Implicit Differentiation Practice Questions

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To review these concepts, go to Implicit Differentiation Study Guide.

Implicit Differentiation Practice Questions

Find $\frac{dy}{dx}$ in the following equations.

1. $(y + 1)^3 = x^4 - 8x$
2. $y^3 + y = \sin(x)$
3. $\sin(y) = 4x + 7$
4. $y - \sqrt{y} = \ln(x)$
5. $y^2 + x = 3x^4 + 8y$
6. $e^x + e^y = x^3$
7. $\tan(y) = \cos(x)$
8. $y = \sqrt{x + y}$
9. $\sin(x) - \sin(y) = x$
10. $y - \ln(y) = 10x^3 - 6x^2 + 4$
11. $(y + x^2)^4 = 10x$
12. $x^2y = y^4x^4$
13. $\frac{x}{y} + xy = x + y$
14. $\sec(y) + 9y = x^3 \cos(y)$
15. Find the tangent line slope of $y^3 + x^2 = y^2 - 5y + 14$ at $(-3, 1)$.
16. Find the tangent line slope of $x^3 + y^3 = 3y - x$ at $(\mathbf{1}, -2)$.
17. Find the slope of the tangent line to $\ln(3y - 5) + x = y^2$ at $(4,2)$.
18. Find the slope of the tangent line at $(2,3)$ on the graph of $x^2y + y^2x = 30$.
19. Find the equation of the tangent line to $\sin(y) = x$ at the point $\left(\frac{1}{2}, \frac{\pi}{6}\right)$.
20. Find the equation of the tangent line to $x^2 + 6y = xy + 3$ at $(3, -2)$.

Solutions

1. $3(y + 1)^2 \cdot \frac{dy}{dx} = 4x^3 - 8$, so $\frac{dy}{dx} = \frac{4x^3 - 8}{3(y + 1)^2}$

2. $3y^2 \cdot \frac{dy}{dx} + \frac{dy}{dx} = \cos(x)$, so $\frac{dy}{dx} = \frac{\cos(x)}{3y^2 + 1}$
3. $\frac{dy}{dx} = \frac{4}{\cos(y)} = 4\sec(y)$
4. $\frac{dy}{dx} = \frac{\frac{1}{x}}{1 - \frac{1}{2\sqrt{y}}} = \frac{2\sqrt{y}}{2x\sqrt{y} - x}$
5. $\frac{dy}{dx} = \frac{12x^3 - 1}{2y - 8}$
6. $\frac{dy}{dx} = \frac{3x^2 - e^x}{e^y}$
7. $\frac{dy}{dx} = \frac{-\sin(x)}{\sec^2(y)} = -\sin(x)\cos^2(y)$
8. $\frac{dy}{dx} = \frac{1}{2\sqrt{x + y}}(1 + \frac{dy}{dx})$, so $\frac{dy}{dx} = \frac{\frac{1}{2\sqrt{x + y}}}{1 - \frac{1}{2\sqrt{x + y}}} = \frac{1}{2\sqrt{x + y} - 1}$
9. $\frac{dy}{dx} = \frac{1 - \cos(x)}{-\cos(y)}$
10. $\frac{dy}{dx} = \frac{30x^2 - 12x}{1 - \frac{1}{y}} = \frac{30x^2y - 12xy}{y - 1}$
11. $\frac{dy}{dx} = \frac{5}{2(y + x^2)^3} - 2x$
12. $\frac{dy}{dx} = \frac{4x^3 - 2xy}{x^2 - 4y^3}$
13. $\frac{y - x \cdot \frac{dy}{dx}}{y^2} + y + \frac{dy}{dx} \cdot x = 1 + \frac{dy}{dx}$, so $\frac{dy}{dx} = \frac{1 - y - \frac{1}{y}}{-\frac{x}{y^2} + x - 1} = \frac{y^2 - y^3 - y}{-x + xy^2 - y^2}$
14. $\frac{dy}{dx} = \frac{3x^2\cos(y)}{\sec(y)\tan(y) + 9 + x^3\sin(y)}$
15. $3y^2 \cdot \frac{dy}{dx} + 2x = 2y \cdot \frac{dy}{dx} - 5 \cdot \frac{dy}{dx}$, so at (–3,1), the tangent slope is $\frac{dy}{dx} = 1$.
16. $\frac{dy}{dx} = -\frac{4}{9}$ at (1,–2)
17. $\frac{dy}{dx} = 1$ at (4,2)
18. $\frac{dy}{dx} = -\frac{21}{16}$ at (2,3)
19. $\frac{dy}{dx} = \frac{2\sqrt{3}}{3}$ at $(\frac{1}{2}, \frac{\pi}{6})$, so the tangent equation is $y = \frac{2\sqrt{3}}{3}(x - \frac{1}{2}) + \frac{\pi}{6}$.
20. $\frac{dy}{dx} = -\frac{8}{3}$ at (3, –2) , so the tangent equation is $y = -\frac{8}{3}(x - 3) - 2 = -\frac{8}{3}x + 6$.

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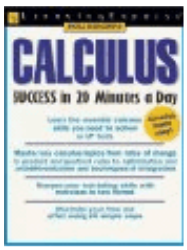

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