MATH 110 Problem Set 2.6

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The following problems based on Section 2.6 of the textbook will help you study. *You do not need to hand in solutions to these problems.*

1. (Based on 2.6.5–20) Find dy/dx for the following implicitly defined functions.

   (a) $x^2 + xy - y^2 = 4$ (b) $\sqrt{x} + 2\sqrt{y} = 3$ (c) $x^3(x-y) = y^2(x+3y)$

2. (Based on 2.6.25–30) Use implicit differentiation to find an equation for the tangent line to the given curve at the given point.

   (a) $x^2 + xy + y^2 = 7$; $(1,2)$ (b) $x^{2/3} + y^{2/3} = \dfrac{25}{9}$; $(-\dfrac{64}{27}, -1)$

3. (Based on 2.6.31–32) Use implicit differentiation to find equations for the tangent line and normal line for the curve

   $$2(x^2 + y^2)^2 = 25(x^2 - y^2)$$

   at the point $(3, -1)$.

4. (Based on 2.6.35–38) Find y'' by implicit differentiation for each of the following implicitly defined curves.

   (a) $4x^2 + 9y^2 = 36$ (b) $x^3 + y^3 = a^3$

5. (Based on 2.6.48) Find the derivatives of the following functions.

   (a) $y = \sin^{-1}(\sqrt{x})$
   (b) $y = \sqrt{\sin^{-1} x}$
   (c) $y = \tan^{-1}(t) + \tan^{-1}(1/t)$
   (d) $f(\theta) = \arcsin(2\sin\theta)$

6. (Based on 2.6.21–22) If $[f(x)]^2 + xf(x) = 3$ and $f(2) = 1$, find $f'(2)$.

7. (Based on 2.6.23–24) Regarding y as the independent variable and x as the dependent variable, use implicit differentiation to find dx/dy for $x^3y^2 - xy^3 + 3xy = 0$.

8. (Based on 2.6.44) Find an equation for the normal line to the ellipse

   $$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

   at the point (x_0, y_0) on the ellipse.

9. (Based on 2.6.49–54) Show that every member of the family of parabolas $x = cy^2$ and every member of the family of ellipses $2x^2 + y^2 = k$ have perpendicular tangents where they intersect.

10. (Based on 2.6.60) Find equations of both tangent lines to

$$\frac{x^2}{3^2} + \frac{y^2}{6^2} = 1$$

which pass through the point $(3, 12)$.

You may find the following additional exercises from Section 2.6 helpful.

2.6 C-level: 1–4, 5–20, 25–30, 31–32, 33–34, 35–38, 39–40;
B-level: 43, 44–45, 46–47;
A-level: 48, 49–52, 53–54, 55, 57–62