Do the following series converge? Why or why not? If so, what do they converge to?

Problem 1. $\displaystyle\sum_{n=1}^{\infty} n^2$

Problem 2. $3 + \dfrac{3}{4} + \dfrac{3}{16} + \dfrac{3}{64} + \cdots$

Problem 3. $\dfrac{1}{2} + \dfrac{2}{3} + \dfrac{3}{4} + \dfrac{4}{5} + \cdots$

Problem 4. $\displaystyle\sum_{n=0}^{\infty} e^{-2n}$