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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 that 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 you answer in the box provided.**
- **This test has 5 problems. and is worth 70 points, It is your responsibility to make sure that you have all of the pages!**
- **Good luck!**

1	
2	
3	
4	
5	
total	

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1. (*20 points*) Compute the following integrals:

(a) $\int \tan^4(x)\sec^4(x)\,dx$

(b) $\int \frac{dx}{(1+4x^2)^{\frac{3}{2}}}$

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(c) $\int_{-1}^{1} \frac{x+1}{-x^2-2x}\ dx$

(d) $\int \frac{4}{(x^2-1)(x+1)\ dx}$

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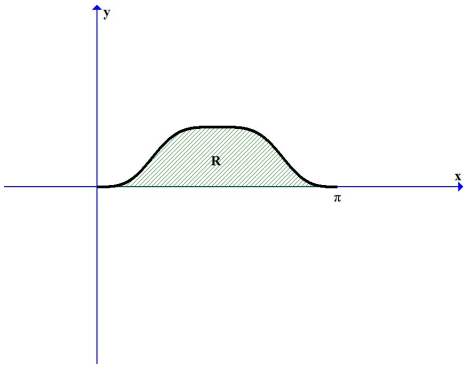
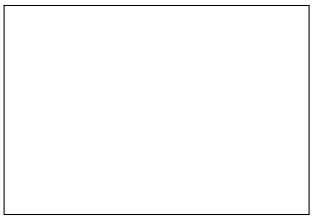
2. (*10 points*) Let R be the region bounded by $f(x) = \sin^3(x)\cos^2(x)$ the x-axis, $x = 0$ and $x = \pi$ (see picture below) set up the integral find the volume obtained by rotation R about the X-axis. Do not integrate.





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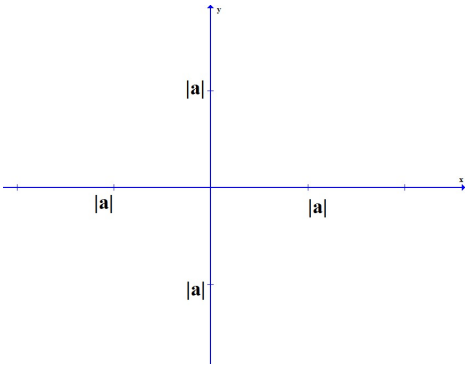
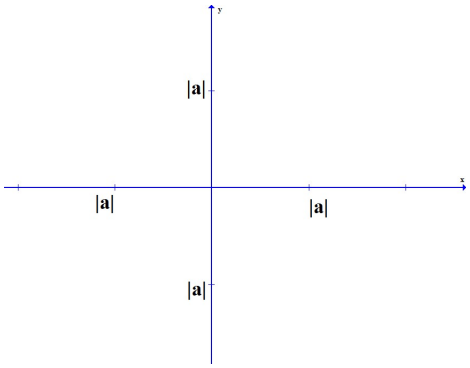
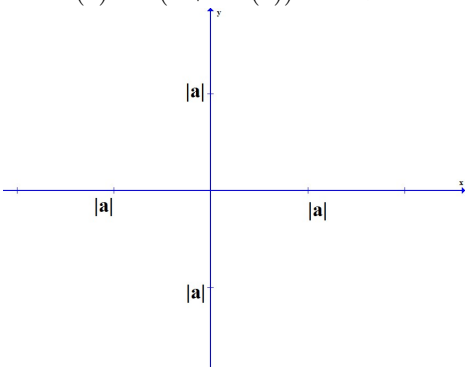
3. (*20 points*) Graph the following polar equations, then answer the question.



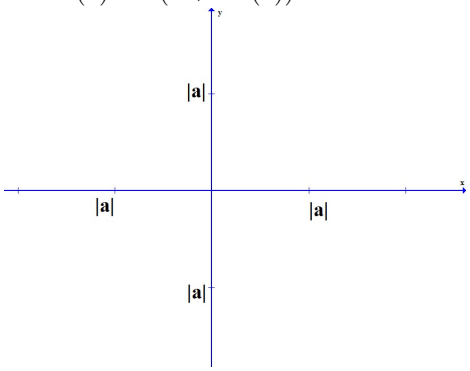
$r(\theta) = a(1 + \cos(\theta))$ for $a > 0$



$r(\theta) = a(1 + \cos(\theta))$ for $a < 0$



$r(\theta) = 2a\cos(\theta)$ for $a > 0$



$r(\theta) = 2a\cos(\theta)$ for $a > 0$

Find the between $r_1(\theta) = 2\cos(\theta)$ and $r_2(\theta) = -2(1 + \cos(\theta))$. Be careful with the limits of integration, the curves have a different periods (they finish their cycles at different θ's.)

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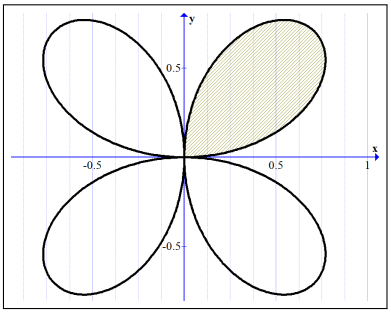
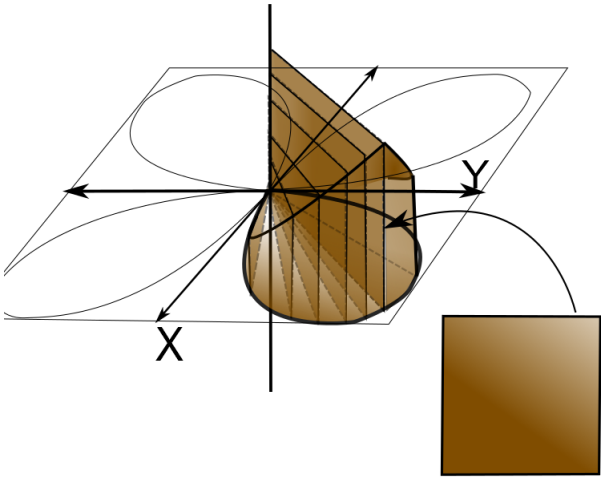
4. (*10 points*)
Let A be the 2 dimensional region enclosed by the polar equation $r(\theta) = \sin(2\theta)$ for $0 \leq \theta \leq \frac{\pi}{2}$ and V be the solid with base A whose cross sections are squares perpendicular to the base which radiate outwards from the center to the edge of the shape (see picture below.)

(a) Find the function $f(\theta)$ so that the volume of V is given by $\int 0\frac{\pi}{2} f(\theta)\, d\theta$
(hint: the estimating shape is not a square prism.)

(b) Find the volume of V i.e. evaluate $\int_0^{\frac{\pi}{2}} f(\theta)\, d\theta$.

(c) Let B was the 2 dimensional region enclosed by $r(\theta) = \sin(2\theta)$ for $0 \leq \theta \leq 2\pi$ and W the solid with base B whose cross sections are squares perpendicular to the base which radiate outwards from the center to the edge of the shape. Then is the volume of W given by $\int_0^{2\pi} f(\theta)\, d\theta$ where $f(\theta)$ is the function you found in part (a)





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5. (*10 points*) Choose either problem 1 or 2 but not both, make it clear which problem you choose.

1. (a) Give the parametric equation (in terms of t) for a circle of radius one oriented in the counter-clockwise direction which finishes a full cycle on the interval $0 \leq t \leq 2\pi$.

   (b) Give a parametric equation for a line segment between the points $(3, 2)$ and $(5, 1)$ make sure to include the interval for t

   (c) Give the equation (in terms of x and y) of the tangent line to the parametric curve $x(t) = \sin(2t)$, $y(t) = 2\sin(t)$ at the point $(\frac{\sqrt{3}}{2}, 1)$.

2. Compute the following integral

$$\int_{-\pi}^{\pi} x \sin^2(2x) \cos(2x)\ dx$$