Math 126D **Midterm I** **Autumn 2010**

Your Name _____

Student I.D.# | | | | | | | | **Quiz Section** | | |

TA's Name _____

HONOR STATEMENT

"I affirm that work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam."

SIGNATURE: _____

Score

1.	(25)	
2.	(25)	
3.	(25)	
4.	(25)	
Total	(100)	

- Your exam should consist of this cover sheet, followed by four problems. Check that you have a complete exam.
- If you cannot complete a problem in the given space, then continue your work on the back of the page or on the back of the preceding page. *If you do continue your work any place other than the given space for the problem, make sure you note where it is so the grader can find it.*
- Answers with insufficient work shown may not get full credit. Show enough work on each problem for the grader to tell how you obtained your answer. This may also help you get some partial credit if your answer is incorrect or incomplete. Using a few words of English may help the grader understand your work. You should show enough work so that a grader can give you partial credit if your final answer is not complete.
- Unless otherwise indicated, your answers should be exact values rather than decimal approximations. (For example, $\frac{\pi}{4}$ is an exact answer and is preferable to its decimal approximation 0.7854.)
- You may use a scientific calculator and one 8.5×11-inch sheet of handwritten notes. All other electronic devices (including graphing calculators) are forbidden.
- Turn your cell phone OFF and put it AWAY for the duration of the exam.

Good luck!

 # 1. (25 points) The points $A(1,2,3)$, $B(0,1,3)$, and $C(2,-1,-1)$ determine a triangle.

(a) Find the interior angle of the triangle at vertex A.

(b) What is the area of the triangle?

(c) What is the equation for the plane containing the points A, B,and C?

(d) What is the distance from the point $D(2,0,1)$ to the plane containing A, B, and C?

(a) angle:

(b) area:

(c) plane:

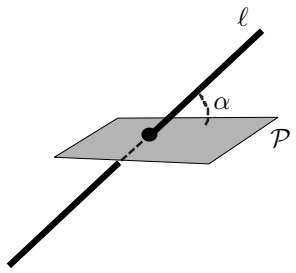
(d) distance:

 # 2. (25 points) Let $\mathcal{P}$ be the plane given by the equation $2x + y + z = 2$; and let ℓ be the line passing through the points $A(1, 1, 1)$ and $B(1, 1, -1)$.

(a) Find a parametric equation for ℓ. (Give your answer in vector form $\mathbf{r} = \mathbf{r}(t)$.)

(b) Find the point Q where ℓ intersects $\mathcal{P}$.

(c) The line ℓ intersects $\mathcal{P}$ at an angle α. Find α.



(a) $\mathbf{r}(t) =$

(b) $Q =$

(c) $\alpha =$

 # 3. (25 points) A bug moves in the (x, y) plane according to the parametric equation

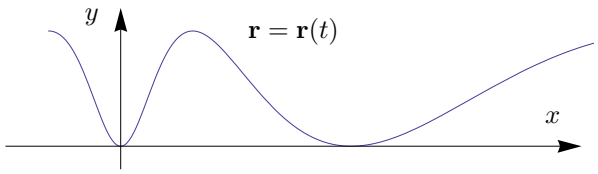
$$\mathbf{r} = (t + t^3)\,\hat{\mathbf{i}} + \sin^2(\pi t)\,\hat{\mathbf{j}}\,,$$

where t denotes time in seconds and position is measured in meters. The bug is located at the origin at time $t = 0$ and touches the x-axis again at time $t = b$, as shown in the figure below.

(a) Give the first time after time $t = 0$ and before time $t = b$ when the velocity of the bug is parallel to the x-axis.

(b) Express the area of the region above the x axis and below the trajectory of the bug for $0 \le t \le b$ as a definite integral. Simplify your expression, but do not attempt to evaluate the integral.

(c) Express the distance the bug travels in the time interval $0 \le t \le b$ as a definite integral. Simplify your expression, but do not attempt to evaluate the integral.



(a) $t =$

(b) area =

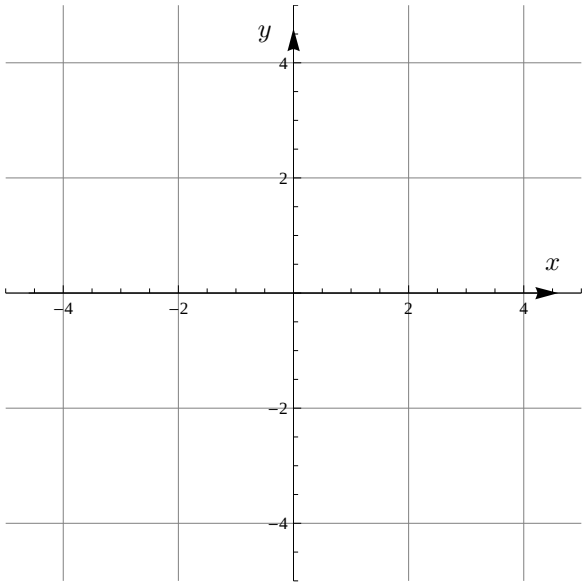
(c) distance =

 # 4. (25 points) Consider the curve given in polar form by the formula $r = 1 - 2\cos(\theta)$.

(a) Carefully sketch the curve in the grid below.

(b) Express the curve in vector form $\mathbf{r} = f(\theta)\,\hat{\mathbf{i}} + g(\theta)\,\hat{\mathbf{j}}$.

(c) Find parametric equation for the tangent line to the curve at the point $\theta = \pi/2$. (Do this in rectangular coordinates.)



(a) Sketch the curve here.

(b) $\mathbf{r}(t) =$

(c) $\mathbf{r}(t) = \langle f(t), g(t) \rangle =$