DRAFT

MATH 115, EXAM 1, Thursday, November 14, 2006

first and last NAME:

Student number:

Section number:

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Instructions: Please work and write carefully: it should be obvious to the grader how to read your solutions. The exam lasts 90 minutes; there are four problems on four pages, worth a total of 30 points.

Problem 1. The base of a triangle is on the line defined (in rectangular coordinates) by $2x - 3y = 4$. The triangle has a vertex at $(-5, 5)$. Call this vertex A; then the triangle has an altitude AB.

(a) Find the equation defining the line that contains AB.

(b) Find a point C on the line found in (a) such that B is the midpoint of AC.

Problem 2. This problem involves polar coordinates.

(a) Determine whether the curve defined by $r = 2\cos\theta$ is symmetric with respect to the X- and Y-axes.

(b) Sketch (together) the graphs of $r = 2\cos\theta$ and $r = 4\cos\theta$.

(c) Sketch the set of points (r, θ) such that $2\cos\theta \leqslant r \leqslant 4\cos\theta$.

Problem 3. A triangle ABC has medians AD, BE, and CF. The directed line-segments $\overrightarrow{AD}$, $\overrightarrow{BE}$, and $\overrightarrow{CF}$ represent vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$ respectively. Show that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$.

Problem 4. Suppose $\vec{e}_1$ and $\vec{e}_2$ are unit vectors such that

$$\vec{e}_1 + 2\vec{e}_2 \perp 5\vec{e}_1 - 4\vec{e}_2.$$

Find (in radians) the angle between $\vec{e}_1$ and $\vec{e}_2$.