PROOF OF FORMULA 3.624.3

$$\int_0^{\pi/4} \frac{\cos^{n-1/2}(2x)}{(\cos x)^{2n+1}}\,dx = \frac{(2n-1)!!}{2(2n)!!}\pi$$

This is the special case $\mu = n - \frac{1}{2}$ in entry **3.624.4** which states that

$$\int_0^{\pi/4} \frac{\cos^{\mu}(2x)}{(\cos x)^{2(\mu+1)}}\,dx = 2^{2\mu}B(\mu+1,\mu+1).$$

The expression

$$\Gamma\left(n+\tfrac{1}{2}\right) = \frac{\sqrt{\pi}\,(2n)!!}{2^{2n}\,n!}$$

is useful in the simplification.