Justify the following integrals. (Due: 2018.10.21. 24:00.)

1.

$$\text{p.v.}\int_{-\infty}^{\infty}\frac{\cos x + x\ \sin\ x}{x^2+1}dx = \frac{2\pi}{e}$$

2.

$$\int_0^{2\pi}\frac{1}{(1+2a\ \sin\theta+a^2)^2}d\theta = \frac{2\pi(1+a^2)}{(1-a^2)^3}\ , \quad (|a|<1)$$

3.

$$\int_0^{\infty}\frac{\sin x}{x^{3/2}}dx = \sqrt{2\pi}$$