

NAME: _____

Read all of the following information before starting the exam:

- **WRITE YOUR NAME AT THE TOP OF EACH PAGE** (you will lose points otherwise)
- **DO NOT WRITE ON THE FRONT OR BACK OF THE FIRST PAGE** other than writing your name.
- Show all work and give explanations where needed. I reserve the right to take off points if I cannot see how you arrived at your answer (even if your final answer is correct).
- Use only the paper provided, your one page notes and a pen or pencil.
- Write your answer in the box provided.
- This test has 6 problems. and is worth 85 points, It is your responsibility to make sure that you have all of the pages!
- Good luck!

1	
2	
3	
4	
5	
6	
total	

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1. (20 points) Choose 5 of the following to do and make it clear which you have chosen. Decide whether the following series converge. If they converge and you can decide what they converge to then give the value. You are expected to know for which convergent series you can find the limit.

(a)
$$\sum_{k=4}^{\infty} \frac{(-1)^{k+1}}{3^k}$$

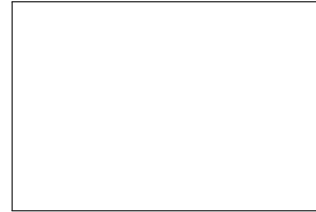


(b)
$$\sum_{k=1}^{\infty} \frac{\arctan(k)}{k^2}$$



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(c) $\sum_{k=0}^{\infty} (-1)^k \left(\frac{k^2 + 2k + 2}{k^3 + 15k + 1} \right)$

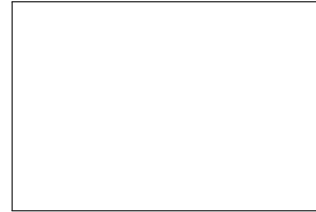


(d) $\sum_{k=1}^{1003} \frac{2}{k^2 + 2k}$



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(e)
$$\sum_{k=0}^{\infty} \frac{k^k}{(k+1)!}$$

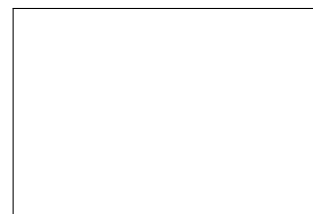
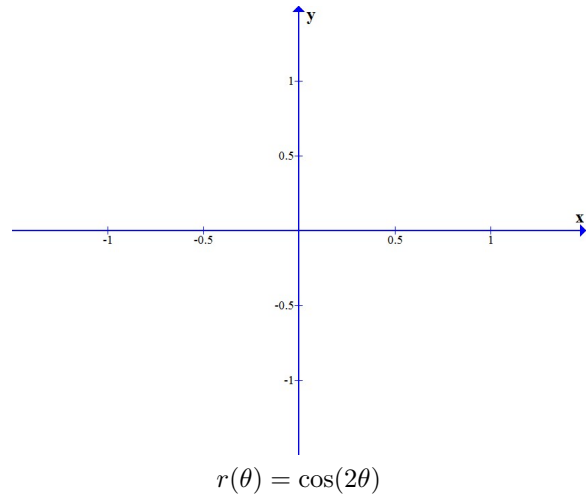
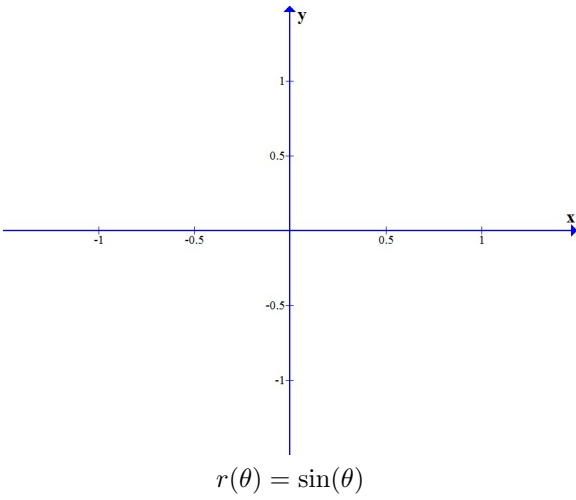


(f)
$$\sum_{k=0}^{\infty} \frac{k}{e^{k^2}}$$



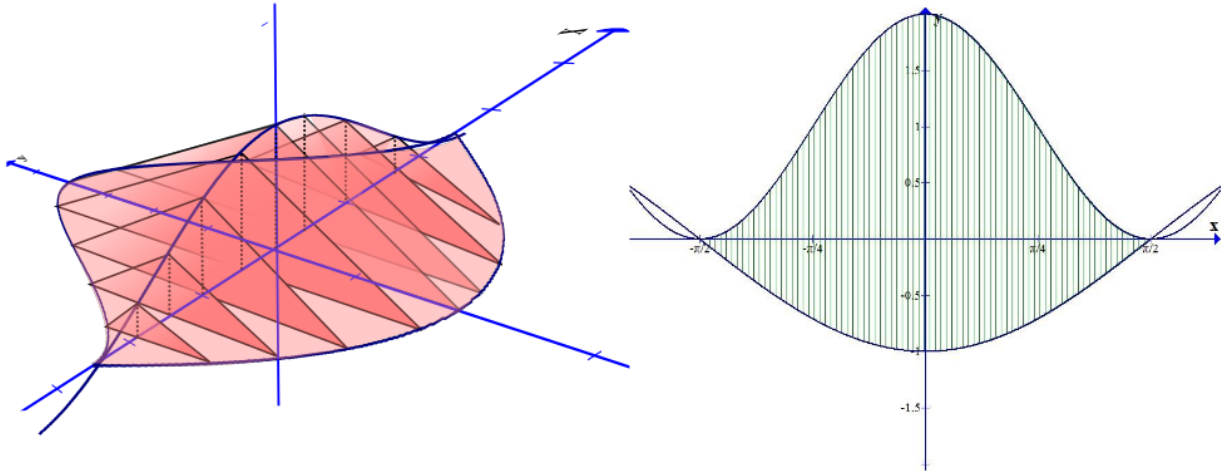
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2. (15 points) Graph the polar functions $r(\theta) = \sin(\theta)$ and $r(\theta) = \cos(2\theta)$ then find the area bounded inside $r(\theta) = \cos(2\theta)$ outside $r(\theta) = \sin(\theta)$ in the first quadrant.



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3. (10 points) Let R be the region bounded by $f(x) = 2 \cos^2(x)$ and $f(x) = -\cos(x)$. Find the volume (ignore units) of the shape which is above R and consists of triangular cross sections perpendicular to R and parallel to the y -axis, the triangles have height $h(x) = \cos(x)$.



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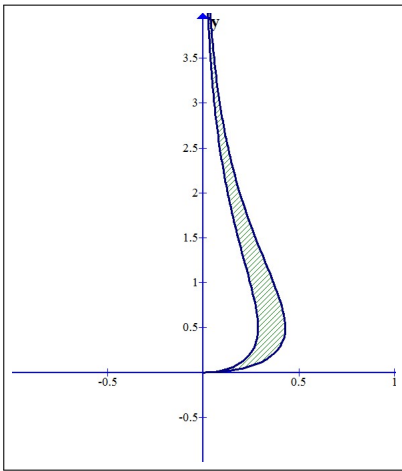
4. (15 points)

(a) Integrate $\int_0^a \frac{y}{e^{2y}} dy$ where a is a constant



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- (b) Let R be the region enclosed by $y = 0$, $f(y) = \frac{y^{\frac{1}{2}}}{e^y}$ and $f(y) = \frac{y^{\frac{1}{2}}}{\sqrt{2}e^y}$. An ambitious vase maker is going to make a vase by rotation the region R about the y -axis how much clay will they need (ignore units).



- (c) The vase maker's close friend (who happens to be a pump maker) cautions the vase maker that his project is unreasonable because it would take a lot of work to pump the water out of the vase (pump makers are against pouring water out of vases for obvious reasons...and really how does one tip an infinite vase.) So the vase maker takes on a much less exciting project and bounds the height of the vase by $\ln(8)$. Assume the density of water is ρ and gravity is g set up the integral to find the work to lift water out of the short vase but **do not integrate** (ignore units.)



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5. (15 points)

(a) Find a power series representation $f(x) = \ln(1 - x^2)$ and state its radius of convergence.

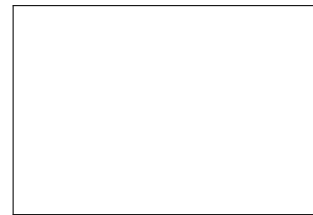
An empty rectangular box with a thin black border, intended for the student to write their answer to part (a).

(b) Find the 3-rd order Taylor polynomial for $f(x) = x \ln(x)$ with center 1.

An empty rectangular box with a thin black border, intended for the student to write their answer to part (b).

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(c) let $f(x) = \sum_{k=0}^{\infty} \frac{(x-2)^k}{\sqrt{k}}$ find the interval of convergence.



6. (10 points) Find the the Value for k so that areas A and B are equal

