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Assignment No. 4

Q No.1) Evaluate the integral $\int_c \vec{F} \cdot d\vec{r}$ where C is a circle $x^2 + y^2 = 9$ in the xy - plane $(z = 0)$ and $\vec{F}$

solution $x = 3\cos(\theta)$

$y = 3\sin(\theta)$

$z = 0$

$dr = -3\sin\theta\, i + 3\cos(\theta)\, j$

$F \cdot dr = (2x - y + z)(-3\sin\theta) + (x + y - z^2)\, 3\cos\theta + (3x - 2y + 4z)(0)$

$F \cdot dr = -6(3\cos(\theta)\sin(\theta) + 3(3\sin(\theta)\cos\theta)$

$= -18\cos\theta\sin\theta + 9\sin\theta\cos\theta$

$= 0$

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$(-1/4)\ [\,5\pi\ldots^{*}\ ,\ldots\ -\ 5\pi(\ldots)\,]$
$-(\,5\pi\ldots^{*}\ ,\ldots\ -\ 5\pi\ldots\,)$

$=(-1/4)\ [0]$
$=0$
$\int \ldots\, ds = 0$

Q1b-i) x-axis $y=0$
y-axis $x=0$
line $x+y=1$

$\oint (3x^2 - 8y^2)\,dx + (4y - 6xy)\,dy$

$\int_0^1 (3x^2 - 8(0)^2\,dx + (4(0) - 6x(0)\,dy$

$\int_0^1 3x^2\,dx + 0dy$

$\int_0^1 3x^2\,dx$

$[x^3]_0^1$

$=1$

, $x=0$ $dx=0$ and $dy=dy$

$\oint (3x^2 - 8y^2)\,dx + (4y - 6xy)\,dy$

$\int_0^1 3(0)^2 - 8y^2)\,dx + (4y - 6(0)y\,dy$
$[\,0 + 4y\,dy\,]_0^1$
$=2$

$F \cdot \hat{n} = u$

$$\iint F \cdot \hat{n}\, dS = \iint u\, dS$$

$$\int_0^4 \int_0^{6} -v \underbrace{\sqrt{1+(16u)^2+(16v)^2}}_{dS}\, dv\, du$$

$$= \int_0^4 \int_0^6 v \sqrt{1+(16u)^2+(16v)^2}\, dv\, du$$

$$\int_0^4 \left[-(1/3)\, v^2 \sqrt{1+(16u)^2+(16v)^2}\right]_0^6$$

$$\int_0^4 \left[-(1/3)(6)^2 \sqrt{1+(16u)^2}+(16)(6)^2\right] du$$

$$\int_0^4 \left[-(1/3)(36) \sqrt{1+(16u)^2}+576\right] du$$

$$\int_0^4 \left[-12 \sqrt{1+(16u)^2}+576\right] du$$

$$\left[-12 \int_0^4 \sqrt{1+(16u)^2}+576\right] du$$

$dw = 32u\, du$

$u = 0,\ w = 1 + 16(0)^2 + 576 = 577$

when $u = 4,\ w = 1 + 16(4)^2 + 576 = 577 + 1024 =$

$= 2177$

$$\left[-12 \int_{577}^{2177} \sqrt{w}\, (1/32)\, dw\right]$$

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Q) $F = 2yi - 2zj + x^2k$ and S is the surface of the parabolic cylinder $y = 8x^2$

first octant bounded by the plane $y = 4$ and $z = 6$

evaluate $\iint F \cdot \vec{n} \, ds$

Let parametrize surface S using variable u and v

$x = u$
$y = 8u^2$
$z = v$

$\Delta u = 1i, 16uj, 0$

$\Delta v = 0, 0, 1$

$\vec{n} = (0 \times 0)i + (1 \times 1)j \; (16u \times 0)k$

$\vec{n} = j$

$\vec{F} \cdot \vec{n}$

$\vec{F} \cdot \vec{n} = (2yi - 2zj + x^2k) \cdot j$
$= -2z$

substitute $z = v$

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Q no 4)

(a) $L\{\sin^4(4t)\}$

$= \frac{1}{8}(3 - 4\cos(8t) + \cos(16t))$

$\int \frac{1}{8}(3 - 4\cos(8t) + \cos(16t))\, dt$

$= \frac{3}{8}t - \frac{1}{32}\sin(8t) + \frac{1}{128}\sin(16t)$

$= \left(\frac{3}{8}\right)b - \frac{1}{32}\sin(8b) + \frac{1}{128}\sin(16a)$

(b) $L\{5\sin^2 2(t) \cdot \cos^2(t) + \cos^5 t$

~~$t \cdot t \left(\frac{1}{4}\right)\left(\frac{1}{3}\right)(3+3b)^5 - \left(\frac{1}{4}\right)\left(\frac{1}{5}\right)(3+3a)^5$~~

$\left(\frac{1}{8}\right)\frac{5}{4}b - \frac{1}{40}\sin 5b + \frac{5}{3}\sin 3b + \frac{5}{8}\sin b$

$- \frac{1}{8}\ \frac{5}{4}a + \frac{1}{40}\sin 5a - \frac{5}{3}\sin 3a$

$- \frac{5}{8}\sin a$

(c) $L\{(3+3t)^4\}$

$= \left(\frac{1}{4}\right)\left(\frac{1}{5}\right)(3+3b)^5 - \left(\frac{1}{4}\right)\left(\frac{1}{5}\right)(3+3a)^5$

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d. $L\{e^{-3t}\cosh(3t) + e^{2t}\sinh 2t\}$

$\left(-\frac{1}{3}\right)e^{t}(3h)\ \sin(3b) + \left(\frac{1}{2}\right)e^{2h}\cos 2t$

$\left(-\frac{1}{3}\right)e^{-3a}\ \sin 3a\ \ -\frac{1}{2}\ e^{2a}\cosh 2a)$