Solution (#1415) Let x be a real number such that $2x$ is not a non-positive integer. Then by #1413 we have

$$\begin{aligned}
& \frac{\Gamma(x)\Gamma(x+\frac{1}{2})}{\Gamma\left(\frac{1}{2}\right)} 2^{2x-1} \\
= \; & \frac{2^{2x-1}}{\sqrt{\pi}} \left(\lim_{n\to\infty} \frac{n! n^x}{x(x+1)(x+2)\cdots(x+n)} \right) \left(\lim_{n\to\infty} \frac{n! n^{x+1/2}}{(x+1/2)\,(x+3/2)(x+5/2)\cdots(x+1/2+n)} \right) \\
= \; & \frac{2^{2x-1}}{\sqrt{\pi}} \left(\lim_{n\to\infty} \frac{2^{n+1} n! n^x}{2x(2x+2)(2x+4)\cdots(2x+2n)} \right) \left(\lim_{n\to\infty} \frac{2^{n+1} n! n^{x+1/2}}{(2x+1)\,(2x+3)(2x+5)\cdots(2x+2n+1)} \right) \\
= \; & \lim_{n\to\infty} \frac{2^{2n+2x+1}(n!)^2 n^{2x+1/2}/\sqrt{\pi}}{2x(2x+1)(2x+2)\cdots(2x+2n+1)} \\
= \; & \lim_{n\to\infty} \frac{2^{2n+1/2}(n!)^2 (2n)^{2x+1/2}/\sqrt{\pi}}{2x(2x+1)(2x+2)\cdots(2x+2n+1)} \\
= \; & \left(\lim_{n\to\infty} \frac{(2n)!(2n)^{2x}}{2x(2x+1)(2x+2)\cdots(2x+2n)} \right) \left(\lim_{n\to\infty} \frac{(n!)^2 2^{2n}}{(2n)!\sqrt{\pi n}} \right) \left(\lim_{n\to\infty} \frac{2n}{(2x+2n+1)} \right) \\
= \; & \Gamma(2x) \times 1 \times 1 \qquad \text{[using \#1414]} \\
= \; & \Gamma(2x).
\end{aligned}$$