MATH 220–02 (Kunkle), Quiz 5 | Name: ______________________

10 pts, 10 minutes | Oct 10, 2023

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1 (10 pts). Find the limit of the sequence, if it exists.

a. $\dfrac{3n^2-5}{4n^2+2}$ b. $\dfrac{\ln(3n^2-5)}{\ln(4n^2+2)}$ c. $\ln(3n^2-5)-\ln(4n^2+2)$

1a.(Source: 11.1.23) By Famous Limit 5*,

$$\lim_{n\to\infty}\frac{3n^2-5}{4n^2+2}=\lim_{n\to\infty}\frac{3n^2}{4n^2}=\lim_{n\to\infty}\frac{3}{4}=\frac{3}{4}.$$

1b.(Source: 11.1.38) Looks like $\frac{\infty}{\infty}$. Try l'Hospital's Rule:

$$\lim_{n\to\infty}\frac{\ln(3n^2-5)}{\ln(4n^2+2)}=\text{“}\frac{\infty}{\infty}\text{”}\overset{HR}{\longrightarrow}\lim_{n\to\infty}\frac{\frac{6n}{3n^2-5}}{\frac{8n}{4n^2+2}}=\frac{6}{8}\lim_{n\to\infty}\frac{4n^2+2}{3n^2-5}.$$

By Famous Limit 5, this equals

$$\frac{3}{4}\lim_{n\to\infty}\frac{4n^2}{3n^2}=\frac{3}{4}\cdot\frac{4}{3}=1.$$

Therefore, the original limit is also 1.

1c.(Source: 11.1.49,31) Use the properties of logs to reduce this problem to 1a:

$$\lim_{n\to\infty}\big(\ln(3n^2-5)-\ln(4n^2+2)\big)=\lim_{n\to\infty}\ln\left(\frac{3n^2-5}{4n^2+2}\right)=\ln\left(\lim_{n\to\infty}\frac{3n^2-5}{4n^2+2}\right)=\ln\left(\frac{3}{4}\right).$$

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* http://kunklet.people.cofc.edu/MATH220/flesk.pdf