

### [nex3] Gaussian shootist versus Lorentzian shootist

The shots of two marksmen on a square-shaped target of dimensions  $20\text{cm} \times 20\text{cm}$  are found to be distributed with probability densities

$$P_1(x, y) = C_1 e^{-(x^2+y^2)}, \quad P_2(x, y) = \frac{C_2}{1+x^2+y^2},$$

where  $r = \sqrt{x^2 + y^2}$  is the distance from the center of the target, and  $C_1, C_2$  are normalization constants. Answer the following questions separately for each marksman.

- (a) What is the probability that a given shot that hits the target is at least 1cm high ( $y > 1\text{cm}$ )?
- (b) Given that a shot that hits the target is at least 1cm high ( $y > 1\text{cm}$ ), what is the probability that it is also at least 1cm to the right ( $x > 1\text{cm}$ )?

**Solution:**