Note: We have now basically finished chapter 10. You are not responsible for section 10.19. We have not yet covered section 10.21, but you should know theorem 10.9. (I hope to have time to discuss the proof next week.)

To do (but not to turn in):

§ 10.9: 10
§ 10.18: 1, 4, 5, 7, 8, 9

To hand in:

1. Let $C$ be the portion of the curve:

$$x + \sqrt{xy} + 3y = 15$$

starting at $A = (1, 4)$ and ending at $B = (9, 1)$. Find $\int_C y^2 \, dx + (2xy + 3y^2) \, dy$.

2(a). Let $S$ be a nonempty closed set in $\mathbb{R}^n$. Let $a$ be a point in $\mathbb{R}^n$. Prove that there is a point $x$ in $S$ closest to $a$. (There may be more than one such point.) Note: $S$ may not be bounded.

2(b). Suppose the set $S$ in part (a) is not all of $\mathbb{R}^n$. Prove that the boundary of $S$ is not empty.

3. Suppose $F: \mathbb{R}^3 \to \mathbb{R}^3$ is a continuous vectorfield and that $D_i F_j = D_j F_i$ for all $i$ and $j$ and at all points of $\mathbb{R}^3$. Let $S$ be a sphere in $\mathbb{R}^3$. Prove that there is some point $x$ in $S$ such that $F(x)$ is normal to $S$ at $x$. 