**Chapter 2: Derivatives**

**Section 2.6 Implicit Differentiation**

All page numbers refer to original APEX text page numbers.

In general, in this section, watch for the use of the word "function".

**p. 106**

Third paragraph: "... A graph of this implicit ~~function~~ equation is given..."

The line with $\frac{d}{dx}\left(f(y)\right)$ needs to have right ) parenthses removed in three places after the $f(y)$

**p. 107**

In the two paragraphs under the solution to Example 67: The word "function(s)" either needs to be replaced (or could just be replaced for consistency) with "equation(s)" in at least 6 places.

Example 68 change the directions to say: "Find the equation of the line tangent to the implicitly defined curve $y + y^3$..."

**pp. 108-109**

Toward the end of the solution to Example 68: Therefore the equation of... defined ~~function~~ curve..."

Example 69 - replace the format of the current solution with:
SOLUTION We will take the implicit derivatives term by term. Using the Chain Rule the derivative of $y^3$ is $3y^2y'$.

The second term, , $x^2y^4$ is a little more work. It requires the Product Rule as it is the product of two functions of $x$: $x^2$ and $y^4$. We see that $\frac{d}{dx}(x^2y^4)$ is

$$x^2 \cdot \frac{d}{dx}(y^4) + \frac{d}{dx}(x^2) \cdot y^4$$
$$x^2 \cdot (4y^3y') + 2x \cdot y^4$$

The first part of this expression requires a $y'$ because we are taking the derivative of a $y$ term. The second part does not require it because we are taking the derivative of $x^2$.

The derivative of the right hand side of the equation is found to be 2...

Top of page 109 - lots of "function" use -

To confirm the validity of...to this ~~function~~ curve at a point... graph of this ~~function~~ curve... The ~~function~~ equation and its tangent..."

Notice how our curve looks much different than the graphs of functions we have worked with up to this point. ~~It fails the vertical line test.~~Such curves are important in many areas of mathematics, so develping tools to deal with them is important.

Figure 2.21 description, replace "function" with "curve". Same for Figure 2.22 description.

Example 70:
"Given the implicitly defined ~~function~~ curve..."

**p. 110**
First line replace "function" with "equation"
Tim, can you mess with the graph so we can see the 3rd tangent line - or is it just not possible? Maybe it could be made longer.

Second to the last paragrph: "This section has shown... defined ~~functions~~ curves..."

**p. 110-112**
I think we decided to cut this everything from the last paragraph on p. 110 "~~One hole in ...~~" through Example 72 on p. 112. The proof will be given in Calculus II after discussion of logarithmic differentiation.
**p. 113**
Example 73 Solution:
After "replace $y'$ with $\frac{-x}{y}$:

$$\begin{aligned} y'' &= -\frac{y - x \cdot \frac{-x}{y}}{y^2} \\ &= -\frac{y + \frac{x^2}{y}}{y^2} \\ &= -\frac{y + \frac{x^2}{y}}{y^2} \cdot \frac{y}{y} \\ &= -\frac{y^2 + x^2}{y^3}, \text{ since we were given } x^2 + y^2 = 1 \\ &= -\frac{1}{y^3} \end{aligned}$$

**p. 113 - 114**
Move Logarithmic Differentiation section to Calculus II.
Create a Chapter Summary section to include a table of the derivatives developed in this chapter. The intro of this section can be the paragraph that currently appears right before Theorem 24. From Theorem 24 we want to include #1-9, 13-18 in this table.

**Exercises**
Cut exercises #5 - 12 & move #18, 36-41 to the appropriate Calculus II sections

**After current #25 insert the following 3 problems:**

$xe^x = ye^y$

Answer: $y' = \dfrac{e^x(x+1)}{e^y(y+1)}$

$y\sin(x^3) = x\sin(y^3)$

Answer: $y' = \dfrac{3x^2y\cos x^3 - \sin y^3}{3xy^2\sin y^3 - \sin x^3}$

$\sqrt{xy} = 1 + s^2y = x\sin(y^3)$

Answer: $y' = \dfrac{y - 4xy\sqrt{xy}}{2x^2\sqrt{xy} - x}$

**After current #25 insert the following problem. I do not have a graph for this one so the directions to this set of problems needs to be altered. Maybe just cut the last sentence, ~~As a visual aid each ... graphed.~~**

$x^2 + 2xy - y^2 + x = 2$ at $(1, 2)$

Answer: $y = \dfrac{7}{2}x - \dfrac{3}{2}$

So that the corresponding exercises from #13 - 16 & #32 - 35 have the same parity, the current #32 needs to be odd, #33 even, #34 odd, #35 even. This may happen naturally depending on how added problems change the numbering.