Ask! Indicate your approach! Show your work! Good Luck! There are 10 problems, 6 pages, and 120 points.

(1) [10] Find $\int\int_{\partial D} x\,dy\,dz$, where D is the "can" with height 3 whose base is the unit circle in the xy-plane. If you use a Theorem to evaluate this integral, state the Theorem's formula and the conditions!

(2) [10] Let S denote the "lower" part of ∂D in # 1 (all but the top). Find $\int\int_S \text{curl}\,\mathbf{v} \bullet \mathbf{n}\,d\sigma$, where $\mathbf{v} = (y^3 - z^3)\mathbf{i} + (z^3 - x^3)\mathbf{j} + (x^3 - y^3)\mathbf{k}$. If you use a Theorem to evaluate this integral, state the Theorem's formula and the conditions!

(3) [10] Find $\int_C (y^2+z^2)\,dx + (z^2+x^2)\,dy + (x^2+y^2)\,dz$, where C is given by $t\mathbf{i} - t^2\mathbf{j} + t^3\mathbf{k}$, with $-1 \le t \le 2$. If you use a Theorem to evaluate this integral, state the Theorem's formula and the conditions!

(4) [10] Find $\sum_{n=1}^{\infty} \frac{2^{n+1}}{3^n}$. If you use a Theorem to evaluate this series, state the Theorem's formula and the conditions!

Scratch Page **Be sure to CLEARLY link work here to a problem! Put the link THERE too!**

(5) [10] Give an example of a series whose terms tend to zero, but which does not converge. Justify your answer!

(6) [10] Give an example of an alternating series whose terms tend to zero, but which does not converge. Justify your answer! Hint: Remember exactly what the Alternating Series Test needs.

(7) [10] Determine whether or not the following series converge, and for which x, if an x is present. Justify your answers!

(a) $\sum_{n=0} \frac{x^n}{n!}$ (b) $\sum_{n=0} \frac{x^{n^2}}{(n^2)!}$ (c) $\sum_{n=0} \frac{n!}{n^n}$ Note: you may use without proof that $(1 + (1/n))^n \to e > 2$.

(8) [15] Determine whether or not the following sequences converge, and for which x, if an x is present. Justify your answers!

(a) $\{x^n\}$ (b) $\{x^n/n\}$ (c) $\{nx^n\}$

(9) [10] State the Monotone Convergence Theorem and the Nested Intervals Theorem and **briefly** say how one of them is used to prove the other one.

(10) [10] State the Ratio Test and the Root Test and **briefly** say how they are both proved, using a certain Theorem that you should state in its extended form.