Exercises: Stirling's Formula

$$n! \sim (n/e)^n \sqrt{2\pi n}, \qquad \lim_{n\to\infty} \frac{n!}{(n/e)^n \sqrt{2\pi n}} = 1$$

1. Use Stirling's formula to estimate $2 \cdot 4 \cdot 6 \cdots 2n$.
2. Use Stirling's formula to estimate $1 \cdot 3 \cdot 5 \cdots (2n-1)$.
3. Use the previous two exercises to compute
$$\lim_{n\to\infty} \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{2 \cdot 4 \cdot 6 \cdots 2n}$$
4. Show that
$$\binom{3n}{n} \sim \frac{(27/4)^n \sqrt{3}}{2\sqrt{\pi n}}$$
5. Show that $(1+1/n) \sim 1$. Apply it to $(1+1/n)^n$. Is there a problem?