一、 Let $f(x) = x^3 + 3bx + c$.
Find the necessary and sufficient conditions on b and c such that
the equation $f(x) = 0$ has three distinct real roots. (20%)

二、 Let D be the region bounded by the curve $y = -x^2$ and the line
$y = mx + (m-1)$, where $m < 0$. Find a real number c such that the line
L： $x = c$ divides the region D into two parts with equal area . (20%)

三、 Let $D = \{(x, y) \mid (x-1)^2 + y^2 \leq 20\}$ be a thin plate and the temperature at

the point (x, y) on the D is $T(x, y) = 12xy + 9y^2 - 12y + 10$.
Find the highest and lowest temperatures. (20%)

四、 Let $D = \{(x, y) \mid (x-6)^2 + y^2 \leq 36 \text{ and } x^2 + y^2 \geq 36\}$ be a lamina .

Suppose the density at the point (x, y) is $\rho(x, y) = \dfrac{4}{\sqrt{x^2 + y^2}}$.

Find the mass of D. (20%)

五、 Let $\vec{F}(x, y, z) = (0, 0, 7z - 3)$ be a vector field, $D = \{(x, y) \mid x^2 + y^2 \leq 25\}$,

$f(x, y)$ be a function such that $f(x, y) \geq 0$ for any $(x, y) \in D$, and
S be the surface $z = f(x, y)$ for $(x, y) \in D$. Suppose that the volume of

the solid region $K = \{(x, y, z) \mid x^2 + y^2 \leq 25, 0 \leq z \leq f(x, y)\}$ is 110.

Find the flux $\iint_S \vec{F} \cdot \vec{n} \, dA$, where $\vec{n}$ is the upward unit normal vector

of the surface S. (20%)

試題必須隨卷繳回