A. Due at the start of class on Day 20 (but not collected): Complete these exercises, just to practice basic skills. If you want more practice, then do more problems from the book.

Section 16.1 Exercises 13-20, 21, 25, 33

B. Due at the start of class on Day 23, as part of your weekly homework packet: Submit polished solutions, including all necessary work and no unnecessary work, in the order assigned.

1. Section 16.1 Exercise 34

For the remaining problems, let X be the set of points in the plane other than the origin:

$$X = \{(x, y) : x \neq 0 \text{ or } y \neq 0\}.$$

Also let

$$\vec{F} = \left\langle \frac{-y}{x^2 + y^2}, \frac{x}{x^2 + y^2} \right\rangle.$$

Notice that $\vec{F}$ is defined on all of X.

2. Show that $\frac{d}{dy}F_1 = \frac{d}{dx}F_2$ everywhere on X.

3. Find a potential function for $\vec{F}$ on the part of X where $x > 0$. (Hint: You may find the trigonometric identity $\tan(\theta + \pi/2) = -1/\tan(\theta)$ helpful. Bigger hint: Consider something like $\arctan(y/x)$ or $\arctan(-x/y)$.)

4. Find a potential function for $\vec{F}$ on the part of X where $y > 0$.

5. Find a potential function for $\vec{F}$ on the part of X where $x < 0$.

6. Find a potential function for $\vec{F}$ on the part of X where $y < 0$.

7. Explain thoroughly why there is no one potential function for $\vec{F}$ on all of X. (Hint: Figure out what the value of the function must be at the four points $(x, y) = (\pm 1, \pm 1)$.)