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Sign Your Name: \_\_\_\_\_

Please clearly organize your work, show all steps, simplify all answers, and BOX your answers.

1. (3 points) For the given series  $\sum a_n$ , write the ratio  $\frac{a_{n+1}}{a_n}$  from the ratio test. Simplify your answer but *do not* take a limit.

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

$$\frac{a_{n+1}}{a_n} = \boxed{\phantom{\frac{a_{n+1}}{a_n}}}$$

2. (3 points) Briefly explain the flaw in the following argument. Use complete sentences, justify your reasoning, and use correct terminology from the class.

The series  $\sum_{n=2}^{\infty} \frac{\sqrt{n}}{\sqrt{n^3-1}}$  converges by the direct comparison test, since you can compare the terms  $a_n = \frac{\sqrt{n}}{\sqrt{n^3-1}}$  to the terms  $b_n = \frac{\sqrt{n}}{\sqrt{n^3}} = \frac{1}{n}$ .

3. (8 points) Determine if each series converges or diverges. Fully justify your answer for credit, *e.g.*, state the convergence test you used and clearly state the necessary conditions for the test you are using. Points will be deducted for arguments that are not clearly organized.

(a) 
$$\sum_{n=2}^{\infty} \frac{\sqrt{n}}{\sqrt{n^3 - 1}}$$

(b) 
$$\sum_{n=1}^{\infty} \left( \frac{4n + 3}{3n - 5} \right)^n$$