

Instructions:

PLEASE PROVIDE STEP BY STEP EXPLANATIONS

ANSWERS WITHOUT EXPLANATION WILL ONLY GET 40%

Time Limit 45 minutes

Please read the questions carefully before answering

It is recommended that you try those problems you are most comfortable with, first.

Attempt as many as you can; Anything over 100 is extra credit.

1. (10 pts) Convert the following to polar co-ordinates: $xy = 1$.
2. (15 pts) Sketch the curve in polar co-ordinates by marking the graph at $\theta = 0, \pi/3, \pi/6, \pi/2, 2\pi/3, \pi$ and using symmetry: $r = 2 + \sin\theta$. Say what kind of curve it is.
3. (15 pts) Find the slope of the tangent line to the polar curve $r = 1 - \cos\theta$ at $\theta = \pi/2$.
4. (15 pts) Find the area of the region enclosed by the circle $r = 2\cos\theta$ using integration over θ .
5. (15 pts) Find the length of the arc of the curve $r = 2\sec\theta$ from $\theta = 0$ to $\theta = \pi/4$.
6. (15 pts) Sketch the ellipse with equation $16x^2 + 25y^2 = 400$ and label the vertices, foci, and the ends of the minor axis.
7. (15 pts) Sketch the hyperbola with equation $xy = 1$ by finding its equation after rotating the co-ordinate axes and label the vertices and foci.
8. [Challenge problem, 20 points] The planets' orbits around the sun is an ellipse, with the sun at one of the foci. We can write the equation of the ellipse in the form $r = \frac{ed}{1 + e\cos\theta}$ where d and e are constants and the pole is at one of the foci (in this case we can take that as the focus where the sun is) and the polar axis is also the major axis. Find the farthest and closest that the planet is to the sun, in terms of d and e .