

Name _____

Honors Advanced Mathematics Test

Class block _____

Sections 6.4–6.6

March 23, 2005

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Part A (60%) _____
Part B (40%) _____
overall _____

Write complete, fully explained solutions. If you use your calculator for a significant step, tell what you did on the calculator.

Note: $\text{cis } \theta$ is an abbreviation for $(\cos \theta + i \sin \theta)$.

Part A. Polar coordinates and equations

1. a. Find the ranges of possible r -values for these two polar equations.

$$r = 3 + 7 \sin(2\theta) \quad \text{range: } \underline{\hspace{2cm}}$$

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- b. For the polar graph of $r = 3 + 7 \sin(2\theta)$, find the lengths of all the “leaves” (or “petals”).

- c. Explain why the polar graph of $r = 7 + 3 \sin(2\theta)$ does not pass through the origin.

2. Write any polar equation whose graph fits each of the following descriptions.

No explanations or justifications are required.

- a. a circle centered at the origin

- b. a circle not centered at the origin

- c. a line passing through the origin

- d. a line not passing through the origin

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3. You are given the following **polar** coordinates for points: $X = (2, \frac{\pi}{6})$ and $Y = (4, \frac{2}{3}\pi)$.

Let O stand for the origin.

a. Find the rectangular coordinates of points X and Y .

b. Calculate the vector dot product $\vec{OX} \cdot \vec{OY}$.

c. Using the result of part **b**, draw a conclusion about triangle $\triangle OXY$.

d. Find the distance XY .

4. a. Convert the equation $x^2 + 6y + y^2 = 0$ into polar form, and simplify as much as possible.

b. Convert the equation $r = \tan \theta$ into rectangular form, and simplify as much as possible.

c. Find a pair of parametric equations that would have the same graph as the polar equation $r = \sin(4\theta)$.

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2. Let $u = \frac{\sqrt{3}}{2} + \frac{1}{2}i$. Perform these calculations, and express your final answers in $a + bi$ form.

a. Calculate u^{11} .

b. Calculate $\frac{1}{u}$.

3. In the complex number system, find the cube roots of -216 . Express your final answers in $a + bi$ form.