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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. If you need additional scratch paper some will be provided.**
- **Write you answer in the box provided.**
- **This test has 5 problems with one bonus problem and is worth 45 points (not counting the bonus problem, It is your responsibility to make sure that you have all of the pages!**
- **Good luck!**

1	
2	
3	
4	
5	
Bonus	
total	

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1. (*12 points*) Evaluate the following integrals, be sure to check if they are improper.

a) $\int_0^1 \frac{x^4+x^3+x^2+3x+1}{x^3+x^2+x+1}\,dx$

b) $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos(x)\csc^2(x)\,dx$

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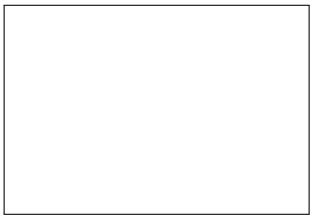
c) $\int_{-\infty}^{0} \frac{x}{x^2+2x+2}\, dx$



2. (*5 points*) Give a parametric equation for a circle of radius 2 oriented in the clockwise direction centered at $(0, -2)$ with initial point $(0, 0)$.

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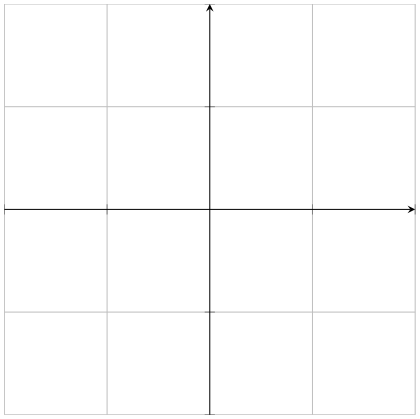
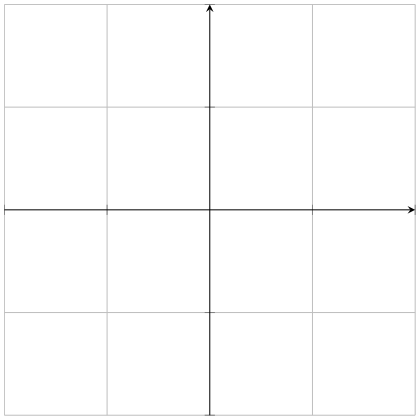
3. (*12 points*) Graph the following functions. Label the x and y axis values or points on the curve (make it clear you know what the graph looks like.)

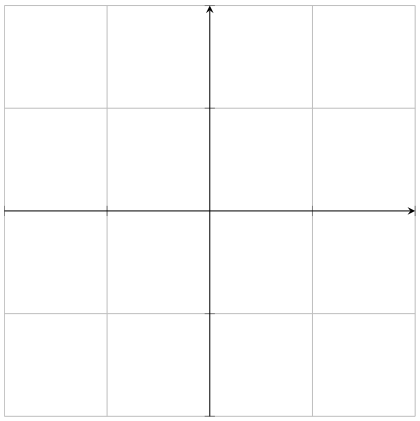
1. Parametric equation $x(t) = 1 + t$ $y(t) = 1 - 2t$ for $-1 \leq t \leq \frac{1}{2}$



2. Parametric equation $x(t) = \tan(t)$ $y(t) = \sec^2(t) - 1$ for $\frac{\pi}{4} \leq t < \frac{\pi}{2}$. Hint: eliminate the parameter.



3. The polar function $r(\theta) = \frac{2}{2\cos(\theta)+3\sin(\theta)}$. Hint: convert to a Cartesian function.



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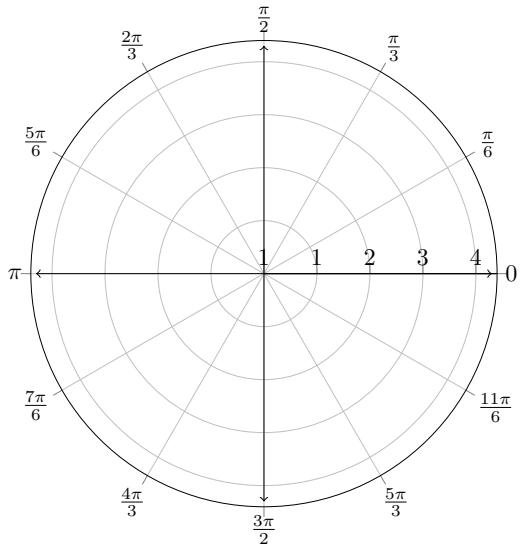
4. (*8 points*)

1. Plot both the polar curves $r(\theta) = -2 + 2\cos(\theta)$ and $r(\theta) = 2\cos(\theta)$on the graph given below. It is a good idea to check your graphs by plugging points into the functions.

2. Compute the area in the first quadrant bounded inside $r(\theta) = -2 + 2\cos(\theta)$ and outside $r(\theta) = 2\cos(\theta)$



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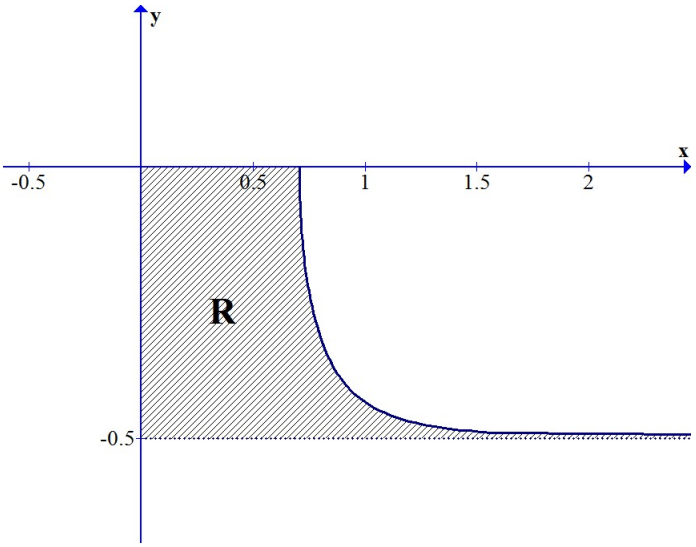
5. (*8 points*) Suppose you have a water "tank" obtained by rotating the region R about the y-axis (this is an infinitely wide shape but treat this as a normal work problem). R is the region in the fourth quadrant bounded below by $f(x) = -\frac{1}{2}$ and above by $y = \left(\frac{1}{\sqrt{4-16y^2}}\right)^{\frac{1}{2}}$.



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6. (*4 points*) This is a bonus problem, the points will be added to your score (up to a maximum of 45 points.) Graph the polar equation $r(\theta) = 1 - 2\sin(4\theta)$, then set up the integral to find that area inside one big and one small petal.