**WRITE YOUR NAME:**

MAC 2312 Quiz 21
Tuesday April 9th

Determine whether the series converges or diverges.

$$\sum_{n=1}^{\infty} \frac{n^2}{3^n}$$

Try ratio test. $a_n = \dfrac{n^2}{3^n}$ $\quad a_{n+1} = \dfrac{(n+1)^2}{3^{n+1}}$

$$R = \lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right| = \lim_{n\to\infty}\left|\frac{(n+1)^2}{3^{n+1}} \div \frac{n^2}{3^n}\right|$$

$$= \lim_{n\to\infty}\left|\frac{(n+1)^2}{3^{n+1}} \cdot \frac{3^n}{n^2}\right| = \lim_{n\to\infty}\left|\frac{(n+1)^2}{n^2} \cdot \frac{3^n}{3^{n+1}}\right|$$

$$= \lim_{n\to\infty}\left|\frac{n^2+2n+1}{n^2} \cdot \frac{1}{3}\right| = \lim_{n\to\infty}\left(\frac{n^2+2n+1}{n^2} \cdot \frac{1}{3}\right)$$

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

Since $R = \lim_{n\to\infty}\left|\dfrac{a_{n+1}}{a_n}\right| = \dfrac{1}{3}$ is LESS than 1,

we conclude by the ratio test that the given series CONVERGES.