Algebraic geometry II: HW 5

No collaboration is allowed on this homework; however, you are free to talk to anyone about what I did in class (e.g., definitions, results, etc.). In particular, you are not allowed to look at someone else's homework or ask someone how they did the problem.

1. Let B be the affine coordinate ring of the curve X given by $y^2 = x^3 + x^2$ in $\mathbf{A}^2$ over an algebraically closed field k. Give an explicit description of the module of differentials $\Omega_{B/k}$. Use this description (and, but not or, any other results) to decide at what points x on X (i.e., elements of $X(k)$) the stalk of the sheaf of differentials $\Omega_{X/k}$ is locally free over $\mathcal{O}_x$ of rank one, where $\mathcal{O}$ is the structure sheaf of X. Hint: Recall that if A is a ring, and $B = A[x_1, \ldots, x_n]/(f_1, \ldots, f_r)$, then $\Omega_{B/A}$ is the quotient of the free B-module on $\{dx_1, \ldots, dx_n\}$ by the ideal generated by the df_j's.