Homework: Section 3.6 (page 153): 13 - 31 (10 problems)

13 $\frac{dy}{dx} =$
15 $\frac{dy}{dx} =$
17 $\frac{dy}{dx} =$
19 $\frac{dy}{dx} =$
21 $\frac{dy}{dx} =$
23 $\frac{dy}{dx} =$
25 $\frac{dr}{d\theta} =$
27 $\frac{dr}{d\theta} =$
29 $y'' =$
31 $y'' =$

Notes

Homework: Section 3.6 (page 153): 33 - 37 Odd, 41 - 48 (11 problems)

33 $(f \circ g)' =$
35 $(f \circ g)' =$
37 $(f \circ g)' =$
41 $y =$
42 $y =$
43 $y =$
44 $y =$
45 $y =$
46 $y =$
47 $y =$
48 $y =$

Notes

Implicit Functions

Sometimes a curve is defined by an equation that is not a function.

Example

Consider the folium $x^3 + y^3 - 9xy = 0$, dating back to Descartes in 1638 (Use WinPlot)

- This is not a function because ...
- We can split this into three functions that are joined together
- Our equation defines these functions implicitly.
- We can still calculate the derivative of the equation.

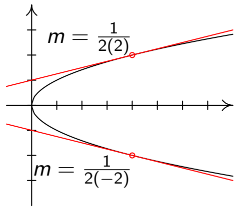
Notes

Differentiating Implicitly

Example (Find $\frac{dy}{dx}$ if $y^2 = x$)

Use the chain rule, and differentiate both sides.

$$\begin{aligned} y^2 &= x \\ 2y\frac{dy}{dx} &= 1 \\ \frac{dy}{dx} &= \frac{1}{2y} \end{aligned}$$



Notes

Implicit Differentiation Process

1. Differentiate both sides of the equation with respect to x.
2. Collect the terms that include $\frac{dy}{dx}$ one one side of the equation.
3. Factor out $\frac{dy}{dx}$.
4. Solve for $\frac{dy}{dx}$.

Notes

Implicit Differentiation Example

Example (Find the derivative for $2y = x^2 + \sin y$)

$$\begin{aligned} \frac{d}{dx}(2y) &= \frac{d}{dx}(x^2 + \sin y) \\ 2\frac{dy}{dx} &= 2x + \cos y \frac{dy}{dx} \\ 2\frac{dy}{dx} - \cos y \frac{dy}{dx} &= 2x \\ (2 - \cos y)\frac{dy}{dx} &= 2x \\ \frac{dy}{dx} &= \frac{2x}{2 - \cos y} \end{aligned}$$

Is the slope $\frac{dy}{dx}$ defined at every point on this curve? If so, why? Ifnot, why not?

Notes