

## Section 3-10 : Implicit Differentiation

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For problems 1 – 3 do each of the following.

(a) Find  $y'$  by solving the equation for  $y$  and differentiating directly.

(b) Find  $y'$  by implicit differentiation.

(c) Check that the derivatives in (a) and (b) are the same.

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

2.  $x^2 + y^3 = 4$

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

For problems 4 – 9 find  $y'$  by implicit differentiation.

4.  $2y^3 + 4x^2 - y = x^6$

5.  $7y^2 + \sin(3x) = 12 - y^4$

6.  $e^x - \sin(y) = x$

7.  $4x^2y^7 - 2x = x^5 + 4y^3$

8.  $\cos(x^2 + 2y) + xe^{y^2} = 1$

9.  $\tan(x^2y^4) = 3x + y^2$

For problems 10 & 11 find the equation of the tangent line at the given point.

10.  $x^4 + y^2 = 3$  at  $(1, -\sqrt{2})$ .

11.  $y^2e^{2x} = 3y + x^2$  at  $(0, 3)$ .

For problems 12 & 13 assume that  $x = x(t)$ ,  $y = y(t)$  and  $z = z(t)$  and differentiate the given equation with respect to  $t$ .

12.  $x^2 - y^3 + z^4 = 1$

13.  $x^2 \cos(y) = \sin(y^3 + 4z)$

