IMPLICIT DIFFERENTIATION:

EXPLICIT → stated openly or directly.

IMPLICIT → implied, not stated directly.

$y = 3x + 2$ is explicit

$f(x) = 3x + 2$

$3x^2y^3 + 6xy^2 + 7y - 2 = 5$

There is an "implicit" relationship between x & y, but it is not defined explicitly.

$\frac{dy}{dx}$ or y'

$\frac{d}{dx}$

IMPLICIT

$x^2 + y^2 = 25$

$2x + 2y = 0$

$-2x \qquad -2x$

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

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

$y^2 = 25 - x^2$

$y = \pm\sqrt{25 - x^2}$

EXPLICIT

$y^2 = 25 - x^2$

$y = \pm\sqrt{25 - x^2}$

$y = \pm(25 - x^2)^{1/2}$

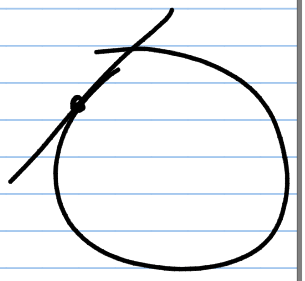
$y' = \pm\frac{1}{2}(25 - x^2)^{-1/2}(-2x)$

$y' = \pm\frac{x}{\sqrt{25 - x^2}}$

$\frac{-x}{\pm\sqrt{25 - x^2}}$

$\therefore \quad y' = -\frac{x}{y}$ ✓ m of $(-4, 3)$

$y' = \frac{4}{3}$



Ex2 $\frac{d}{dy}(2x^5 + x^4y + y^5 = 36)$ ($f \cdot g$)

$10x^4 + x^4(1)\cdot y' + 4x^3 \cdot y + 5y^4 \cdot y' = 0$ ($f \cdot g' + f' \cdot g$; $y = y'$)

find $\frac{dy}{dx}$ and the eqn of the tangent line at $(1,2)$

$10x^4 + x^4 \cdot y' + 4x^3 y + 5y^4 y' = 0$

$x^4 + 5y^4 = -10x^4 - 4x^3 y$

$y' \frac{(x^4+5y^4)}{(x^4+5y^4)} = \frac{-10x^4 - 4x^3 y}{(x^4+5y^4)}$

$y' = -\frac{10x^4 - 4x^3 y}{x^4 + 5y^4}$

x y
(1, 2)

$= \frac{-10(1)^4 - 4(1)^3(2)}{1^4 + 5(2)^4} = \frac{-18}{81} = -\frac{2}{9}$

$y - 2 = -\frac{2}{9}(x - 1)$

$9y - 18 = -2x + 2$

$2x + 9y - 20 = 0$

Circles

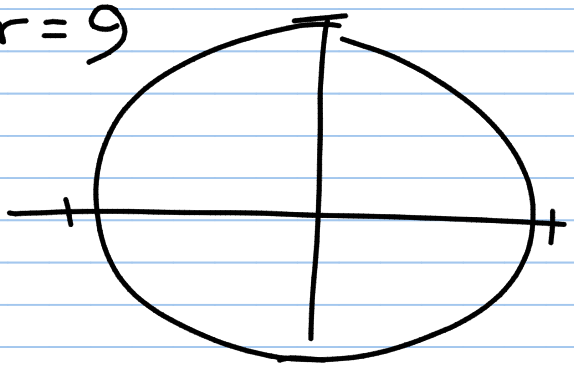
$x^2+y^2=1$ is a circle, centred at $(0,0)$ with a radius of 1

$x^2+y^2=25$ $(0,0)$ $r=5$

$x^2+y^2=81$ $(0,0)$ $r=9$

$(x-3)^2+(y-2)^2=100$

$(3,2)$ $r=10$



$$\frac{x^2}{2}+\frac{y^2}{4}=10$$

2.8 Higher Order Differentiation:

$f(x) = 6x^5$

$f'(x) = 30x^4$

$f''(x) = 120x^3$

$f'''(x) = 360x^2$

$f^{(4)}(x)$

$d = \_\_.\_t$

d' = m = velocity.

d'' = acceleration

$d = V_0 t + \frac{1}{2} a t^2$

$d' = V_0 + at$

$d'' = a$

$d''' =$

$$f''(x) = \frac{d}{dx}\left(\frac{dy}{dx}\right)$$

$$= \frac{d^2y}{dx^2}$$

$$f'''(x) = \frac{d^3y}{dx^3}$$

$y = x^4 + 2x^3 - 5x^2 + 3x - 6$

$y' = 4x^3 + 6x^2 - 10x + 3$

$y'' = 12x^2 + 12x - 10$

$y''' = 24x + 12$

$y^{(4)} = 24$

$y^{(5)} = 0$

Now do 2.7 & 2.8