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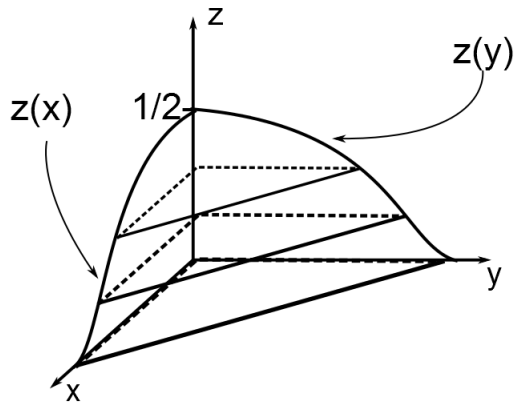
Read all of the following information before starting the exam:

- **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 50 points, It is your responsibility to make sure that you have all of the pages!
- Good luck!

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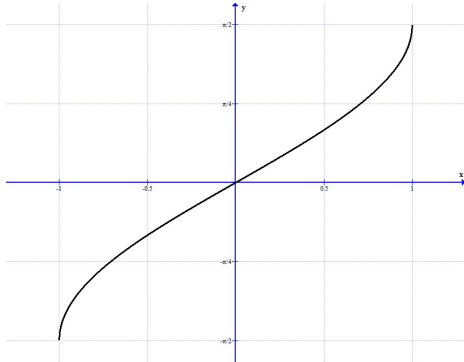
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1. (9 points) Compute the work required to lift the water out of the tank shown in the picture below (that is lift the water in the tank to the height of the tank) use ρ as the density constant for water, and g as the acceleration constant for gravity. The two functions given are $z(x) = e^{(-x^2)-\frac{1}{2}}$ and $z(y) = e^{(-y^2)-\frac{1}{2}}$.



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2. (9 points) Compute the Volume of the hour glass obtained by rotating the region bounded by $y = \arcsin(x)$ about the y -axis. See the picture below, remember the range of $\arcsin(x)$ is bounded between $-\frac{\pi}{2}$ and $\frac{\pi}{2}$.



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3. (9 points) Let R be the region bounded by $f(x) = \cos(x^2)$, $x = 0$, $x = \sqrt{\frac{\pi}{2}}$ and the x -axis. Compute the mass of the shape obtained by rotating R about the x -axis if the shape has a density function $\rho(x) = x^3$.

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4. (8 points) Let $f(x) = \frac{x}{x^2-1}$.

a) Does $\sum_{n=2}^{\infty} f(n)$ converge or diverge. If it converges give the value it converges to.

b) Compute $\int_{-\frac{1}{2}}^{\frac{1}{2}} f(x) dx$. Explain how this integral changes if the limits of integration are from $\frac{1}{2}$ to $\frac{3}{2}$.

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5. (6 points) An eagle is standing on the edge of a river which is 930 feet across. It takes off and flies in a path given by $y = \frac{2}{3}x^{\frac{3}{2}}$ starting at $x = 0$. It flies for 1800 feet (not horizontal feet nor vertical feet but along the path given) then plummets straight down. Does the eagle land in the river (and hopefully live) or to the hard earth below (where it will certainly die...?) How far does the eagle fall?

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6. (9 points) Choose 3 of the following 4 integrals to compute.

a) $\int \frac{\sqrt{4x^2 - 2}}{x} dx$

b) $\int_0^1 \sin^3(\pi x) \cos^4(\pi x) dx$

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c) $\int_0^1 \arctan(x) dx$

d) $\int x^3 \sqrt{1+x^2} dx$