

# **AP** Calculus **AB**

## **Topic:** Implicit Differentiation

#### Instructions

Solve the following problems. Show all work and include proper mathematical justifications. Use implicit differentiation wherever applicable.

### **Practice Problems**

- 1. Differentiate the following equations implicitly:
  - (a)  $x^2 + y^2 = 25$
  - (b)  $xy + x^2 = y^3$
  - (c)  $\sin(xy) = x + y$
- 2. Use implicit differentiation to find  $\frac{dy}{dx}$  for:
  - (a)  $x^3 + y^3 = 6xy$
  - (b)  $e^x \cdot y = \ln(y+x)$
  - (c)  $x^2y + y^2x = 1$
- 3. Solve for  $\frac{dy}{dx}$  using implicit differentiation:
  - (a)  $\cos(xy) = x^2 y^2$
  - (b)  $x^2 + y^2 + 2xy = 10$
  - (c)  $x^2 \cdot e^y = y^2 \cdot e^x$
- 4. Determine the equation of the tangent line to the curve  $x^2 + y^2 = 25$  at the point (3, 4).

- 5. Find  $\frac{dy}{dx}$  for  $x^2 2xy + y^2 = 7$ . Then evaluate  $\frac{dy}{dx}$  at the point (2, 1).
- 6. Sketch the graph of the circle  $x^2 + y^2 = 25$  and draw the tangent line at the point (3, 4). Indicate the slope of the tangent line.



7. Graph the hyperbola  $x^2 - y^2 = 1$  and find the tangent line at the point  $(\sqrt{2}, 1)$ .



### Multiple Choice Questions

- 1. What is the derivative of  $x^2 + y^2 = 25$  using implicit differentiation?
  - a.  $\frac{-x}{y}$ b.  $\frac{-y}{x}$ c.  $\frac{y}{x}$ d.  $\frac{x}{y}$
- 2. Which of the following is the derivative of xy = 1?
  - a.  $\frac{dy}{dx} = -\frac{y}{x}$ b.  $\frac{dy}{dx} = \frac{x}{y}$ c.  $\frac{dy}{dx} = \frac{-x}{y}$ d.  $\frac{dy}{dx} = \frac{y}{x}$
- 3. What is the slope of the tangent line to the curve  $x^2 + y^2 = 25$  at (3, 4)?

a. -4/3
b. 3/4
c. -3/4
d. 4/3

4. For the equation  $x^3 + y^3 = 6xy$ , find  $\frac{dy}{dx}$ :

a.  $\frac{2y-3x^2}{3y^2-2x}$ b.  $\frac{3x^2-2y}{2x-3y^2}$ c.  $\frac{2x-3y^2}{3x^2-2y}$ d.  $\frac{3y^2-2x}{2y-3x^2}$ 

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