

Goals

Implicit Differentiation

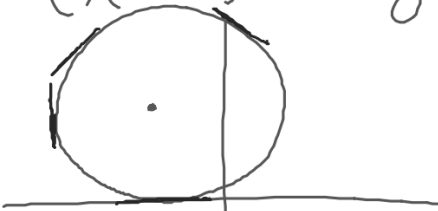
Hw

finish wksh

$$(x+3)^2 + (y-4)^2 = 16$$

What is this?

$$(x-h)^2 + (y-k)^2 = r^2$$



Implicit
Diff.

Explicit

$$y = 2x + 3$$

$$\hookrightarrow y' = 2$$

Implicit

$$-2x + y = 3$$

$$\left(\frac{dy}{dx}\right)$$

$\left[\frac{d}{dx} \text{ as an operator}\right]$



$$f(x) = g(x)$$

$$f'(x) = g'(x)$$

$$\frac{d}{dx}(-2x + y) = (3) \frac{d}{dx}$$

$$\frac{d}{dx}(-2x) + \frac{d}{dx}y = 0$$

$$-2 + \frac{dy}{dx} = 0$$

$$+2 \quad \frac{dy}{dx} = \frac{+2}{+2}$$
$$\frac{dy}{dx} = 2$$

$$\text{ex } \frac{d}{dx}(x^2 + 2y) = (2x - 4) \frac{d}{dx}$$

find $\frac{dy}{dx}$.

$$\begin{array}{r} 2x + 2 \frac{dy}{dx} = 2 \\ -2x \qquad \qquad -2x \end{array}$$

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

$$\frac{dy}{dx} = 1 - x$$

① Take $\frac{d}{dx}$ of both sides.

② Find derivative of each x-term.

③ Use chain rule.

④ use algebra to isolate $\frac{dy}{dx}$

~~ex~~ $y = 2$ ~~■~~

find

$$\frac{dy}{d\blacksquare} = 2$$

$$\frac{dy}{d\blacktriangle} = \frac{dy}{d\blacksquare} \cdot \frac{d\blacksquare}{d\blacktriangle}$$

$$\frac{dy}{d\blacktriangle} = 2 \frac{d\blacksquare}{d\blacktriangle}$$

~~ex~~ $y = \sin(2x)$

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

$$\cos(2x) \cdot 2$$

$$2\cos(2x)$$

$$\frac{d}{dx} -3x^3y^3 - 4x^2 + 5 = (2x^3) \frac{d}{dx}$$

$$\frac{d}{dx}(-\underbrace{3x^3}_f \underbrace{y^3}_g) - 8x + 0 = 6x^2$$

$$f'g + f(g')$$

$$\underline{-9x^2 \cdot y^3} + \underbrace{(-3x^3) 3y^2 \cdot \frac{dy}{dx}} - 8x = 6x^2$$

$$\underline{-9x^2 y^3} - 9x^3 y^2 \left(\frac{dy}{dx} \right) - 8x = 6x^2$$

$$\frac{-\cancel{9x^3 y^2} \cdot \frac{dy}{dx}}{-9x^3 y^2} = \frac{6x^2 + 8x + 9x^2 y^3}{-9x^3 y^2}$$

$$\frac{dy}{dx} = \frac{6x^2 + 8x + 9x^2 y^3}{-9x^3 y^2}$$