Name: ______________________ **ID:** ______________

Clear your desk of everything except pens, pencils and erasers. Show all work clearly and in order. No notes, phones and calculators. You have 10 minutes to finish these two problems for 10 points. (**Formula Sheet is on the back**.)

1. (6 points) Determine whether the following SERIES is convergent or divergent, state the reason (test).

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

Direct C.T.

$2n^3-1 < 2n^3$

$\frac{n^2}{2n^3-1} > \frac{n^2}{2n^3} = \frac{1}{2n}$

$\sum \frac{1}{2n}$ DIV $\Rightarrow \sum \frac{n^2}{2n^3-1}$ DIV.

Limit C.T.

$a_n = \frac{n^2}{2n^3-1}$, $b_n = \frac{n^2}{2n^3} = \frac{1}{2n}$.

$\lim_{n\to\infty} \frac{a_n}{b_n} = \lim_{n\to\infty} \frac{n^2}{2n^3-1} \cdot 2n = 1 \neq 0$.

$\sum b_n$ DIV $\Rightarrow \sum a_n$ DIV.

- $$\sum_{n=1}^{\infty} \frac{4^n}{n!3^n}.$$

Ratio Test:

$\lim_{n\to\infty} \frac{a_{n+1}}{a_n} = \lim_{n\to\infty} \frac{4^{n+1}}{(n+1)!\cdot 3^{n+1}} \cdot \frac{n!\cdot 3^n}{4^n} = \lim_{n\to\infty} \frac{4}{(n+1)\cdot 3} = 0 < 1$

$\Rightarrow \sum \frac{4^n}{n!\cdot 3^n}$ is convergent.

2. (4 points) Which statements about the series $\sum_{n=0}^{\infty} \frac{\cos n}{7^n}$ is true? State the reason.

I. Absolutely Convergent; **II**. Convergent; **III**. Divergent.

$\left|\frac{\cos n}{7^n}\right| = \frac{|\cos n|}{7^n} \leq \frac{1}{7^n}$, $\sum \frac{1}{7^n}$ is convergent (Geometric Series)

implies $\sum \left|\frac{\cos n}{7^n}\right|$ is convergent (Comparison Test)

implies $\sum \frac{\cos n}{7^n}$ is absolutely convergent and therefore is convergent.