicit Differentiation

AP Calculus AB–5 / BC–5

2000

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Consider the curve given by $xy^2 - x^3y = 6$.

- (a) Show that $\frac{dy}{dx} = \frac{3x^2y - y^2}{2xy - x^3}$.
- (b) Find all points on the curve whose x -coordinate is 1, and write an equation for the tangent line at each of these points.
- (c) Find the x -coordinate of each point on the curve where the tangent line is vertical.

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Question 6

The function f is differentiable for all real numbers. The point $\left(3, \frac{1}{4}\right)$ is on the graph of $y = f(x)$, and the slope at each point (x, y) on the graph is given by $\frac{dy}{dx} = y^2(6 - 2x)$.

- (a) Find $\frac{d^2y}{dx^2}$ and evaluate it at the point $\left(3, \frac{1}{4}\right)$.
- (b) Find $y = f(x)$ by solving the differential equation $\frac{dy}{dx} = y^2(6 - 2x)$ with the initial condition $f(3) = \frac{1}{4}$.

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Question 4

Consider the curve given by $x^2 + 4y^2 = 7 + 3xy$.

- (a) Show that $\frac{dy}{dx} = \frac{3y - 2x}{8y - 3x}$.
- (b) Show that there is a point P with x -coordinate 3 at which the line tangent to the curve at P is horizontal. Find the y -coordinate of P .
- (c) Find the value of $\frac{d^2y}{dx^2}$ at the point P found in part (b). Does the curve have a local maximum, a local minimum, or neither at the point P ? Justify your answer.

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Question 5

Consider the curve given by $y^2 = 2 + xy$.

- (a) Show that $\frac{dy}{dx} = \frac{y}{2y - x}$.
- (b) Find all points (x, y) on the curve where the line tangent to the curve has slope $\frac{1}{2}$.
- (c) Show that there are no points (x, y) on the curve where the line tangent to the curve is horizontal.
- (d) Let x and y be functions of time t that are related by the equation $y^2 = 2 + xy$. At time $t = 5$, the value of y is 3 and $\frac{dy}{dt} = 6$. Find the value of $\frac{dx}{dt}$ at time $t = 5$.

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