1.47 All of the functions are continuous, hence right-continuous. Thus we only need to check the limit, and that they are nondecreasing

a. $\lim_{x\to-\infty} \frac{1}{2} + \frac{1}{\pi}\tan^{-1}(x) = \frac{1}{2} + \frac{1}{\pi}\left(\frac{-\pi}{2}\right) = 0$, $\lim_{x\to\infty} \frac{1}{2} + \frac{1}{\pi}\tan^{-1}(x) = \frac{1}{2} + \frac{1}{\pi}\left(\frac{\pi}{2}\right) = 1$, and $\frac{d}{dx}\left(\frac{1}{2}+\frac{1}{\pi}\tan^{-1}(x)\right) = \frac{1}{1+x^2} > 0$, so $F(x)$ is increasing.

b. See Example 1.5.5.

c. $\lim_{x\to-\infty} e^{-e^{-x}} = 0$, $\lim_{x\to\infty} e^{-e^{-x}} = 1$, $\frac{d}{dx}e^{-e^{-x}} = e^{-x}e^{-e^{-x}} > 0$.

d. $\lim_{x\to-\infty}(1-e^{-x}) = 0$, $\lim_{x\to\infty}(1-e^{-x}) = 1$, $\frac{d}{dx}(1-e^{-x}) = e^{-x} > 0$.

e. $\lim_{y\to-\infty} \frac{1-\epsilon}{1+e^{-y}} = 0$, $\lim_{y\to\infty} \epsilon + \frac{1-\epsilon}{1+e^{-y}} = 1$, $\frac{d}{dx}\left(\frac{1-\epsilon}{1+e^{-y}}\right) = \frac{(1-\epsilon)e^{-y}}{(1+e^{-y})^2} > 0$ and $\frac{d}{dx}(\epsilon + \frac{1-\epsilon}{1+e^{-y}}) > 0$, $F_Y(y)$ is continuous except on $y = 0$ where $\lim_{y\downarrow 0}(\epsilon + \frac{1-\epsilon}{1+e^{-y}}) = F(0)$. Thus is $F_Y(y)$ right continuous.