(3) $x^2 y$

Take $\frac{d}{dx}$: $x^2 \frac{dy}{dx} + y(2x)$

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

(7) $3x + 2y = 5$

Take $\frac{d}{dx}$: $3 + 2\frac{dy}{dx} = 0$

$2\frac{dy}{dx} = -3$

$\frac{dy}{dx} = -\frac{3}{2}$

(11) $x^2 - 4y^2 - 9 = 0$

Take $\frac{d}{dx}$: $2x - 8y\frac{dy}{dx} = 0$

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

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

$\frac{dy}{dx} = \frac{x}{4y}$

(15) $y^2 + y = x^2 - 4$

Take $\frac{d}{dx}$: $2y\frac{dy}{dx} + \frac{dy}{dx} = 2x$

$$[2y+1]\frac{dy}{dx} = 2x$$

$$\frac{dy}{dx} = \frac{2x}{2y+1}$$

(19) $x^2 = \frac{x-y}{x+y}$

Take $\frac{d}{dx}$: $2x = \frac{(x+y)(1-\frac{dy}{dx}) - (x-y)(1+\frac{dy}{dx})}{(x+y)^2}$

$$2x(x+y)^2 = (x+y)(1-\frac{dy}{dx}) \overset{+(-x+y)}{\cancel{-(x-y)}}(1+\frac{dy}{dx})$$

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

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

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

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

$\rightarrow$

or $\dfrac{dy}{dx} = \dfrac{y - x(x+y)^2}{x}$

or $\dfrac{dy}{dx} = \dfrac{y - x(x^2+2xy+y^2)}{x}$

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

(23) $(2y-x)^4 + x^2 = y+3$

Take $\frac{d}{dx}$: $4(2y-x)^3\left(2\frac{dy}{dx}-1\right) + 2x = \frac{dy}{dx}$

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

$$8(2y-x)^3\frac{dy}{dx} - \frac{dy}{dx} = 4(2y-x)^3 - 2x$$

$$\left[8(2y-x)^3 - 1\right]\frac{dy}{dx} = 4(2y-x)^3 - 2x$$

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

(27) $3x^3y^2 - 2y^3 = -4$

Take $\frac{dy}{dx}$: $3x^3\left(2y\frac{dy}{dx}\right) + y^2(9x^2) - 6y^2\frac{dy}{dx} = 0$

$$6x^3y\frac{dy}{dx} + 9x^2y^2 - 6y^2\frac{dy}{dx} = 0$$

$$6x^3y\frac{dy}{dx} - 6y^2\frac{dy}{dx} = -9x^2y^2$$

$$\left[6x^3y - 6y^2\right]\frac{dy}{dx} = -9x^2y^2$$

$$\frac{dy}{dx} = \frac{-9x^2y^2}{6x^3y - 6y^2}$$

$$\left.\frac{dy}{dx}\right|_{(x,y)=(1,2)} = \frac{-36}{12-24}$$

$$= \frac{-36}{-12}$$

$$= 3$$

29. $5y^4 + 7 = x^4 - 3y$

Take $\frac{d}{dx}$: $20y^3 \frac{dy}{dx} = 4x^3 - 3\frac{dy}{dx}$

$$20y^3 \frac{dy}{dx} + 3\frac{dy}{dx} = 4x^3$$

$$[20y^3 + 3]\frac{dy}{dx} = 4x^3$$

$$\frac{dy}{dx} = \frac{4x^3}{20y^3+3}$$

$$\left.\frac{dy}{dx}\right|_{(x,y)=(3,-2)} = \frac{108}{-157}$$

$$= \frac{-108}{157}$$

(31) $xy^2 + 3x^2 - y^2 + 15 = 0$

Take $\frac{d}{dx}$: $x\left(2y\frac{dy}{dx}\right) + y^2(1) + 6x - 2y\frac{dy}{dx} = 0$

$$2xy\frac{dy}{dx} - 2y\frac{dy}{dx} = -y^2 - 6x$$

$$\left[2xy\frac{dy}{dx} - 2y\right]\frac{dy}{dx} = -y^2 - 6x$$

$$\frac{dy}{dx} = \frac{-y^2 - 6x}{2xy - 2y}$$

$$\left.\frac{dy}{dx}\right|_{(x,y)=(-1,3)} = \frac{-9+6}{-6-6}$$

$$= \frac{-3}{-12}$$

$$= \frac{1}{4}$$

(33) $x^2+y^2=4x$

Take $\frac{d}{dx}$: $2x + 2y\frac{dy}{dx} = 4$

$$2y\frac{dy}{dx} = 4-2x$$

$$\frac{dy}{dx} = \frac{4-2x}{2y}$$

Horizontal tangent line $\Rightarrow$ $\frac{dy}{dx}=0$

Set $\frac{dy}{dx}=0$: $\frac{4-2x}{2y}=0$

$$4-2x=0$$
$$4=2x$$
$$x=2$$

To find the y-value(s), sub $x=2$ into the original equation.

$x=2 \rightarrow$ $x^2+y^2=4x$

$$4+y^2=8$$
$$y^2=4$$
$$y=\pm 2$$

The points are $(x,y)=(2,2)$ and $(2,-2)$.