NAME: _____

**Find $\frac{dy}{dx}$**

**1) $x^2 + y^2 = 16$**

$2x + 2y \cdot \frac{dy}{dx} = 0$

$2y \cdot \frac{dy}{dx} = -2x$

$\frac{dy}{dx} = \frac{-2x}{2y}$

$\boxed{\frac{dy}{dx} = \frac{-x}{y}}$

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

$3x^2 + 3y^2 \cdot \frac{dy}{dx} = 8x \cdot \frac{dy}{dx} + 8y$

$3y^2 \cdot \frac{dy}{dx} - 8x \frac{dy}{dx} = 8y - 3x^2$

$\frac{dy}{dx}(3y^2 - 8x) = 8y - 3x^2$

$\boxed{\frac{dy}{dx} = \frac{8y - 3x^2}{3y^2 - 8x}}$

**3) $\frac{1}{x} + \frac{1}{y} = 1$**

$-x^{-2} - y^{-2} \cdot \frac{dy}{dx} = 0$

$-x^{-2} = y^{-2} \cdot \frac{dy}{dx}$

$\frac{dy}{dx} = \frac{-x^{-2}}{y^{-2}}$

$\boxed{\frac{dy}{dx} = -\frac{y^2}{x^2}}$

**4) $\sqrt{x} + \sqrt{y} = 4$**

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

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

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

$\boxed{\frac{dy}{dx} = -\frac{\sqrt{y}}{\sqrt{x}}}$

**5) $x^2y^2 = x^2 + y^2$**

$x^2 \cdot 2y \cdot \frac{dy}{dx} + 2xy^2 = 2x + 2y \cdot \frac{dy}{dx}$

$2x^2y\frac{dy}{dx} - 2y\frac{dy}{dx} = 2x - 2xy$

$\frac{dy}{dx}(2x^2y - 2y) = 2x - 2xy$

$\boxed{\frac{dy}{dx} = \frac{x - xy}{x^2y - y}}$

**6) $y = \cos(x - y)$**

$\frac{dy}{dx} = -\sin(x-y)\left(1 - \frac{dy}{dx}\right)$

$\frac{dy}{dx} = -\sin(x-y) + \frac{dy}{dx}\sin(x-y)$

$\frac{dy}{dx} - \frac{dy}{dx}\sin(x-y) = -\sin(x-y)$

$\frac{dy}{dx}(1 - \sin(x-y)) = -\sin(x-y)$

$\boxed{\frac{dy}{dx} = \frac{-\sin(x-y)}{1-\sin(x-y)}}$

**7) $\sec^2 x + \csc^2 y = 4$**

$= 2\sec x \cdot \sec x \cdot \tan x + 2\csc y \cdot -\csc y \cot y \cdot \frac{dy}{dx} = 0$

$= 2\sec^2 x \tan x = 2\csc^2 y \cot y \cdot \frac{dy}{dx}$

$\boxed{\frac{dy}{dx} = \frac{\sec^2 x \tan x}{\csc^2 y \cot y}}$

**8) $x \sin y + y \cos x = 1$**

$x \cdot \cos y \cdot \frac{dy}{dx} + \sin y + y \cdot -\sin x + \cos x \cdot \frac{dy}{dx} = 0$

$x\cos y \frac{dy}{dx} + \cos x \frac{dy}{dx} = y\sin x - \sin y$

$\frac{dy}{dx}(x\cos y + \cos x) = y\sin x - \sin y$

$\boxed{\frac{dy}{dx} = \frac{y\sin x - \sin y}{x\cos y + \cos x}}$