AMERICAN UNIVERSITY OF BEIRUT
DEPARTMENT OF MATHEMATICS
FALL SEMESTER 2002-03
MATH 201, QUIZ II

Answer the following questions:

1. Consider the polar curves $r = 2\cos\theta$ and $r = \frac{3}{2} + \cos\theta$. (10 points)
   (a) Sketch the graphs of the polar curves.
   (b) Find their points of intersection.
   (c) Find the area of the region lying inside both curves. (10 points)

2. Let $f(x) = 1$ if $0 < x < \pi$, and $f(x) = -1$ if $-\pi < x < 0$.
   (a) Find the Fourier series of f. (10 points)
   (b) Use (a) to conclude that $\pi/4$. (10 points)
   (c) Find the polar equation of the tangent line to the graph at the polar point $(2, -\pi/4)$. (10 points)

3. Consider the polar equations $r = 2$ and $r = 4\cos(2\theta)$.
   (a) Find the points of intersection of the two graphs. (10 points)
   (b) find the area of the region lying outside the graph of $r = 2$ and inside the graph of $r = 4\cos(2\theta)$. (10 points)

4. Consider in rectangular form the equation $z = x^2 - y^2$.
   (a) Write the equation in cylindrical and spherical coordinates. (10 points)
   (b) Sketch the graph of the equation by showing its traces with the rectangular planes. (10 points)

5. Identify the surfaces given in spherical and cylindrical coordinates, respectively, by $\rho\cos\phi = 1$ and $r = z$. (10 points)