

Solution (#1356) Prove first the reduction formula

$$I_n = \frac{2n}{2n+1} I_{n-1}$$

and then note the rearrangement

$$\frac{2n}{2n+1} \times \frac{2n-2}{2n-1} \times \frac{2n-4}{2n-3} \times \cdots \times \frac{2}{3} \times 1 = \frac{2^n n!}{(2n+1)(2n-1)(2n-3) \cdots 1} \times \frac{2n \times (2n-2) \times (2n-4) \times \cdots \times 2}{2n \times (2n-2) \times (2n-4) \times \cdots \times 2}.$$