How your proof should look

I realized that some of you have never had to prove anything before, so I wanted to jump in and give you all some guidance!

The short story: *To show that two quantities are equal, you start on* ***one side*** *of the equal sign (****without*** *messing with the other side) and you do math until the thing you have looks like the* ***other side*** *of the equation!*

Below is an outline of how the "homework" proof should look: Your job is to use the justifications provided (to the right of the blanks) to fill in the blanks provided. Once you've filled in all the blanks, what you *should* have is a proof that the integrating factor satisfies the identity claimed in class.

Note 1: Throughout, $\exp(x)$ is shorthand for e^x and $I(x)$ is shorthand for $\int p(x)\,dx$. Using this notation,

$$e^{\int p(x)\,dx} = \exp\left(I(x)\right)$$

is the thing we called $m(x)$ in class and is explicitly highlighted below.

Note 2: "FTC" stands for "Fundamental Theorem of Calculus."

$$\frac{d}{dx}\left(\underbrace{\exp\left(I(x)\right)}_{m(x)}\, y\right) = \underline{\qquad\qquad\qquad\qquad} \qquad \text{(by the product rule)}$$

$$= \underline{\qquad\qquad\qquad\qquad} \qquad \left(\text{because } \frac{d}{dx}\left(y\right) = \frac{dy}{dx}\right)$$

$$= \underline{\qquad\qquad\qquad\qquad} \qquad \text{(by the chain rule)}$$

$$= \underbrace{\exp\left(I(x)\right)}_{m(x)}\frac{dy}{dx} + \underbrace{\exp\left(I(x)\right)}_{m(x)}p(x)\,y \qquad \text{(by FTC)}$$