Homework due 12/06

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Sec. 17.1

1) $\int_{-1}^{1}\int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} -x \, dy \, dx = 0$

3) $\int_{0}^{1}\int_{0}^{1} (2x-2y) \, dx \, dy = 0$

5) $\int_{-1}^{1}\int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} -x^2 \, dy \, dx = -\frac{\pi}{4}$

7) $\int_{0}^{1}\int_{x^2}^{x} 2x \, dy \, dx = \frac{1}{6}$

9) $-\int_{0}^{2}\int_{0}^{x} (e^{x-y} - e^{x+y}) \, dy \, dx - \int_{2}^{4}\int_{x-2}^{2} (e^{x-y} - e^{x+y}) \, dy \, dx$

$= \frac{e^6}{2} - \frac{e^4}{2} - \frac{5e^2}{2} + \frac{5}{2} \approx 158.44$

13) $2 \cdot 8 - \int_{0}^{1} (6-6t)(-6) \, dt = 16 - (-18) = 34$

17.2

1) $r(t) = \langle \cos(t), \sin(t), 0 \rangle \quad 0 \leq t \leq 2\pi$

$\langle 2\cos(t)\sin(t), \cos(t), \sin(t) \rangle \cdot \langle -\sin(t), \cos(t), 0 \rangle$

$= \cos^2(t) - 2\cos(t)\sin^2(t)$

$$\int_0^{2\pi} \left(\cos^2(t) - 2\cos(t)\sin^2(t)\right) dt = \pi$$

$\text{curl}(F) = \langle 1, 0, 1-2x \rangle$

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

3) $\text{curl}(F) = \langle 0, -e^{y-z}, -e^{y-z} \rangle$

$$\int_0^1\int_0^1 -e^{y-1}\, dx\, dy = e^{-1} - 1$$

$r_1(t) = \langle 1, t, 1 \rangle \quad r_2(t) = \langle 1-t, 1, 1 \rangle$

$r_3(t) = \langle 0, 1-t, 1 \rangle \quad r_4(t) = \langle t, 0, 1 \rangle$

$$\int_0^1 \left(-e^0 + e^{-1}\right) dt = e^{-1} - 1$$

5) $\text{curl}(F) = \langle -3z^2 e^{z^3}, z\sin(xz) + 2ze^{z^2}, 2 \rangle$

$$\int_0^{2\pi} \left((1-\sin(t))(-\sin(t)) + (1+\cos(t))(\cos(t)) \right) dt = 2\pi$$

9) $\text{curl}(F) = \langle 0, 0, 0 \rangle$

It's conservative so an integral over a closed region will be 0.

11) $\text{curl}(F) = \langle 3, 0, -5 \rangle$

$$\int_{-3}^{3} \int_{-\sqrt{9-x^2}}^{\sqrt{9-x^2}} \left(\frac{3x}{\sqrt{x^2+y^2}} - 5 \right) dy\, dx$$

$$\int_0^{2\pi} \int_0^{3} (3\cos(\theta) - 5) r \, dr\, d\theta = -45\pi$$

13) $\text{curl}(F) = \langle -1, -1, -1 \rangle$

Plane eq: $z - y = 0 \Rightarrow z = y$

$$\int_0^{3} \int_0^{3-x} (1-1)\, dy\, dx = 0$$