Calculus 2: I don't want the answers; I want the questions!

(Q1.) Give an integral so that…

(a) it can be done with either IBP or trig sub

(b) it has to be done with both u-sub and PFD

(c) the midpoint rule M_n is better than the Simpson's rule S_n for some n

(d) it is an improper integral of both type 1 and type 2 and it converges

(Q2.) Give two functions f and g at some a (a can be infinity) so that…

(a) $\lim_{x\to a} f(x)=1$ and $\lim_{x\to a} g(x)=\infty$ but $\lim_{x\to a}\left(f(x)^{g(x)}\right)=2$

(b) $f(x)-g(x)\neq 2$ for any x; $\lim_{x\to a} f(x)=\infty$ and $\lim_{x\to a} g(x)=\infty$ but $\lim_{x\to a}\left(f(x)-g(x)\right)=2$

(c) $\lim_{x\to a} f(x)=0$ and $\lim_{x\to a} g(x)=0$ but $\lim_{x\to a}\left(f(x)^{g(x)}\right)=2$

(d) $\lim_{x\to a} f(x)=\infty$ and $\lim_{x\to a} g(x)=0$ but $\lim_{x\to a}\left(f(x)^{g(x)}\right)=2$

(Q3.) Give an infinite series $\sum a_n$ so that…

(a) it has to be tested by the integral test

(b) the ratio test gives inconclusive result but it actually converges

(c) LCT doesn't work but DCT does

(d) it is alternating but AST doesn't apply

[Bonus. Shout out to Allen & Math Nerd 1729] Give a sequence a_n so that…

#bprplive

(a) $\sum_{n=0}^{\infty} a_n = 0$

(b) $a_n \neq 0$ for all n but $\sum_{n=0}^{\infty} a_n = 0$

(c) $a_n \neq 0$ for any n but $\sum_{n=0}^{\infty} a_n = 0$