Homework 52

The **due date** for this homework is **Tue 7 May 2013 12:00 AM EDT -0400**.

This homework is a bit different. There are very few problems, but each one is an amalgam of many problems. It may take a long time to do these, but the practice will be very good for you!

Question 1

For which of the following series does the *root test* ensure **convergence**? Select all that apply.

- [ ] $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2n^2+4n+1}{3n^2+1}\right)^n$
- [ ] $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2\arctan n}{\pi}\right)^n$
- [ ] $\displaystyle\sum_{n=1}^{\infty}\left(\frac{3n-1}{3n}\right)^{n^2}$
- [ ] $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n^4\ln^2\left(\cos\frac{1}{n}\right)}{n+1}\right)^n$
- [ ] $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2n}{2n+1}\right)^{2n}$
- [ ] $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n}{\ln n}\right)^{n/2}$
- [ ] $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n+1}{2n-1}\right)^n$

- [ ] $\sum_{n=1}^{\infty}\left(\frac{\pi}{2\arctan n}\right)^{n}$
- [ ] $\sum_{n=1}^{\infty}\left(\frac{3n}{3n-1}\right)^{n^2}$
- [ ] $\sum_{n=1}^{\infty}\left(\frac{\ln(3n+1)}{n}\right)^{2n}$

Question 2

For which of the following series does the *ratio test* ensure **divergence**? Select all that apply.

- [ ] $\sum_{n=1}^{\infty}\frac{(n^2)!}{(2n)!}$
- [ ] $\frac{1}{2}+\frac{1\cdot 5}{2\cdot 5}+\frac{1\cdot 5\cdot 9}{2\cdot 5\cdot 8}+\cdots+\frac{1\cdot 5\cdot 9\cdots(4n-3)}{2\cdot 5\cdot 8\cdots(3n-1)}+\cdots$
- [ ] $\frac{2}{1}+\frac{2\cdot 5}{1\cdot 5}+\frac{2\cdot 5\cdot 8}{1\cdot 5\cdot 9}+\cdots+\frac{2\cdot 5\cdot 8\cdots(3n-1)}{1\cdot 5\cdot 9\cdots(4n-3)}+\cdots$
- [ ] $\sum_{n=1}^{\infty}\frac{(n!)^2}{(2n)!}$
- [ ] $\sum_{n=1}^{\infty}\frac{n!}{2^{n!}}$
- [ ] $\frac{1}{3}+\frac{1\cdot 3}{3\cdot 5}+\frac{1\cdot 3\cdot 5}{3\cdot 5\cdot 7}+\cdots+\frac{1\cdot 3\cdot 5\cdots(2n-1)}{3\cdot 5\cdot 7\cdots(2n+1)}+\cdots$
- [ ] $\sum_{n=1}^{\infty}\frac{(n+1)^{2n}}{(n+1)!}$
- [ ] $\sum_{n=1}^{\infty}\frac{e^n}{n^2}$
- [ ] $\sum_{n=1}^{\infty}\frac{n!}{2^n+3}$

- [ ] $\frac{3}{1} + \frac{3 \cdot 5}{1 \cdot 3} + \frac{3 \cdot 5 \cdot 7}{1 \cdot 3 \cdot 5} + \cdots + \frac{3 \cdot 5 \cdot 7 \cdots (2n+1)}{1 \cdot 3 \cdot 5 \cdots (2n-1)} + \cdots$

Question 3

Using *any* of the convergence tests covered in this chapter, determine which of the following sequences **converge**. Select all that converge.

- [ ] $\sum_{n=1}^{\infty} \frac{1+(-1)^n}{2+(-1)^n}$
- [ ] $\frac{2}{2} + \frac{2 \cdot 5}{2 \cdot 9} + \frac{2 \cdot 5 \cdot 10}{2 \cdot 9 \cdot 28} + \cdots + \frac{2 \cdot 5 \cdot 10 \cdots (n^2+1)}{2 \cdot 9 \cdot 28 \cdots (n^3+1)}$
- [ ] $\sum_{n=1}^{\infty} \frac{3^n}{n^3}$
- [ ] $\sum_{n=1}^{\infty} \left(\frac{n-1}{n+1}\right)^{n^2+n}$
- [ ] $\sum_{n=1}^{\infty} \frac{n^2-1}{n^3+n^2+1}$
- [ ] $\sum_{n=1}^{\infty} \arcsin\frac{1}{2} \arcsin\frac{2}{3} \cdots \arcsin\frac{n}{n+1}$
- [ ] $\sum_{n=1}^{\infty} \frac{n!}{(2n)!}$
- [ ] $\sum_{n=1}^{\infty} \left(1+\frac{1}{n^2}\right)^{n^3}$
- [ ] $\sum_{n=1}^{\infty} \frac{n(n^2+1)^2}{n^8+2n^2+4n+1}$
- [ ] $\sum_{n=1}^{\infty} \ln\frac{n^2+1}{n^2}$

- [ ] $$\sum_{n=1}^{\infty} \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{n!}$$
- [ ] $$\sum_{n=1}^{\infty} \frac{\cos^2 n}{n^2}$$
- [ ] $$\sum_{n=1}^{\infty} \frac{n^3+1}{\sqrt[3]{n^{10}+n}}$$
- [ ] $$\sum_{n=1}^{\infty} \frac{1}{2^n+n^2}$$
- [ ] $$\sum_{n=1}^{\infty} \left(\frac{n^2}{2n+1}\right)^n$$
- [ ] $$\sum_{n=1}^{\infty} \left(\frac{2n}{3n+1}\right)^n$$

- [ ] In accordance with the Honor Code, I certify that my answers here are my own work.

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