A5 Q3

JIASHENG NI 58887167, YINGJUN SUN 56096167, CHASE ZHOU 25493164

February 2017

1. $\int_0^1 (x-2)sin(4x-8)dx$
Use the integration by substitution
Let u=x-2, du=dx
x=1 u=-1, x=0, u=-2
$\int_0^1 (x-2)sin(4x-8)dx$
$= \int_{-2}^{-1} usin(4u)du$
Then use the intergration by parts
Let c=u, dc=du, $dv = sin(4u)du$, $v = \frac{-cos(4u)}{4}$
Therefore, $= \int_{-2}^{-1} usin(4u)du$
$= u \times \frac{-cos(4u)}{4}|_{-2}^{-1} - \int_{-2}^{-1} \frac{-cos(4u)}{4} du$
$= u \times \frac{-cos(4u)}{4}|_{-2}^{-1} + \frac{sin(4u)}{16}$
$= \frac{1}{16}(-sin(4) + sin(8) + 4cos(4) - 8cos(8))$
2. $\int_0^1 2x^3e^{x^2}dx$
use the integration by substitution
u=x^2 du=2xdx dx=$\frac{1}{2x}$du
$\int_0^1 2x^3e^{x^2}dx$=$\int_0^1 ue^u du$
Use the integration by parts
u=u dv=e^u
du=1du v=e^u
$\int_0^1 ue^u du$=ue$^u|_0^1$-$\int_0^1 e^u du = e - (e-1) = 1$
3. $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \frac{8}{1 + sinx - cosx} dx$
Use the integration by substitution
Let $t = tan(\frac{x}{2})$
$cos(x) = \frac{1-t^2}{1+t^2}$

$sin(x) = \frac{2t}{1+t^2}$
$dx = \frac{2}{1+t^2}dt$
The function will be $\displaystyle\int_{\frac{\sqrt{3}}{3}}^{1} \frac{8}{1+\frac{2t}{1+t^2}-\frac{1-t^2}{1+t^2}}\frac{2}{1+t^2}dt$
$= \displaystyle\int_{\frac{\sqrt{3}}{3}}^{1} \frac{8}{t^2+t}dt$
Use integration by partial fraction
$\frac{8}{t^2+t} = \frac{A}{t} + \frac{B}{t+1}$
A=8, B=-8
$\displaystyle\int_{\frac{\sqrt{3}}{3}}^{1} \frac{8}{t}dt - \frac{8}{t+1}dt$
$(8log(t) - 8log(t+1))|_{\frac{\sqrt{3}}{3}}^{1}$
$= -4log(4-2\sqrt{3})$