1125-11-3154 **Mojtaba Moniri*** (`m-moniri@wiu.edu`). *Diophantine questions on a familiar limit.*

This is a proposed UGR project on some plausible Diophantine-analytic identities as $\frac{\sin x}{x}$ converges to 1 along certain values $x \to 0$. Using $\csc^2 x = \frac{1}{x^2} + \frac{1}{3} + \frac{x^2}{15} + \mathcal{O}(x^4)$ about 0, as $m \to \infty$ one has $\frac{1}{4}\csc^2\frac{\pi}{2^{m+2}} = \frac{4^{m+1}}{\pi^2} + \frac{1}{12} + \frac{\pi^2}{15\times 4^{m+3}} + \mathcal{O}(4^{-2m})$. We wrote this with $\frac{1}{4}$ and $m+2$ on the left to go with $\frac{1}{2-\underbrace{\sqrt{2+\sqrt{2+\cdots+\sqrt{2}}}}_{m \text{ times}}} = \frac{1}{4}\csc^2\frac{\pi}{2^{m+2}}$. We ask whether

$$\lfloor \frac{1}{4}\csc^2\frac{\pi}{2^{m+2}} \rfloor =^? \lfloor \frac{4^{m+1}}{\pi^2} + \frac{1}{12} \rfloor \ (?)$$

for all m. We similarly raise the questions $\lfloor \frac{1}{4}\csc^2\frac{3\pi}{2^{m+3}} \rfloor =^? \lfloor \frac{4^{m+2}}{9\pi^2} + \frac{1}{12} \rfloor$ (?), $\lfloor \frac{1}{4}\csc^2\frac{\pi}{3\times 2^{m+2}} \rfloor =^? \lfloor \frac{9\times 4^{m+1}}{\pi^2} + \frac{1}{12} \rfloor$ (?), and $\lfloor \frac{1}{4}\csc^2\frac{5\pi}{12\times 2^{m}} \rfloor =^? \lfloor \frac{9\times 4^{m+1}}{25\pi^2} + \frac{1}{12} \rfloor$ (?).

[Using Mathematica, we verified all four when $m \leq 20,000$.] (Received September 21, 2016)