

$$\frac{2 \cdot 4}{1}$$

$$n=2$$

$$\frac{4 \cdot (2)^2}{2+1} < 4!$$

$$n=k$$

$$\frac{4^k (k!)^2}{k+1} < (2k)!$$

$$n=k+1$$

$$\frac{4^{k+1} [(k+1)!]^2}{k+2} < (2k+2)!$$

$$\frac{4 \cdot 4^k \cdot (k!)^2 (k+1)^2}{k+2} \stackrel{?}{<} (2k)! \cdot (2k+1) \cdot 2(k+1)$$

$$\frac{2 \cdot 4^k (k!)^2 (k+1)}{k+2} \stackrel{?}{<} (2k)! \cdot (2k+1)$$

$$\frac{2 \cdot 4^k (k!)^2 (k+1)}{k+2} \stackrel{?}{<} \frac{4^k (k!)^2}{k+1} (2k+1)$$

$$\frac{2(k+1)}{k+2} \stackrel{?}{<} \frac{2k+1}{k+1}$$

$$2(k+1)^2 \stackrel{?}{<} (2k+1)(k+2)$$

$$2k^2 + 4k + 2 < 2k^2 + 5k + 2$$