A.（8 points for each of the following 9 blanks.）

- $\lim_{x\to\infty} x\frac{\int_x^\infty e^{-t^2/6}dt}{e^{-x^2/6}} =$ (1).
- $\lim_{n\to\infty}\left(1-\frac{\cos(3/n)}{2n}\right)^n =$ (2).
- When $dg(x)/dx = 1+[g(x)]^2$ and $g(0)=0$, then $g(x)=$ (3).
- When $a=$ (4), $\int_1^\infty\left(\frac{ax}{x^2+x+1}-\frac{1}{2x}\right)dx$ converge.
- Find $ab=$ (5) such that $\int_a^b\left(24-2x-x^2\right)^{1/3}dx$ has its largest value.
- $\int_1^e\int_1^x\int_0^z \frac{2y}{z^3}dydzdx=$ (6).
- It is known that $r=\sqrt{x^2+y^2+z^2}$. Then $r\left(\partial^2 r/\partial x^2+\partial^2 r/\partial y^2+\partial^2 r/\partial z^2\right)-\left((\partial r/\partial x)^2+(\partial r/\partial y)^2+(\partial r/\partial z)^2\right) =$ (7).
- The plane $z=Ax+By+C$ is said to be fitted to the points $(x_1,y_1,z_1),\cdots,(x_n,y_n,z_n)$ when A, B and C minimize $\sum_{i=1}^n\left(Ax_i+By_i+C-z_i\right)^2$. Due to the nature of the problem, it is known that $A\le 10$. When $\sum_{i=1}^n x_i=0$, $\sum_{i=1}^n y_i=0$, and $\sum_{i=1}^n x_iy_i=0$, $A=$ (8).
- $\int_0^1\int_{y^2}^1 e^{\sqrt{x}}dxdy=$ (9).

B.（14 points）

- The profit of buying a units of stock and b units of bond can be described by a function $W(a,b)=\sqrt{2}e^{-b}\cos a$. A profit-driven individual with a units of stock and b units of bond will move in the direction of maximum profit increase. Find the equation $b=f(a)$ for the path of a profit-seeking individual starting with $a=\pi/4$ and $b=0$.

C.（14 points）

- A bowl is in the shape of the graph of $z=x^2+y^2$ from $z=0$ to $z=10$ inches. You plan to calibrate the bowl to make it into a rain gauge. Assume that the rain falls into the bowl vertically. Determine the height in the bowl which corresponds to 1 inch of rain.