1 | Implicit Differentiation

The usual process:

1. Differentiate everything with respect to x
2. Apply the chain rule to functions left in the mix: since $(f(g(x)))' = g'(x)f'(g(x))$, $\frac{d}{dx}y^2 = \frac{dy}{dx}y^2$.
3. Apply algebra to get $\frac{dy}{dx}$ on one side.
4. OPTIONAL(?): Convert back to explicit form by plugging in value of y.

1.1 | Common Problems and their Respective Approaches

1.1.1 | Find the equation of the tangent/normal at (A,B)

Remember that $L(a) = f(a) + f'(a)(x - a)$, and that'll give you tangent. Normal line is just perpendicular of tangent, so $\frac{-1}{L(a)}$.

1.1.2 | Find location of curve where tangent is *vertical*

Simply find what values of x and y make the tangent go to infinity. System of equations with the derivative and the original implicit equation itself. You can make this faster with fractions by only using denom/numerator.

1.1.3 | Find location of curve where tangent is *horizontal*

Same as above but solve for what makes tangent go to zero.

1.2 | Misc Tips

1.2.1 | Pay attention to the original equations!

They're very useful in algebra!

2 | Derivatives of Inverse Functions

Formula for this is $(f^{-1}(x))' = \frac{1}{f'(f^{-1}(x))}$.

3 | Derivatives of Inv. Trig Functions

Remember the derivs

3.1 | TODO Explicitly deriving

4 | Linear Approximations

$L(a) = f(a) + f'(a)(x - a)$ Plug in for appropriate a, and manually check for over/underestimation if problem asks.

4.1 | TODO Algebraically getting set accuracy bounds

5 | Differentials

$dy = f'(x)dx$

$-dx < dy < dx$