Subject: Problem Set 8
Year. Month. Date. ( )

4A_1 d) unit length, Clockwise, unit speed, not at origin

4A_2 b) $\langle \frac{x}{r^2}, \frac{y}{r^2} \rangle$ c) $f(r) \langle \frac{x}{r}, \frac{y}{r} \rangle$

4A_3 b) $-r\langle x, y \rangle$ d) $f(x,y)\langle 1,1 \rangle$

4B_1 a) $\int_{x=-1}^{x=1} x^2-y+2x\cdot 0\,dx = \frac{2}{3}$

$\int_{x=1}^{x=1} (x^2-y)\,dx + 2x\,dy = \int_{-1}^{1} (2x^2-1)\,dx - 4x^2\,dx$

$= -\frac{10}{3}$

b) $\int_{\frac{\pi}{2}}^{0} -\sin^2 t\cos t\,dt - \cos^2 t\cos t\,dt = 1$

4B_3 a) ~~the~~ Parallel to 1,1

b) // // 1,1

c) // // -1,1

d) $\pm\sqrt{2}$

4C_1 a) $F = \nabla f = \langle 3x^2y, x^3+3y^2 \rangle$

$dx = 2y\,dy$

$\Rightarrow \frac{dx}{2y} = dy$

b) i) $\int_{y=-1}^{1} 3x^2y\,dx + 9x^3+3y^2\,dy$

$r(t) = \langle 1, \cancel{t} \rangle$

$= \int_{-1}^{1} \cancel{3}^{6}x^2y^2 + yx^3+3y^2\,dy$

$= \frac{x^2y^3}{3} + \frac{y^2x^3}{2\cancel{4}} + y^3 \Big|_{-1}^{1} = y^{\cancel{2}}+y^3 = 4$

PAPCO

Subject:
Year. Month. Date. ( )

ii) $\int_{-1}^{1}(1+3y^2)dy = y+y^3\Big|_{-1}^{1} = 4$

iii) $f(1,1)-f(1,-1)= 4$

4C-3

a) $F=\nabla f = \langle \cos x \cos y, -\sin x \sin y \rangle$

b) ~~[illegible]~~ $(-\frac{\pi}{2},0) \to (\frac{\pi}{2},0)$

4C-5

a) $M_y = N_x = 2y = ay \Rightarrow a=2$

b) $M_y = N_x = e^{x+y}(x+a) = e^{x+y}(x+1) \Rightarrow a=1$

4-C a) $1 \neq -1 \Rightarrow \times$

b) $M_y = 2x+2y = N_x$ ✓

Subject.
Year. Month. Date. ( )

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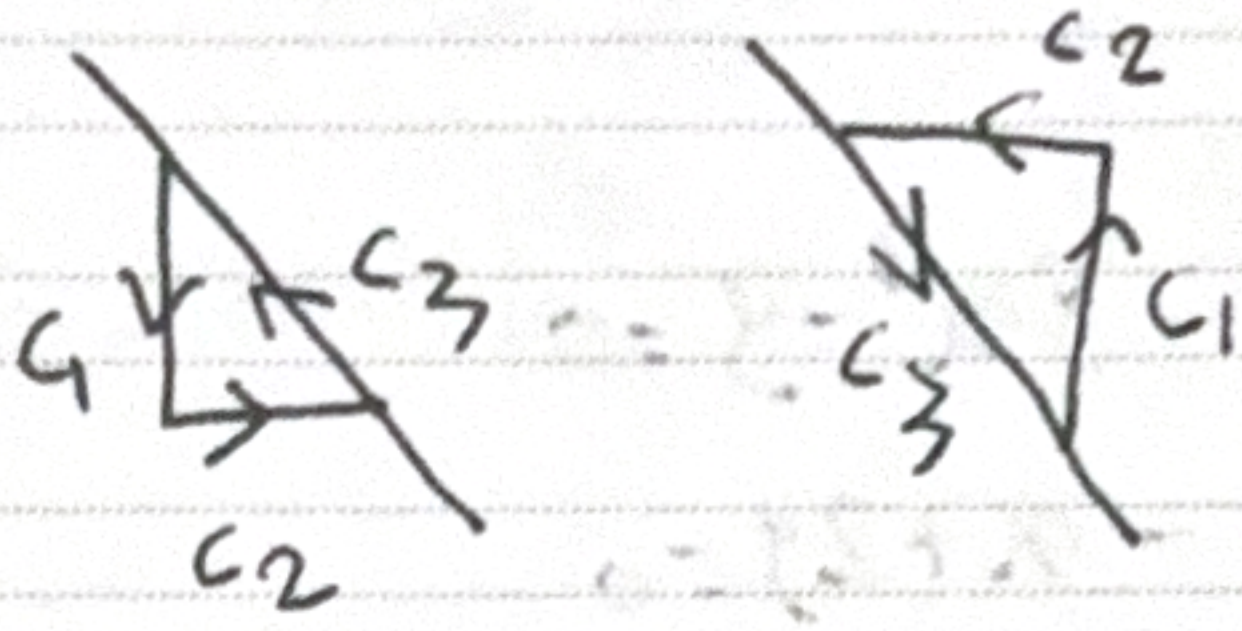
Problem 1

a*) $\langle -x - y \rangle$ j

b)



$C_3: F=0$

$C_2: F.T=0$

$C_1: F.T>0 \Rightarrow \int > 0$

or $F.T<0 \Rightarrow \int < 0$

Problem 2

a) ~~∫ 0 Perpendecular~~ $\int_0^{\infty} \frac{-x}{x^2+1}\,dx = \cancel{+}\infty$

b) 0. Perpendecular.

c) $r(t) = \langle t, 1-t \rangle$

$\int_0^1 \frac{t + t - 1}{2t^2 - 2t + 1} = \cancel{\int_0^1 \frac{?}{2t^2}} \cancel{\int_0^1 2t^2 = 2t\Big|_0^1} = 0$

$\cancel{= 2}$

Subject:
Year. Month. Date. ( )

Problem 3

a) $r=\sqrt{x^2+y^2} \Rightarrow \frac{\partial r}{\partial x}=\frac{x}{r}, \frac{\partial r}{\partial y}=\frac{y}{r}$

$\Rightarrow -\nabla \ln r = -\langle \frac{x}{x^2+y^2}, \frac{y}{x^2+y^2} \rangle$

b) $\int_{P_1}^{P_2} F\cdot dr = -\ln r \Big|_{P_1}^{P_2} = -\ln \frac{r_2}{r_1}$

Problem 4

a) $\int_C \cancel{x} 2yx+2y^2 dx + x^2+4xy dy$

b) $\langle \frac{1}{3}\cos t, \frac{1}{2}\sin t \rangle \quad 0 \le t \le \frac{\pi}{2}$

$\Rightarrow \int_0^{\frac{\pi}{2}} \left(\frac{2}{6}\cos t\sin t+\frac{2}{4}\sin^2 t\right)\left(-\frac{1}{3}\sin t\right)dt + \left(\frac{1}{9}\cos^2 t+\frac{4}{6}\cos t\sin t\right)\left(\frac{1}{2}\cos t\right)dt$

c) $f(0,\frac{1}{2})-f(\frac{1}{3},0)=0$

d) 0

PAPCO

Subject:
Year. Month. Date. ( )

Problem 5

a) $M_y = x \neq N_x = 3x^2$

b) $\int_{C_1+C_2} xy\,dx + x^3\,dy = x^3 y \Rightarrow \nabla f \neq F$

$f_x = xy \Rightarrow f = \frac{x^2 y}{2} + g(y)$

$f_y = \frac{x^2}{2} + g'(y) = x^3 \Rightarrow \underbrace{g'(y) = x^3 - \frac{x^2}{2}}_{\text{Not a function of } y}$