1. $8x^2 + y^2 = 10$

$16x + 2y\,y' = 10$

$y' = \dfrac{10 - 16x}{2y}$

$$\boxed{y' = \frac{5 - 8x}{y}}$$

2. $4x^3 - 2y^3 = x$

$12x^2 - 6y^2 y' = 1$

$$\boxed{y' = \frac{1 - 12x^2}{-6y^2}}$$

3. $2x^3 + x^2 y + y^3 = 1$

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

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

$$\boxed{y' = \frac{-6x^2 + 2xy}{x^2 + 3y^2}}$$

4. $5x^2 + 2x^2y + y^2 = 8$

$10x + 2x^2y' + y(4x) + 2yy' = 0$

$y'(2x^2 + 2y) = \dfrac{-10x - 4xy}{2x^2 + 2y}$

$$\boxed{y' = \frac{-5x + 2xy}{x^2 + y}}$$

5. $\sqrt{x} + \sqrt{y} = 100$

$x^{1/2} + y^{1/2} = 100$

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

$\frac{1}{\sqrt{y}}y' = -\frac{1}{\sqrt{x}}$

$$\boxed{y' = -\frac{\sqrt{y}}{\sqrt{x}}}$$

6. $x^{2/3} + y^{2/3} = 4$

$\frac{2}{3}x^{-1/3} + \frac{2}{3}y^{-1/3}y' = 0$

$y^{-1/3}y' = -x^{-\frac{1}{3}}$

$$\boxed{y' = -\frac{y^{1/3}}{x^{1/3}}}$$

7. $x^2 + x^{1/2}y^{1/2} = 7$

$$2x + x^{1/2}\left(\tfrac{1}{2}y^{-\frac{1}{2}}y'\right) + y^{1/2}\left(\tfrac{1}{2}x^{-1/2}\right) = 0$$

$$\frac{\sqrt{x}}{2\sqrt{y}}y' = -2x - \frac{\sqrt{y}}{2\sqrt{x}}$$

$$y' = -2x\left(\frac{2\sqrt{y}}{\sqrt{x}}\right) - \frac{\sqrt{y}}{2\sqrt{x}}\left(\frac{2\sqrt{y}}{\sqrt{x}}\right)$$

$$\boxed{y' = -4\sqrt{x}\sqrt{y} - \frac{y}{x}}$$

8. $2x - x^{1/2}y^{1/2} + y^3 = 16$

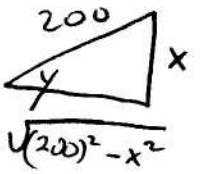
$$2 - x^{1/2}\left(\tfrac{1}{2}y^{-1/2}y'\right) - y^{1/2}\left(\tfrac{1}{2}x^{-\frac{1}{2}}\right) + 3y^2y' = 0$$

$$y'\left(\frac{-\sqrt{x}}{2\sqrt{y}} + 3y^2\right) = -2 + \frac{\sqrt{y}}{2\sqrt{x}}$$

$$y' = \frac{-2 + \frac{\sqrt{y}}{2\sqrt{x}}}{\frac{-\sqrt{x}}{2\sqrt{y}} + 3y^2} \cdot \frac{2\sqrt{y}\sqrt{x}}{2\sqrt{y}\sqrt{x}} = \boxed{\frac{-4\sqrt{x}\sqrt{y} + y}{-x + 6y^{5/2}\sqrt{x}}}$$

9. $\tan y = \frac{x}{200}$

$\sec^2 y \, y' = \frac{1}{200}$



$\cos y = \frac{\sqrt{200^2 - x^2}}{200}$

$\sec y = \frac{200}{\sqrt{200^2 - x^2}}$

$y' = \frac{1}{200 \sec^2 y}$ ⟷ on

$y' = \frac{1}{200\left(\frac{200^2}{200 - x^2}\right)} = \frac{200 - x^2}{(200)^3}$

10. $x + \sin(xy) = \sec x$

$1 + \cos(xy)[x y' - y(1)] = \sec x \tan x$

$\cos(xy)[x y' - y] = \sec x \tan x - 1$

$x y' - y = \frac{\sec x \tan x - 1}{\cos(xy)}$

$x y' = \frac{\sec x \tan x - 1}{\cos(xy)} + y$

$y' = \frac{\sec x \tan x - 1}{x \cos(xy)} + \frac{y}{x}$

11. $\tan(x+y) = \sec x$

$$\sec^2(x+y)(1+y') = \sec x \tan x$$

$$1 + y' = \frac{\sec x \tan x}{\sec^2(x+y)}$$

$$\boxed{y' = \frac{\sec x \tan x}{\sec^2(x+y)} - 1}$$

12. $1 + \cos y = 4 \cos x \sin(2x)$

$$-\sin y \, y' = 4\cos x \left(\cos(2x)(2)\right) + \sin(2x)\left(4(-\sin x)\right)$$

$$\boxed{y' = \frac{8\cos x \cos 2x - 4 \sin x \sin 2x}{-\sin y}}$$

13 $x^3 + y^3 - 12xy = 0$ Eq Tan at $(6,6)$

$3x^2 + 3y^2y' - 12xy' - y(12) = 0$

$y'(3y^2 - 12x) = -3x^2 + 12y$

$y' = \frac{-3x^2 + 12y}{3y^2 - 12x} = \frac{x^2 + 4y}{y^2 - 4x}$

$y'(6,6) = \frac{36 + 24}{36 - 24} = \frac{60}{12} = 5$

$M = 5$ Point $= (6,6)$

$\boxed{y - 6 = 5(x - 6)}$

14. $(x^2 + y^2)^2 = 4xy$

$2(x^2 + y^2)'(2x + 2yy') = 4xy' + y(4)$

$(2x^2 + 2y^2)(2x) + (2x^2 + 2y^2)(2yy') - 4xy' = 4y$

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

$y' = \frac{y - x^2 - xy^2}{x^2y + y^3 - x}$ @ $(1,1)$

$y'(1,1) = \frac{1 - 1 - 1}{1 + 1 - 1} = \frac{-2}{1} = -2$ $\boxed{y - 1 = -2(x - 1)}$