implicit differentiation:
diff. both sides with respect to some variable - usually x
all other variables - especially y - have the role of an "inside function".

#1 $x^2y + xy^2 = 6$

$u = x^2 \quad v = y$
$u' = 2x \quad v' = \frac{dy}{dx}$

$u = x \quad v = y^2$
$u' = 1 \quad v' = 2y \cdot \frac{dy}{dx}$

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

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

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

#2 $x^3+y^3=18xy$

$u=x \quad v=y$
$u'=1 \quad v'=\frac{dy}{dx}$

$$3x^2+3y^2\frac{dy}{dx}=18\cdot\left(y+x\frac{dy}{dx}\right)$$

$$3x^2+3y^2\frac{dy}{dx}=18y+18x\frac{dy}{dx}$$

$$\frac{dy}{dx}(3y^2-18x)=18y-3x^2$$

$$\frac{dy}{dx}=\frac{18y-3x^2}{3y^2-18x}$$

$$=-\frac{3x^2-18y}{3y^2-18x}$$

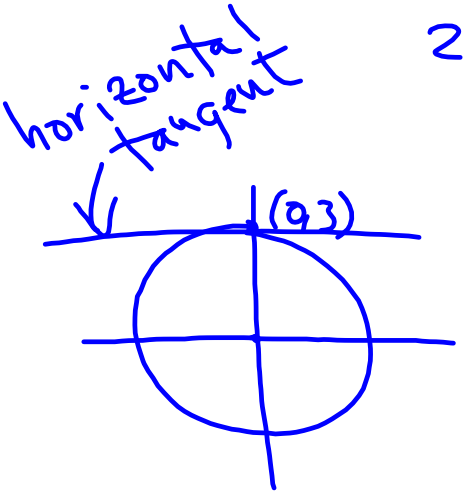
#10 $x^2+y^2=9$

slope at $(0,3)$

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

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

$$\frac{dy}{dx}=-\frac{x}{y}\Big|_{(0,3)}=0$$



#16 finding where slope is defined.
(where: conditions x & y; slope: derivative)

$$x^2+4xy+4y^2-3x=6$$

$$2x+4\left(y+x\frac{dy}{dx}\right)+8y\frac{dy}{dx}-3=0$$

$$2x+4y+4x\frac{dy}{dx}+8y\frac{dy}{dx}=3$$

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

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

Q: When is $\frac{dy}{dx}$ not defined?

$$4x+8y=0$$

$$4(x+2y)=0$$

$$x=-2y$$

∴ Slope is defined: $x\neq -2y$

$$\frac{d}{dx}(x^2)=2x$$

$$\frac{d}{dx}(y^2)=2y\cdot\frac{dy}{dx}$$