Calculus H Name _______________

Notes 3.8 Implicit Differentiation

Explicit functions: can be solved for *y* without "resorting to cases." This is because y is defined explicitly in terms of x.

Ex. $y = 3x + 5$

Implicit functions either cannot be solved for *y* or cannot be solved for *y* without resorting to some cases. This is because the relations are implied by an equation.

Ex. $x^3y^2 - 5xy\left(3x + 7y^5\right) = 8$

Think about how you would graph a circle on your calculator.

Implicit Form	Explicit Form	Derivative
$x^2y = 2$	$y = \dfrac{2}{x^2}$	

Sometimes working with implicit functions is so much easier that you wouldn't even bother trying to solve for *y*.

Implicit Differentiation

To find $\dfrac{dy}{dx}$ *for a relation whose equation is written implicitly:*

1. Differentiate both sides of the equation with respect to x. Obey the chain rule by multiplying by $\dfrac{dy}{dx}$ each time you differentiate an expression containing y.

2. Isolate $\dfrac{dy}{dx}$ by getting all of the $\dfrac{dy}{dx}$ terms onto one side of the equation, and all other terms onto the other side. Then factor, if necessary, and divide both sides by the coefficient of $\dfrac{dy}{dx}$.

Derivatives of implicit functions really just use the chain rule over and over and over…then you solve for $\frac{dy}{dx}$.

Constantly say this sentence to yourself as you take the derivative: "but y is a function of x so I have to chain rule this thing…"

Example 1:
Find the derivative of $x^2 + y^2 = 1$

Example 2:
Find the derivative of $y^3 + x^2 y^5 - 8x^5 = 24$

Example 3:

Find the derivative of $sin(x \cdot y) = x^2 + y$

Example 4:

Find the derivative of $x^3 y = 5$

Example 5:

Find the equations of the tangent lines to the curve $x^3 + y^2 = 5$ at $x = -3$