2. In each of the following, indicate whether the given statement is TRUE or FALSE by marking the corresponding ☐ with a ✗, and then **explain** why it is true or false.

a. $\int \sin^3 x\,dx = \dfrac{\sin^4 x}{4} + C$ ☐ TRUE ☒ FALSE

$\left(\frac{\sin^4 x}{4}\right)' = \sin^3 x \cos x \neq \sin^3 x$ at $x = \frac{\pi}{2}$

b. $\int \sin^3 x\,dx = \dfrac{\sin^4 x}{4\cos x} + C$ ☐ TRUE ☒ FALSE

$\left(\frac{\sin^4 x}{4\cos x}\right)' = \sin^3 x + \frac{\sin^5 x}{4\cos^2 x} \neq \sin^3 x$ at $x = \frac{\pi}{4}$

c. $\int \sin^3 x\,dx = \dfrac{1}{6}\cos x \cos 2x - \dfrac{5}{6}\cos x + C$ ☒ TRUE ☐ FALSE

$\left(\frac{1}{6}\cos x\cos 2x - \frac{5}{6}\cos x\right)' = \left(\frac{1}{6}\cos x\cdot(2\cos^2 x - 1) - \frac{5}{6}\cos x\right)'$

$= \left(\frac{1}{3}\cos^3 x - \cos x\right)' = -\cos^2 x \sin x + \sin x = \sin^3 x$ for all x

d. $\int \dfrac{dx}{x^2+1} = \dfrac{\ln(x^2+1)}{2x} + C$ ☐ TRUE ☒ FALSE

$\left(\frac{\ln(x^2+1)}{2x}\right)' = \frac{1}{x^2+1} - \frac{\ln(x^2+1)}{2x^2} \neq \frac{1}{x^2+1}$ at $x = 1$

e. $\int \dfrac{dx}{x^2+1} = \arcsin\left(\dfrac{x}{\sqrt{x^2+1}}\right) + C$ ☒ TRUE ☐ FALSE

$\left(\arcsin\left(\frac{x}{\sqrt{x^2+1}}\right)\right)' = \frac{1}{\sqrt{1-\left(\frac{x}{\sqrt{x^2+1}}\right)^2}} \cdot \frac{\sqrt{x^2+1} - \frac{x^2}{\sqrt{x^2+1}}}{x^2+1} = \frac{1}{x^2+1}$ for all x