TOPIC: IMPLICIT DIFFERENTIATION

Finding the Implicit Derivative

◆ To differentiate the function NOT of the form $y = f(x)$, take the derivative $\frac{d}{dx}$ of _____ term on both sides.

► Since y is not isolated, find its derivative using the **chain rule**, then solve for $\frac{dy}{dx}$.

EXAMPLE Find the derivative $\frac{dy}{dx}$.

Recall **Chain Rule**	New **Implicit Differentiation**
$\frac{d}{dx}(f(g(x))) = f'(g(x)) \cdot g'(x)$	
$y = \sqrt{49 - x^2} = (49 - x^2)^{\frac{1}{2}}$	$x^2 + y^2 = 49$
$\frac{dy}{dx} = \frac{1}{2}(49 - x^2)^{-\frac{1}{2}} \cdot \frac{d}{dx}(49 - x^2)$	
$= \frac{1}{2}(49 - x^2)^{-\frac{1}{2}} \cdot -2x$	
$= \frac{-x}{\sqrt{49 - x^2}}$	

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PRACTICE Find $\frac{dy}{dx}$ for the equation below using implicit differentiation.

$5x^2 + y^3 = 12$

PRACTICE Find $\frac{dy}{dx}$ for the equation below using implicit differentiation.

$3\sqrt{y} = x - y$

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PRACTICE Find $\frac{dy}{dx}$ for the equation below using implicit differentiation.

$xy = \sin(y)$

EXAMPLE

Given the equation $\frac{2}{x} - \frac{1}{y} = 36$, $(\boldsymbol{A})$ find y' using implicit differentiation. $(\boldsymbol{B})$ Solve the equation explicitly for y and differentiate to get y' in terms of x. $(\boldsymbol{C})$ Check that your solutions are consistent by substituting the expression for y derived in part $(\boldsymbol{B})$, into your solution for part $(\boldsymbol{A})$.