1 The relative number of gas molecules(氣體分子) in a container(容器) that travel at a velocity of v $cm/\sec$ is $f(v)=cv^2\exp(-\frac{mv^2}{2kT})$, where T is the temperature in ${}^0K$, m is the mass of a molecule and c,k are positive constants. Find the maximum value of f. (10 pts) $V=0$ $\Rightarrow f(0)=0$

2 Find the derivatives of the following functions (a) $f(x)=(\sqrt{x})^{\sqrt{x}}$ (8 pts) $(\sqrt{x})^{\sqrt{x}}+\ln(\sqrt{x})\cdot\frac{1}{2}\cdot(\sqrt{x})^{\sqrt{x}-1}$

$\sqrt{3+\cos^2(2^x)}\cdot\ln 2\cdot 2^x-\sqrt{3+\cos^2(\ln x)}\cdot\frac{1}{x}$

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(b) $g(x)=\int\limits_{\ln x}^{2^x}\sqrt{3+\cos^2 t}\,dt$ (8 pts) (c) $h(x)=\ln\left|\log_2(\sec x+\tan x)\right|$ (8 pts)

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$\frac{\sec x}{\log_2(\sec x+\tan x)\cdot\ln 2}$

3 Find the integrals of the following functions

$-\frac{1}{2}(\ln 1-\ln 2)$ $\frac{1}{2}\ln 2$ $=-\frac{1}{2}\ln(\frac{\sqrt{2}}{2})$ $-\ln(1-\ln 2)$ 換底拆開

(a) $\int\limits_0^{\frac{\pi}{2}}\frac{\cos x\sin x}{\cos^2 x+1}dx$ (8 pts) (b) $\int\limits_0^{\frac{\pi}{8}}\tan 2x\,dx$ (8 pts) (c) $\int\limits_1^2\frac{dx}{x-x\ln x}$ (8 pts)

4 $f(x)=e^x+\ln(x+1), x>-1$

$\frac{1}{2}$ $\frac{1}{x+1}$

increasing

(a) Show that f has inverse (5 pts) (b) Find $(f^{-1})'(1)$ (5 pts)

$x=0$ $f(0)=1$

5 Find the area of the region between $y^2=4x$ and $4x-3y=4$ by integration with respect to y. (8 pts) $\frac{125}{24}$

6 Find the volume of the solid generated by revolving the region bounded by the curve $y=x^3$, the $y-$axis and the line $y=1$ about the $y-$axis (a) by disc method (8 pts) (b) by cylindrical shell method. (8 pts) $\frac{3}{5}\pi$

7 Let the base(底部) of a solid be the first quadrant(第一象限) plane region bounded by $y=\sqrt{x}$ and $y=x^2$. Suppose that the cross sections(截面) perpendicular(垂直) to the $x-$axis are squares(正方形). Find the volume of the solid. $\frac{9}{70}$ (10 pts) $\frac{9}{70}$

24

8 Find the length of the curve $y=(4-\sqrt[3]{x^2})^{\frac{3}{2}}$ between $x=1$ and $x=27$. (10 pts)

9 Find the area of the surface generated by revolving the curve $y=\frac{x^3}{3}, 1\le x\le\sqrt{7}$ about the $x-$axis. (8 pts) $2\pi y$