When you are done with your homework you should be able to…

- π Distinguish between functions written in implicit form and explicit form
- π Use implicit differentiation to find the derivative of a function

Warm-up: Find the derivative of the following relations.

1. $x^2 + y^2 = 25$

2. $(y-1)^2 = -2(x+3)$

IMPLICIT AND EXPLICIT FUNCTIONS

Up to this point, we have seen most functions expressed in ________________ form.

Some functions are only ______________ by an equation.

When you were differentiating the warm-up problems, you were able to explicitly write y as a function of x.

In the example above, it is difficult to write y as a function of x ____________________. In order to differentiate we must use ____________________ differentiation. T

Understand how to find $\frac{dy}{dx}$ implicitly, you must know which variable you are differentiating with respect to. You must use the _____________ rule on any variable which is different than the one you are differentiating with respect to.

Example 1: Find the derivative of the following functions with respect to x. Simplify your result to a single rational expression with positive exponents.

a. $y = x^5$

b. $y = y^5$

c. $x^2 + y^2 = 25$

GUIDELINES FOR IMPLICIT DIFFERENTIATION

1. Differentiate both sides of the equation with respect to *x*.
2. Collect all terms involving $\frac{dy}{dx}$ on the left side of the equation and move all other terms to the right side of the equation.
3. Factor $\frac{dy}{dx}$ out of the left side of the equation.
4. Isolate $\frac{dy}{dx}$.

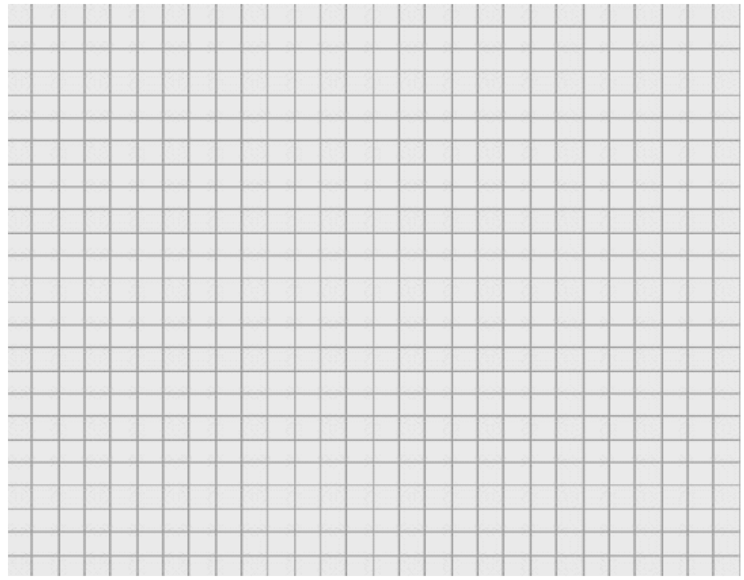
Example 2: Find the derivative of the following functions. Simplify your result to a single rational expression with positive exponents.

1. $4\cos x \sin y = 1$

2. $x^2 y + y^2 x = -2$

3. $x = \csc\frac{1}{y}$

Example 3: Use implicit differentiation to find an equation of the tangent line to the hyperbola $\frac{x^2}{6} - \frac{y^2}{8} = 1$ at $x = 1$. Sketch the graphs of the hyperbola and the tangent line at x = 1.



Example 4: Find the points at which the graph of the equation $4x^2 + y^2 - 8x + 4y + 4 = 0$ has a horizontal tangent line.

Example 5: Find $\frac{\partial^2 y}{\partial x^2}$ in terms of *x* and *y*.

$$1 - xy = x - y$$