Ten conjectures on prime numbers

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Abstract

In this paper ten conjectures on prime numbers are reported. With p_n we indicate the n-th prime number. All the conjectures have been verified for all primes $\leq 10^7$.

1. $\ln(p_{n+1})-\ln(p_n)<\ln\left(\frac{34283}{8219}\right)\cdot n^{-\ln\frac{1907}{919}}$

2. $\frac{p_{n+1}-p_n}{p_{n+1}+p_n}<n^{-\cos\left(\pi\cdot\frac{7}{55}\right)\cdot\cos\left(\pi\cdot\frac{13}{54}\right)}$

3. $\frac{e^{\sqrt{\frac{n+1}{p_{n+1}}}}}{e^{\sqrt{\frac{p_n}{n}}}}<\frac{e^{\sqrt{\frac{3}{5}}}}{e^{\sqrt{\frac{3}{2}}}}$

4. $\left|p_n\cdot(n+1)-n\cdot p_{n+1}\right|<\frac{1}{2}\cdot(n+1)^{\frac{9}{50}}$

5. $\ln(p_{n+1}-p_n)-\ln(\sqrt{p_{n+1}-p_n})<\frac{1}{2}\cdot n^{\frac{3}{10}}$

6. $\left|\ln\left(\sqrt{\ln(p_{n+1})}\right)-\ln\left(\sqrt{\ln(p_n)}\right)\right|<\frac{1}{2n}$

7. $\frac{1}{2^{\ln\sqrt{2}}}<\frac{n^{\ln\sqrt{p_{n+1}}}}{(n+1)^{\ln\sqrt{p_n}}}<\frac{30^{\ln\sqrt{127}}}{31^{\ln\sqrt{113}}}$

8. $\frac{\sqrt{3}-\ln(3)}{\sqrt{2}-\ln(2)}<\frac{\sqrt{p_{n+1}}-\ln(p_{n+1})}{\sqrt{p_n}-\ln(p_n)}<\frac{\sqrt{11}-\ln(11)}{\sqrt{7}-\ln(7)}$

9. $\frac{(\ln(1361))^{\sqrt{1327}}}{(\ln(1327))^{\sqrt{1361}}}<\frac{(\ln(p_{n+1}))^{\sqrt{p_n}}}{(\ln(p_n))^{\sqrt{p_{n+1}}}}<\frac{(\ln(3))^{\sqrt{2}}}{(\ln(2))^{\sqrt{3}}}$

10. $\frac{\sqrt{p_n}-\ln(p_{n+1})}{\sqrt{p_{n+1}}-\ln(p_n)}\geq\frac{\sqrt{3}-\ln(5)}{\sqrt{5}-\ln(3)}$