Honesty Pledge

On my honor, by printing and signing my name below, I vow to neither receive nor given any unauthorized assistance on this examination:

NAME (PRINT): _____   SIGNATURE: _____

Directions

- YOU ARE ALLOWED TO USE ONLY A SCIENTIFIC CALCULATOR ON THIS EXAM.

- You have 85 minutes to complete this exam.

- The exam totals **110 points**.

- There are 8 problems, many of them with multiple parts.

- Place all of your belongings in the front of the classroom and I will assign you a seat. Bring with you your writing utensils.

- Cell phones must be turned off and put away in with your items in the front of the classroom.

- Handwriting should be neat and legible. If I cannot read your writing, zero points will be given.

- Some questions contain multiple-parts which you must do individually and the parts are denoted by (a), (b), (c), etc. Some questions are multiple-choice and the choices are denoted with (A), (B), (C), (D), and (E). For True/False questions, you must spell out the entire word "true" or "false" in your answer.

- Make sure to ALWAYS SHOW YOUR WORK; you will not receive any partial credits unless work is clearly shown. *If in doubt, ask for clarification.*

- A problem which requires a **proof** means you must provide a general proof in complete sentences. Do not use logical short-hand in proofs.

- Leave answers in exact form (as simplified as possible), unless told otherwise.

- Put a | box around your final answer | where applicable.

- **PLEASE CHECK YOUR WORK!!!**

Score	Grade

This page is intentionally blank. It may be used for scratch paper. If you wish for me to grade your work on this page, please (i) label the problem you are working on, (ii) box your answer, (iii) indicate in the original problem's location that you will continue your work on this page.

Problem 1: 20 pts (2 pts each)

Fill-in the blank: *(No work needed)*

(a) A **polar equation**, is an equation in the variables _____ .

(b) The **equation for a line through origin** in polar coordinates is of the form _____ .

(c) Given a point $P = (x, y)$ in rectangular coordinates, to find the **angle** θ we must use the formula _____ .

(d) If $z = r(\cos(\theta) + i\sin(\theta))$ is a complex number in polar form,

then **De Moivre's Theorem** says _____ .

(e) The definition of the **dot product** between $\vec{u} = \langle u_1, u_2 \rangle$ and $\vec{v} = \langle v_1, v_2 \rangle$ is _____ .

TRUE or **FALSE** (please spell out/write the entire word for credit). *(No work needed)*

(a) _____ In **polar coordinates**, the points $P = (r, \theta)$ and $Q = (-r, \theta + \pi)$ correspond to the <u>same</u> point.

(b) _____ The **parametric equations** <u>only</u> tell us information about the shape of the curve and do not tell us the direction it is traced out.

(c) _____ The **dot product** between two vectors $\vec{u}$ and $\vec{v}$ is another vector.

(d) _____ If the **angle** between two <u>unit</u> vectors $\vec{u}$ and $\vec{v}$ is 115°, then $\vec{u} \bullet \vec{v}$ is negative.

(e) _____ The terms orthogonal and perpendicular mean the same thing.

Problem 2: 4 pts

Please give **exact values!** You must show work/formulas used to receive full credit.

(a) The point $P = (12, 7\pi/6)$ is given in polar coordinates, express P in rectangular coordinates.

(b) The point $P = (8, 8)$ is given in rectangular coordinates, express P in polar coordinates.

Problem 3: 8 pts

Solve the following. Please give **exact values!** You must show work/formulas used to receive full credit.

(a) **Convert** the polar equations into equations in rectangular coordinates: $r = 3\cos(\theta)$

(b) Provide a **graph** of the polar equation in part (a). Label at least 4 distinct points on your graph.

Problem 4: 24 pts – 3 pts each

Solve the following. Please give **exact values!** You must show work/formulas used to receive full credit.
Let z_1, z_2 be two complex numbers:
$$z_1 = 4 + 4i \quad \text{and} \quad z_2 = 1 + \sqrt{3}i$$

(a) Find the **modulus** of z_1: $|z_1|$

(e) Find the **modulus** of z_2: $|z_2|$

(b) Find the **argument** of z_1: θ_1

(f) Find the **argument** of z_2: θ_2

(c) Express z_1 in **polar form**

(g) Express z_2 in **polar form**

(d) **Compute:** $z_1 \cdot z_2$ and express your answer in polar form.

(h) **Compute:** z_2^6 and express your answer in polar form.

Problem 5: 5 pts

Find the three **roots of unity**, that is the three complex solutions to the equation $z^3 = 1$. In other words, find the **cube roots** of 1. **Sketch** these roots in the complex plane.

Problem 6: 20 pts

Sketch the following **parametric equations**. Use arrows to indicate the direction of the curve as t increases.

(a) $\begin{cases} x &= \sqrt{t} \\ y &= 1 - t \end{cases}$

(b) $\begin{cases} x &= 2\cos(t) + 3 \\ y &= 4\sin(t) \end{cases}$

Find the **rectangular-coordinate equation** for the curves above by **eliminating the parameter**.

(c) The parametric equations in part (a)

(d) The parametric equations in part (b)

Problem 7: 24 pts

Let $\vec{u} = \langle 5, 1 \rangle$ and $\vec{v} = \langle -1, 4 \rangle$ be two vectors in the plane.

(a) **Compute:** $2\vec{u} - 3\vec{v}$

(d) **Compute:** $|\vec{u} + \vec{v}|$

(b) **Compute:** $\vec{u} \bullet \vec{v}$

(e) Are $\vec{u}$ and $\vec{v}$ **orthogonal**?

(c) Find the **angle** between $\vec{u}$ and $\vec{v}$

(f) Find the **component** of $\vec{u}$ onto $\vec{v}$

(6 pts) **Resolve** $\vec{u}$ into two vectors $\vec{u}_1$ and $\vec{u}_2$, where $\vec{u}_1$ is **parallel** to $\vec{v}$ and $\vec{u}_2$ is **orthogonal** to $\vec{v}$.

Problem 8: 5 pts

Let $\vec{v} = \langle v_1, v_2 \rangle$ be any vector in the plane. **Prove:** $|\vec{v}|^2 = \vec{v} \bullet \vec{v}$.

Post Exam Survey

Now that you have finished the exam, please take a few minutes to reflect on how you prepared for the exam and how you think you did. Then answer these questions.

1. When taking the exam I felt
    (a) Rushed. I wanted more time.
    (b) Relaxed. I had enough time.
    (c) Amazed. I had tons of extra time.

2. The week before the test I did all my homework on time: YES   NO

3. The week before the test, in addition to the homework I followed a study plan.   YES   NO
    (a) I think this helped: YES   NO

4. The day before the test I spend _____ hours studying and reviewing.
    (a) I think that was enough time: YES   NO

5. The night before the test:
    (a) I stayed up very late cramming for the test
    (b) I stayed up very late, but I wasn't doing math
    (c) I didn't need to cram because I was prepared
    (d) I got a good night's sleep so my brain would function well.

6. I think I got the following grade on this test: _____

7. Strategies that worked well for me were (please elaborate):

8. Next time I will do an even better job preparing for the test by: