# Implicit Differentiation

Implicit functions are those that are defined in terms or x*and* y.

**Implicit**

$$x^2y + 2y = 20$$

**Explicit**

$$y = \frac{20}{x^2 + 2}$$

These two equations are the same function defined two different ways. When trying to differentiate an implicit function we can try to rewrite the function as y in terms of x and then differentiate like usual; however, when this is not possible we must use implicit differentiation.

How it Works

Process

# Implicit Differentiation

**Find d/dx[$y^4$]**

**This causes problems because we are differentiating with respect to x and our function is in terms of y. Using the chain rule, we know that:**

$$\frac{d}{\cancel{dy}} \cdot \frac{\cancel{dy}}{dx} = \frac{d}{dx}$$

**So, if we differentiate with respect to y and multiply that answer by dy/dx, then we will have the derivative.**

$$d/dx[y^4] = 4y^3 \frac{dy}{dx}$$

$\frac{d}{dy}$

**How it Works** **Process**

# Implicit Differentiation

## The process...

1. Differentiate the entire equation with respect to whatever variable the problem asks for.

2. Solve for the derivative in question.

3. Use substitutions as needed. This step is used mostly when doing higer order differentiation.

How it Works | Process

# Practice

Find dy/dx of $3y^4 - 2x = 4$

1

2

3

4

5

6

7

8

# Practice

Find dy/dx of 3siny = 4x

1

2

3

4

5

6

7

8

# Practice

Find the derivative of $4x^3 - 3x^2y + y^3 = 24$

1
2
3
4
5
6
7
8

# Practice

Find the derivative of $(x + y)^3 = 5$

1

2

3

4

5

6

7

8

# Practice

Find the derivative of $\sqrt[3]{xy} = 3x + 4y$

1

2

3

4

5

6

7

8

# Practice

Find the slope of the tangent line of $x^3 + y^2 - 4xy = -3$ at the point (1, 2).

1

2

3

4

5

6

7

8

# Practice

**Write the equation of the tangent line of $\sin(x + y) = \sqrt{2}/2$ at the point (0, p/4)**

1 2 3 4 5 6 7 8

Find the second derivative of $x^3 - y^2 = 4$

1

2

3

4

5

6

7

8