

MA 181 SECTION 3.5: IMPLICIT DIFFERENTIATION

1. We usually have explicitly defined equations: (*y is defined in terms of x*)

A.  $y = \cos x + e^x$

B.  $y = 3x^5 - 7x^2 + 9$

2. Some equations are defined implicitly:

A.  $4x^2 + 9y^2 = 36$

B.  $xy = (x^2 + y^2)^2$

C.  $y^2 = \cos(xy) + e^{(xy)}$

3. Sometimes the equation can be written explicitly.

A.  $4x^2 + 9y^2 = 36$  can be solved for  $y$  (*as 2 implicit equations*)

Once the equation is written implicitly, we can find the derivative of both halves.

4. It is usually easier to differentiate the equation in its implicit form using **IMPLICIT DIFFERENTIATION**. You must treat  $y$  as a function of  $x$ . Every instance in which you differentiate an expression containing  $y$  wrt  $y$ , you must use the chain rule and differentiate  $y$  wrt  $x$ . You will have to write either  $dy/dx$  or  $y'$ .

5. Differentiate  $y^2 + x = 4$

6. **NOTE:** We also differentiate  $x$  wrt  $x$ . However, this is not evident as  $dx/dx$  or  $x' = 1$

7. **FIND Y' USING IMPLICIT DIFFERENTIATION**

A.  $4x^2 + 9y^2 = 36$

B.  $xy = (x^2 + y^2)^2$

**IMPLICIT DIFFERENTIATION IS USED TO DERIVE THE DERIVATIVES OF THE INVERSE TRIGONOMETRIC FUNCTIONS. See page 217 - 219 for formulas.**