Q1.Determine wither the following series converges, and if so find its sum

$$\frac{1}{1\cdot 2}+\frac{3}{2\cdot 5}+\frac{5}{5\cdot 10}+\frac{7}{10\cdot 17}+\cdots+\frac{2k-1}{[(k-1)^2+1](k^2+1)}+\cdots$$

Q2. Find all values of x for which the following series converges

$$\sum_{k=0}^{\infty}2^k\sin^k x$$

Q3. Test for convergence:

$$\sum_{k=1}^{\infty}\frac{1\cdot 3\cdot 5\cdots(2k-1)}{2\cdot 5\cdot 8\cdots(3k-1)}$$

Q4.Determine wither the following series converges, and if so find its sum

$$\frac{1}{2}-\frac{1}{3}+\frac{1}{2^2}-\frac{1}{3^2}+\frac{1}{2^3}-\frac{1}{3^3}+\cdots$$

Q5.Test for convergence:

$$\sum_{k=1}^{\infty}\frac{\ln\sqrt{3k-1}}{\sqrt{k}\sqrt{k^3+5k+2}}$$