Same instructions as in Mission 1. See Mission 1 for details.

Problem 91 Your PRINTED NAME below indicates you have:

(a.) I have read §7.1 − 7.5 of Cook: ____________________.

(b.) I have attempted 10 problems either from Stewart(see below) or the end of chapter problems in my notes:________________.

Same deal as Mission 1. Enjoy:

§ 16.1 #'s 5, 9, 11, 13, 15, 17, 21, 23, 25, 29, 31, 33, 35*

§ 16.2 #'s 1, 5, 9, 11, 13, 15, 17, 19, 21, 33, 37, 41, 43, 47, 49

§ 16.3 #'s 3, 5, 7, 9, 11, 13, 15, 17, 19, 23, 25, 29, 31, 32, 33, 34, 35

§ 16.5 #'s 1, 3, 5, 6, 7, 9, 11, 12, 13, 15, 17, 19, 21, 22, 25, 27, 28, 31, 33, 37, 38*

Problem 92 Let f be a smooth function and $\vec{G}$ a smooth vector field on some subset of $\mathbb{R}^3$. Show that $\nabla \bullet (f\vec{G}) = \nabla f \bullet \vec{G} + f\nabla \bullet \vec{G}$ and $\nabla \times (f\vec{G}) = \nabla f \times \vec{G} + f\nabla \times \vec{G}$

Problem 93 Let $f(x, y, z) = x^2 + yz$ and $\vec{G}(x, y, z) = \langle x, z, z^2 \rangle$. Let $\vec{H} = f\vec{G}$ and calculate the curl and divergence of $\vec{H}$.

Problem 94 Let k be a constant and $\vec{F}(x, y, z) = \frac{k}{(x^2+y^2+z^2)^{3/2}} \langle x, y, z \rangle$. Calculate the curl and divergence of $\vec{F}$.

Problem 95 Let $\vec{B}(x, y, z) = \langle -y, x + z, 2 \rangle$. Find $\vec{A}$ for which $\nabla \times \vec{A} = \vec{B}$. To my grader: sorry about this. There are infinitely many correct answers.

Problem 96 Let C be the curve with parametrization $x = e^t \cos(t)$, $y = e^t \sin(t)$ and $z = e^t$ for $0 \le t \le \frac{1}{2} \ln 3$. Assume the mass-density of C is uniform and find the center of mass of the wire as well as its arclength.

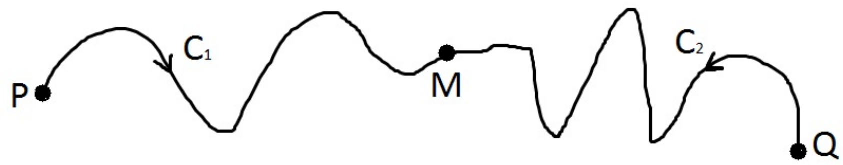
Problem 97 Let C be the curve with parametrization $x = 2 + 3t^2$ and $y = t^3 - 1$ for $0 \le t \le 1$. If $\vec{F}(x, y) = \langle 3x^2 + y, 3y^2 + x \rangle$ then calculate $\displaystyle\int_C \vec{F} \bullet d\vec{r}$.

Problem 98 Let $\vec{F}(x, y) = \langle x^3 + \sin(y), y^3 + \tan(x) \rangle$. Calculate the flux of $\vec{F}$ through the unit-circle $x^2 + y^2 = 1$. I recommend you use the divergence form of Green's Theorem for this problem. Direct calculation of the flux seems less fun.

Problem 99 Let R be the rectangle with corners $(0, 0), (1, 0), (1, 3)$ and $(0, 3)$. Let ∂R be the CCW oriented boundary of R as the notation ∂R indicates. Calculate by Green's Theorem:

$$\oint_{\partial R} \big(\cosh(\sqrt{x} + 3) + y\big)\, dx + \big(3 + x^2\big)\, dy.$$

Problem 100 Suppose $\int_{C_1} \vec{F} \bullet d\vec{r} = 13$ and $\int_{C_2} \vec{F} \bullet d\vec{r} = -29$. Let C be the path from P to M to Q which follows the same set of points as C_1 and C_2. Calculate $\int_C \vec{F} \bullet d\vec{r}$.



Problem 101 Let C be a path from $(0,1)$ to $(2,3)$. Calculate $\int_C (1+4x^3)dx + (2-2y^2)dy$.

Problem 102 Find the work done by the force $\vec{F}(x,y,z) = \langle y+x^2, x, z^3 \rangle$ on a mass as it moves from $(0,0,0)$ to $(1,2,3)$.

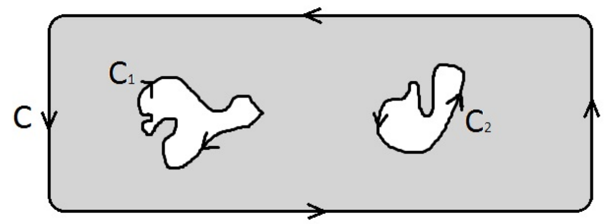
Problem 103 Determine if the vector fields below are conservative. Find potential functions where possible.

(a.) $\vec{F}(x,y) = \langle 2x - \sin(x+y^2), -2y\sin(x+y^2) \rangle$

(b.) $\vec{F}(x,y) = \langle -y, x \rangle$

(c.) $\vec{F}(y,z) = \langle z+y^2, y+z^3 \rangle$

Problem 104 Suppose we are given $\int_{C_1} \vec{F} \bullet d\vec{r} = -10$ and $\int_{C_2} \vec{F} \bullet d\vec{r} = 9$. Calculate $\int_C \vec{F} \bullet d\vec{r}$ given that $\vec{F}$ is conservative (locally) on the domain between C and the curves C_1, C_2. Is $\vec{F}$ conservative on $\mathbb{R}^2$? Explain.



Problem 105 Let $\vec{F} = \langle 0, 0, -mg \rangle$ where m, g are positive constants and suppose $\vec{F}_f = -b\vec{T}$ where v is your speed and b is a constant and $\vec{T}$ is the unit-vector which points along the tangential direction of the path. This is a simple model of the force of kinetic friction, it just acts opposite your motion. Find the work done by $\vec{F}_f + \vec{F}$ as you travel up the helix $\vec{r}(t) = \langle R\cos(t), R\sin(t), t \rangle$ for $0 \leq t \leq 4\pi$.