ACt 3.16

Tecnológico de Monterrey Preparatoria

Rules of Differentiation- Implicit Differentiation

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I. For each of the following equations, find $\frac{dy}{dx}$ using implicit differentiation.

1) $y^3 + y^2 - 7y - x^2 = 9$ $y' = \frac{2x}{3y^2+2y-7}$

2) $x^3 + y^3 = 27$ $y' = \frac{-x^2}{y^2}$

3) $x^3 - 2xy + y^2 = 8$ $y' = \frac{3x^2}{2xy}$

4) $2x^3 - y^2 = 8x + y$ $y' = \frac{(2y+1)}{2(3x^2-4)}$

5) $x^2y + 3y^2x = -3$ $y' = \frac{-y(3y+2x)}{x(x-6y)}$

6) $2x^3y^3 - 5x = 2y$ $y' = -\frac{6x^2+5}{6x^3y^2-2}$

7) $e^{Sin(2y)} = 2x^2$ $y' = 2xe^{\cdot\sin(2y)}\sec(2y)$

8) $3x^2 + Sin(y) = 5y^2$ $y' = 10y - 6x + \sec(y)$

II. Use implicit differentiation to find $\frac{dy}{dx}$, and find the value of the derivative at the indicated point.

9) $4y^3 - 9y = 5x$ at $(0, \frac{3}{2})$ $y' = \frac{5}{18}$

10) $\sqrt{x} + \sqrt{y} = 5$ at $(4,9)$ $y' = -\frac{5}{12}$

...cit Differentiation

1) $y^3 + y^2 - 7y - x^2 = 9$

$(3y^2 \cdot y') + (2y \cdot y') - (7 \cdot y') - 2x = 0$

$(3y^2 \cdot y') + (2y \cdot y') - (7 \cdot y') = 2x$

$y' = \dfrac{2x}{3y^2 + 2y - 7} = \dfrac{2(-6.034)}{3(3.86)^2 + 2(3.86) - 7}$

$y' = -0.2656$

2) $x^3 + y^3 = 27$

$3x^2 + 3y^2 \cdot y' = 0$

$3y^2 \cdot y' = -3x^2$

$y' = -\dfrac{3x^2}{3y^2} = -\dfrac{x^2}{y^2}$

3) $x^3 - 2xy + y^2 = 8$

$3x^2 - (2x \cdot y') + (-2 \cdot y) + 2y = 0$

$-2xy' = -3x^2 + 2y - 2y$

$y' = \dfrac{-3x^2}{-2xy} = \dfrac{3x^2}{2xy}$

4) $2x^3 - y^2 = 8x + y$

$6x^2 - (2y \cdot y') = 8 + y'$

$6x^2 - 8 = (2y \cdot y') + y'$

$2(3x^2 - 4) = (2y + 1)$

$y' = \dfrac{(2y+1)}{2(3x^2-4)}$

5) $x^2y + 3y^2x = -3$

$(2x \cdot y) + (x^2 \cdot y') + (6y \cdot y' \cdot x) + (3y^2) = 0$

$(x^2 \cdot y') + (6y \cdot y'x) = -3y^2 - 2xy$

$y'(x^2 + 6yx) = -3y^2 - 2xy$

$y' = \dfrac{-3y^2 - 2xy}{(x^2 - 6yx)} = \dfrac{-y(3y + 2x)}{x(x - 6y)}$

6) $2x^3y^3 - 5x = 2y$

$(6x^2 \cdot y^3) + (3y^2 \cdot y' \cdot 2x^3) - 5 = 2y'$

$(3y^2 \cdot y' \cdot 2x^3) - 2y' = 6x^2y^3 + 5$

$y' = (3y^2 \cdot 2x^3 - 2) = (-6x^2y^3) + 5$

$y' = \dfrac{-6x^2y^3 + 5}{6x^3y^2 - 2}$

7) $e^{\sin(2y)} = 2x^2$

$2y'\cos(2y)\, e^{\sin(2y)} = 4x$

$2e^{\sin(2y)} \cos(2y) y' = 4x$

$y' = 2xe^{-\sin(2y)}\sec(2y)$

8) $3x^2 + \sin(y) = 5y^2$

$6x + y'\cos(y) = 10y$

$y'\cos(y) = 10y - 6x$

$y' = 10y - 6x + \sec(y)$

9) $4y^3 - 9y = 5x$ at $(0, 3/2)$

$(12y^2 \cdot y') - 9y' = 5$

$y'(12y^2 - 9) = 5$

$y' = \dfrac{5}{12y^2 - 9} = \dfrac{5}{12(\frac{3}{2})^2 - 9}$

$y' = \dfrac{5}{18}$

10) $\sqrt{x} + \sqrt{y} = 5$ at $(4, 9)$

$(x)^{1/2} + (y)^{1/2} = 0$

$\frac{1}{2}x^{-1/2} + \frac{1}{2}y^{-1/2} \cdot y' = 0$

$y' = -\frac{1}{2}x^{-1/2} - \frac{1}{2}y^{-1/2}$

$y' = -\frac{1}{2}(4)^{-1/2} - \frac{1}{2}(9)^{-1/2}$

$y' = -1/4 - 1/6 = -3/12 - 2/12$

$y' = -\dfrac{5}{12}$