Problem 5. (10 pts) Evaluate $\int\int_D (1+x^2+y^2)^2 dydx$ where D is the disk of radius 1 centered at the origin.

A. $2\pi/5$
B. $5\pi/7$
C. $7\pi/3$
D. $3\pi/2$
E. None of the above

$$\int_0^{2\pi}\int_0^1 (1+r^2)^2 r \, dr \, d\theta$$

$$= \pi \left.\frac{(1+r^2)^3}{3}\right|_0^1 = \pi\frac{8}{3} - \frac{\pi}{3} = \frac{7\pi}{3}$$

Problem 6. (10 pts) Find $\int_C \vec{F}\cdot d\vec{r}$ where C is a straight segment from $(0,0)$ to $(1,\pi)$ and $\vec{F}(x,y) = (e^x \cos y)\vec{i} - (e^x \sin y)\vec{j}$.

A. $-e+1$
B. $-e-1$
C. $e-1$
D. $e+1$
E. None of the above

$$\begin{cases} (1) & \dfrac{\partial f}{\partial x} = e^x \cos y \Rightarrow f = e^x \cos y + C(y) \\ (2) & \dfrac{\partial f}{\partial y} = -e^x \sin y \end{cases}$$

IN (2): $-e^x \sin y + C'(y) = -e^x \sin y \Rightarrow C'(y) = 0$
$\Rightarrow C(y) = C$

So $\vec{F} = \vec{\nabla f}$ WHERE $f(x,y) = e^x \cos y$

By Fund. Thm. of Calc: $\int_C \vec{\nabla f}\cdot d\vec{r} = f(1,\pi) - f(0,0)$
$= e\cdot(-1) - e^0\cdot 1$
$= -e-1$