$$\int_0^\pi \sin^2 x\, dx = -\sin x \cos x \,|_0^\pi + \int_0^\pi \cos^2 x\, dx = 0 + \int_0^\pi 1 - \sin^2 x\, dx = \pi - \int_0^\pi \sin^2 x\, dx \implies 2\int_0^\pi \sin^2 x\, dx = \pi$$